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Firm responses to the pandemic crisis:
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Abstract

This paper is meant to address the status of the Italian productive system in the wake of the most severe crisis economies are facing since WWII. In order to accomplish the latter task we rely on the combination of two high quality level dataset informing about so called firm behavioural traits: the first, the IMCPI (2019), collected information on organizational capabilities, practices, attitudes toward innovation, business models and strategies during the period 2016-2018, in so called usual times. The second, the SPIESC-19 (2020), was able to monitor firm responses to the pandemic crisis, collecting information in the period June - October 2020. Two results emerge out of our analysis: first, firm responses are highly path-dependent on their pre-crisis organizational capabilities; second, such crisis might turn out be more pervasive than expected, producing widespread, rather than creative, restructuring processes.

JEL classification: D21, D22, D83, J24, J53

Keywords: Organizational capabilities, Italian productive structure, Pandemic crisis

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1   Introduction

Italy is growing like never before!, many commentators have been recently declaring. Macroeconomic statistics should tell a story of a **V**-shaped and fast recovery from the pandemic, at least this was the initial perception (Sharma et al., 2021). However, the COVID-19 crisis represents a turning point in terms of the organization of the economic and productive system. Although the expectations of a **V**-shaped recovery at the macroeconomic level are prevalent (Caracciolo et al., 2020), potential long-lasting impacts on the industrial system are still hidden, mainly due to the absence of firm-level evidence in terms of economic performance, exits and closures.

The literature has partially addressed firm-level effects of the COVID-19 making use of selected questionnaires, mainly conducted in real-time to monitor the status of the system. Other evidence relies on sectoral level dynamics, the dynamics of vacancies and employment rates. However, a systematic picture on how firms behaved during the COVID-19 crisis and their future prospects is still absent.

This paper intends to fill this vacuum with reference to the Italian economy. How Italian firms have reacted to the COVID-19 crisis in terms of actions and responses put in place? Which reorganizational and strategic choices have been adopted? How their pre-existing capabilities structure has mediated responses to the crisis? Did their pre-crisis attributes influence their in-crisis responses? To address the latter questions we draw on Costa et al. (2021), which develop a comprehensive capability taxa of Italian firms in the pre-crisis period making use of the *Indagine Multiscopo del Censimento Permanente delle Imprese* (IMCPI, 2019), and we exploit a new comprehensive survey launched by ISTAT in 2020, *Situazione e Prospettive delle Imprese nell'Emergenza Sanitaria COVID-19*, collecting specific information on behaviours, practices, effects and strategies put in place during the crisis (SPIESC-19, 2020).

By linking the capability taxa before and after the COVID-19 crisis to study actions and responses in normal and pandemic times, strong stickiness and persistence emerge in terms of the behavioural traits characterizing firms. The first result of our paper is the confirmation of the existence of a neodualistic structure in the composition of the Italian industrial fabric (Dosi et al., 2021), with so called Essential and Managerial firms, according to the capability taxa definition, putting in place minimalistic actions to circumvent and react to the crisis, in terms of organizational choices, technological adoption, human resource management, investment planning, credit and liquidity channels, opening of new markets. At the opposite end, Interdependent and Complex firms show strong capabilities to react to the crisis, accelerating digitalization strategies, adopting reorganization of the workplace, investing in new business plans, opening new directions of export, and notably reorganizing supply chains to circumvent shortages.

We then move to explore diverse events of corporate crises emerging from the questionnaire, specifically looking at different degrees of hazards, explained by more general perceptions of operational and sustainability risks, plans to substantially reduce the labour force, up to changing the ownership structure and finally closing the operating activity and the site. Those risks, different in their distributional patterns and incidence across firms, are however quite revealing of some specific findings. First, whenever firms are affected by such corporate crises, the neodualistic divide tends to disappear and such risks are almost widespread

affecting all four taxa, independently from their attributes. Second, the number of engaged personnel, value added and paid wages involved in such corporate crises are all but negligible. This is so because both Interdependent and Complex firms, the lion share of employment and value added, are non-indifferently affected by such adverse events. The findings warn against considerable social costs potentially around the corner given that this crisis will not exclusively impinge on less productive, small firms, although the latter are primarily more exposed.

Overall, our empirical evidence suggests that the COVID-19 induced crisis might last long than expected, with potential hysteresis effects in the medium run (Cerra et al., 2021). Rather than being a cleansing, productivity-enhancing crisis, only affecting small unproductive zombie firms (Adalet McGowan et al., 2018), it will quite probably result to be a strong reorganizational crisis affecting also the most productive and advanced ladder, leading to a deep reconfiguration of the Italian industrial system in terms of capability taxa, and related of sectoral composition.

The paper is organised as follows: Section 2 presents the context and motivation, while Section 3 the data description. The empirical methodology is discussed in Section 4, while Section 5 digs inside corporate crises. Discussion of our results and concluding remarks are presented in Section 6.

2 Context and motivation

The pandemic induced crisis has been studied since its inception with more efforts devoted to address the epidemiological diffusion potentially interacting with the economic structure (Bellomo et al., 2020; Aguiar et al., 2021, among others) and the labour market impacts, particularly in terms of inequality, socio-economic risk stratification, gender and racial divides (Montenovo et al., 2020; Delaporte et al., 2021; Adams-Prassl et al., 2020; Zamarro and Prados, 2021; Gottlieb et al., 2021; Cetrulo et al., 2022). Supply chains disruption, increasing delivery time, recombination of intermediate inputs, China dependence as the world factory economy (Dosi et al., 2020) have been addressed as well (Baldwin and Freeman, 2021; IMF, 2021), with the image of the Los Angeles port congested by ships waiting for space to open up in October 2021.

The literature on firm-level induced effects of COVID-19 is so far more limited due to lack of data availability. It generally relies on survey-based information administrated to restricted samples. In addition to be mainly based on sampling strategies often not addressing statistical representativeness, in the majority of cases such questionnaires are more directed to assess managerial expectations on future outcomes and intended to track sales dynamics during the crisis. This is the case for the US firms studied in Bartik et al. (2020), who surveyed 5,800 small units between March and April 2020 asking about closures, and in Bloom et al. (2021), who surveyed approximately 2,500 firms using the Study of Internet Entrepreneurship, an ongoing, opt-in quarterly survey that began in early 2019. According to the study, which reports sales drop of 30% over the 2nd and 3rd quarters of 2020, impacts have been heterogeneous across firms, with bigger and online firms more resilient to compulsory closures and in some cases even increasing their sales, while the opposite occurred for black- and female-owned enterprises, often small, which experienced the highest losses.

Financial fragility and bank loans are central to the analysis in Zoller-Rydzek and Keller

(2020), who conducted an online survey among managers of Swiss firms (205 managers in total), asking their current and future expectations about the pandemic induced crisis. Weak evidence in support of prior good economic performance correlated with less adverse expectations about the future is provided. Representative sampling strategies are adopted in the survey run by Ifo (Buchheim et al., 2020) targeting a panel of roughly 6,000 German firms. The survey addresses how pre-crisis attributes affected both business outlook and response strategies to face the pandemic. In general, bad pre-crisis conditions negatively influenced business outlook, not surprisingly, but also their responses, which were quite diverse in intensity and also diversification, ranging from access to telework, firing and postponement of investments.

The stream of literature above was mainly interested in monitoring real time firm responses, perception of uncertainty and potential changes in employment and investment strategies, also to understand the impact of the lock-down. Although forms of stickiness in the response and resilience of firms have been generally identified, with the literature agreeing on fiercer effects upon most vulnerable and fragile units already in the pre-pandemic phase, an analysis connecting firms organizational capabilities in usual and in pandemic times is still missing.

Closer to our analysis are the results in the Industrial Development Report (2022) which launched the *UNIDO COVID-19 firm level survey*, conducted in the period November 2020 - June 2021, targeting 3,700 firms in 26 countries across Asia, Africa and Latin America and including questions about observed and expected impacts on economic variables (employment, investment), but also strategies to cope with the crisis, together with some firm characteristics. Three types of reactions to the pandemic induced crisis have been identified, according to firm responses, namely *robustness*, the capability to be able to more than survive and even profiting from the crisis; *readiness*, the capability of proactively reacting albeit with strong difficulties; *vulnerability* representing conservative and non reactive strategies. In addition, *industrial capabilities*, defined as an ensemble of organizational routines, collective knowledge, procedures and shared behaviours to operate production processes, have been considered a crucial element to positively respond to the crisis. Country-level industrial capabilities are measured by a synthetic indicator, the UNIDO's Competitive Industrial Performance (CIP) Index, which synthesizes nation wide competitiveness as the result of (i) the capacity to produce and export manufactured goods; (ii) technological deepening and upgrading; (iii) and world impact. The Industrial Development Report (2022) further deepens the role of industrial capabilities extending the analysis to both manufacturing and service firms.

The report indeed echoes the notion of *organizational capabilities* (Helfat and Winter, 2011), adopted and operationalised in Costa et al. (2021) to detect the so called "quasi-genetic" traits of Italian firms in usual times. The capability-based theory of the firm, we shall see, proves to be quite revealing in understanding the stickiness of crisis responses with respect to firms pre-pandemic behavioural traits. Indeed, the coherence between ex-ante and ex-post behaviours in conducting the business activities confirms about the correct identification of the organizational and behavioural attributes characterizing the Italian industrial structure.

3   Data and descriptive statistics

Over the last couple of decades, the demand for high-quality firm-level micro-data has increased significantly, both for the purpose of measurement of economic phenomena and for policy reasons. In order to meet such demand, European statistical offices have accelerated the design and production of new data-sets able to accurately capture heterogeneities and changes within productive system, as well as factors underlying e.g. the competitiveness and resilience of firms, competitive and backward segments, and profiles of growing or declining firms.

In this context, the Italian Statistical Office (ISTAT) has undertaken a strategy of designing and implementing a new generation of micro-founded statistics, in which the microeconomic component plays a central role. This new approach has been based on the implementation of a twofold integrated strategy in statistical production:

a) massive use of administrative data for the construction of multidimensional statistical registers, with extensive possibilities to link individual data to additional administrative sources and direct surveys;

b) direct statistical surveys focused on economic units with multi-purpose modules able to measure their organisational structures, behaviours and strategies, not detectable when using administrative sources only.

This new system guarantees also a high level of accuracy of aggregate estimates that can be largely derived from the direct aggregation of individual data. Furthermore, the consistency between the micro and macroeconomic perspectives lends solidity to micro-founded analyses of heterogeneity within various universes (e.g., economic units) in different dimensions (e.g., performance, geographical positioning, workforce utilisation, international openness, remunerations). Moreover, the annual replication of the Register System collecting information on firm balance-sheets (called FRAME-SBS) makes multi-level dynamic analyses possible. This innovative approach has already proved to be particularly useful in studying the factors that have supported firm competitiveness during the last recession and recovery.

The first wave of the *Indagine Multiscopo del Censimento Permanente delle Imprese* (IMCPI) was carried out by ISTAT in 2019. The survey involved a sample of about 280 thousand firms with 3 or more employees, representing a universe of over 1 million units, corresponding to the 24.0% of total Italian firms, which, however, accounts for 84.4% of national value added, employs 76.7% of workers (12.7 millions) and 91.3% of employees.

The questionnaire administrated to firms is structured along nine macro-sections: 1) Ownership, control, management; 2) Human resources; 3) Relations between companies and other organizations; 4) Market; 5) Technology, digitalisation and new professions; 6) Finance; 7) Production internationalisation; 8) New trajectories of development; 9) Environmental sustainability, social responsibility and workplace security. The integration of qualitative information derived from the survey with the register system (FRAME-SBS) enables in-depth analysis of the structure, behaviour and performance of Italian firms, and it is particularly useful in the study of productivity dynamics.

In the following, restricting the scope of the analysis to firms with at least 10 employees to ensure a minimal firm-organizational structure, we obtain a sample of more than 109 thousand

units, representative of a universe of about 215 thousand firms, with 9 million workers (54.7% of the total), of which 8.8 millions are employees (74.7%), with 2,300 euro billion revenues (75.3%) and 557 billion (71.4%) value added. Within this segment, there are approximately 3,700 large firms (250 and more workers), with employment and value added shares of 38.5% and 44.8% respectively. SMEs (10-249 workers) thus constitute the majority of structured Italian firms in all the main macro-sectors (including both manufacturing and services), not only in terms of employment but also in terms of value added.

The second survey labelled *Situazione e Prospettive delle Imprese nell'Emergenza Sanitaria COVID-19* (SPIESC-19), carried out by ISTAT on November 2020, is based on a sub-sample of the IM-CPI. It covers a sample of over 90 thousand companies with at least 3 persons engaged, providing information about the effects of the COVID-19 crisis on firms' performance and strategies (e.g. demand dynamics, turnover, employment, investments, technologies, etc.) and about what type of reaction, if any, enterprises opposed to the shock (e.g. in terms of reorganization, downsizing, digital transformation, management of suppliers and clients, etc.) during the period June 2020 - October 2020. The sample represents a universe of over one million units operating in industry, trade and services sectors. Again, we will restrict our attention to firms with at least 10 employees. More in details, the survey SPIESC-19 uncovers sixth macro sections and administrated 25 demands, structured as follows: 1) Impact of COVID-19; 2) Precautionary procedures and countering COVID-19 spread; 3) Human Resources management and policies; 4) Finance; 5) Digitalization and Technology; 6) Effects, critical issues and strategic orientations. In addition, some of the 25 questions present a nested structure, meaning that a positive reply to a parent question implies a new set of nested demands.

Figure 1 presents the response rate, reported to the universe of over one million firms, aggregated at the macro-section level (top) and at the demand-level (bottom). The response rate looks to be quite homogenous across the six macro-sections, differently from the IMCPI wherein heterogeneity across sections was more pronounced (Costa et al., 2021). When disaggregating by demand-level, a widespread response rate emerges, except for the HR, technology and finance sections, reporting lower levels.

Among the 25 questions, we focus on a subset in order to better highlight (i) the practices put in place to manage workplace adjustments and labour force; (ii) liquidity instruments used to counteract the crisis; (iii) expected effects and reasons; (iv) adopted and planned strategies. More in detail, the selected questions, presented in Table 1 read as:

Section 3 *From June 2020 to date, what human resource management measures has the firm taken as a result of the COVID-19 emergency?*

Section 4 *From June 2020 to date, what instruments has the firm used to meet the liquidity needs caused by the COVID-19 emergency?*

Section 6 *What effects do you expect the COVID-19 emergency to have on the firm up until June 2021?*
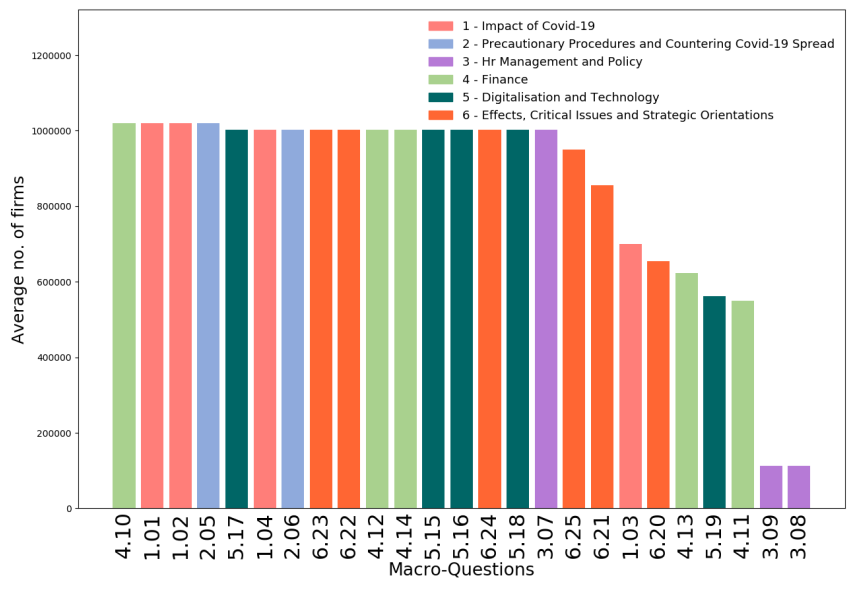
Section 6 *For which reasons?*

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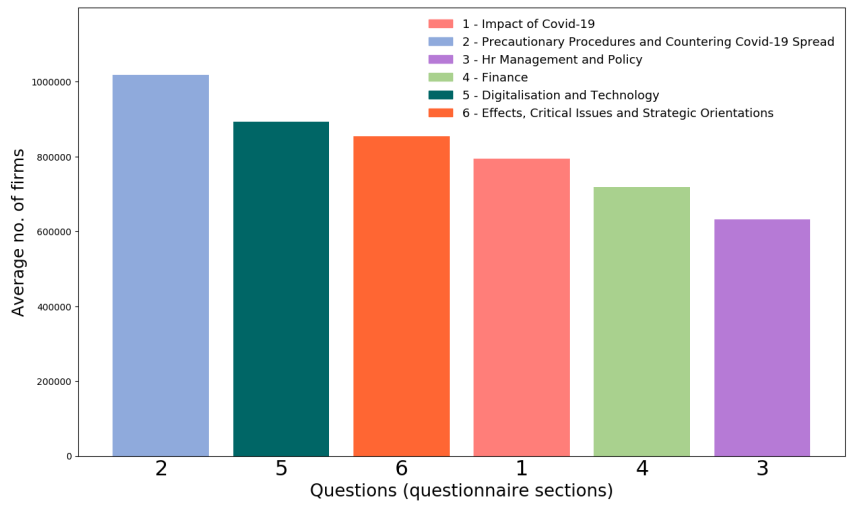
(a) Response rate by macro-section

(b) Response rate by single question

Figure 1: Response rate to the *SPIESC-19* questionnaire.

The selection allows to focus on practices, responses and strategies put in place, with reference to the management of the workforce, access to finance, reported effects and planned actions. Indeed, the rich set of replies allows to detect distinct paths and actions firms have taken. In addition to this selection, in order to portray the status of the overall system, we also focus on the first opening question, namely whether the firms' premises were open, partially open, or alternatively, closed with and without reopening plans, at the time of the questionnaire administration.

Table 1: Selection of questions from the *SPIESC-19* questionnaire carried out by ISTAT in November 2020.

QUESTION	MODALITY
3.7. From June 2020 to date, what human resource management measures has the firm taken as a result of the COVID-19 emergency?	0 - Remote working, smart working or teleworking for the whole or part of the staff 1 - Reduction in working hours or shifts 2 - Increase in working hours or shifts 3 - Rearrangement of working days 4 - Use of the Cassa Integrazione Guadagni (redundancy fund) or similar instruments (Fondo Integrazione Salariale, Fondo Solidarietà Bilaterale Artigianato, etcetera) 5 - Compulsory holiday leave or other temporary cost-cutting measures 6 - Reduction in fixed-term staff or external collaborators (no extension of contracts) 7 - Reduction of permanent staff (redundancies) 8 - Deferral of planned hires 9 - No use of outsourced workers 10 - Hiring 11 - Additional staff training 12 - No measures 13 - Other measures
4.10. From June 2020 to date, what instruments has the firm used to meet the liquidity needs caused by the COVID-19 emergency?	0 - Use of liquid assets on the balance sheet (eg bank deposits) 1 - Disposal of non-liquid assets on the balance sheet (eg sale of real estate or capital goods) 2 - Use of available margins on credit lines 3 - Change in payment terms and conditions with customers 4 - Change in payment terms and conditions with suppliers 5 - Deferment of debt repayments (eg use of a moratorium) 6 - Renegotiation of lease contracts 7 - Taking out new bank debt (eg state-guaranteed debt) 8 - Use of financing instruments other than bank debt (eg bonds, crowdfunding, P2P lending platforms) 9 - Capital increases by the ownership (entrepreneur, shareholders) 10 - Capital increases by external financiers (eg holdings, new shareholders) 11 - Other instruments 12 - No instruments used
6.20. What effects do you expect the COVID-19 emergency to have on the firm up until June 2021?	a. There are serious operational and business sustainability risks b. There will be a reduction in the desirability of goods or services due to the inability to attend, or the cancellation or postponement of trade shows or promotional events c. Demand will be reduced as a result of restrictions due to the implementation of health protocols (e.g. distancing, restrictions on customer access to the business premises, etc.) d. Domestic demand for goods or services (including tourist demand) will be reduced e. Foreign demand for the goods or services will be reduced (including tourist demand) f. There will be more difficulties in exporting/importing goods due to increased transport and logistics costs g. The supply of raw materials, semi-finished goods or intermediate inputs will be reduced or interrupted h. Prices of raw materials, semi-finished products or intermediate inputs will increase i. Serious liquidity problems will arise j. Closure of company offices/premises in Italy or abroad k. No particular effects on the undertaking, which will continue its business as usual. l. Will increase the level of activity of the enterprise m. Other effect

6.20.1 For which of the following reasons?	0 - Increase in domestic demand for goods or services (including tourist demand) 1 - Increase in demand from abroad for the goods or services (including tourism demand) 2 - Reduction in transport and logistics costs 3 - Reduction in prices of raw materials, semi-finished products or intermediate inputs 4 - Growth induced by public incentive measures (eg Eco-bonus) 5 - Development of e-commerce activity 6 - Other reason
6.21. What strategies has the company already adopted or is considering to adopt up to June 2021?	0 - Production of new goods, provision of new services or introduction of new production processes (eg production of masks, respirators, etc) while remaining within the scope of one's own economic activity 1 - Production of new goods, provision of new services or introduction of new production processes while remaining within its own economic activity 2 - Radical change in the type of activity compared with previous activities 3 - Changing or expanding sales channels or methods of supplying/delivering goods or services (eg moving to online services, e-commerce and multi-channel distribution models) 4 - Change and diversification of the modes of transport used for export/import of goods 5 - Change or expansion of exported goods 6 - Change or extension of export destination countries in the EU area 7 - Change or extension of export destination countries in the non-EU area 8 - Acceleration of the digital transition and greater use of internal and external virtual connections 9 - Reorganisation of processes and work or commercial spaces 10 - Search for new industrial and business models based on innovative technologies (Industry 40) 11 - Changing the quantity of orders for input factors (eg raw materials, etc) 12 - Intensification of existing relationships or creation of partnerships with other domestic or foreign companies 13 - Substantial reduction in the number of employees 14 - Change in ownership structure 15 - Other strategy 16 - No strategy
6.21.1 What are the reasons for which the firm has not adopted or is not considering adopting any strategy?	0 - Difficulty in defining/planning a strategy 1 - Difficulty in reorganising premises and production processes 2 - Difficulty in finding/managing the necessary expertise 3 - Difficulty in raising the necessary financial resources 4 - Other reasons 5 - The company's activity is not negatively affected by the COVID-19 emergency

4 Methodology

Both the IMCPI and the SPIESC-19 questionnaires, for their process-centred features, are particularly apt to plumb the structure of the productive system by using the lens of the capability-based theory of the firm. Indeed, the survey design allows to compare the so called *quasi-genetic traits* of the firms in pre-pandemic times, here intended as behavioural entities, and their responses during the pandemic crisis.

In the following, we start by recalling how we identified the emergence of four clusters characterizing the Italian productive structure making use of the IMCPI questionnaire in Costa et al. (2021) (Subsections 4.1, 4.2, 4.3). Then we analyse actions and responses cluster by cluster, comparing the IMCPI and the SPIESC-19 evidence (Subsection 4.4).

4.1 Step 1: Factor analysis on the IMCPI

We adopt a data-driven, multi-step approach. First, we select a subset of items covered by the questionnaire in tune with a capability-based theory that should cover the most distinctive operational attributes of firms. These range from questions on ownership structures, personnel management practices, relations with other firms within the supply chain and customers, market relations, technological set-ups, future investments and development prospects, to social relations, workforce safety and well-being. After our informed selection, we retain forty questions. More in detail, we focus on subsections of the survey belonging to the seven macro-areas: *Ownership, control and management*; *Human resources*; *Relations between firms and other entities*; *Market*; *Technology, digitalisation and new professions*; *New trajectories of development*; *Environmental sustainability, social responsibility and safety*. For the specific choice of the selected questions we make reference to Costa et al. (2021).

As a second step, given the high dimensionality of the information, we carry out an analysis of multiple correspondences in the set of questions we selected and, by operating a dimensionality reduction, we extract seven latent factors that summarise the informative content of each of the seven subsections taken into consideration. Then, we perform a further factor analysis on these initial seven factors, as a result of which we obtain three latent factors that account for 69% of total variance. The sampling adequacy, which yields a KMO (Kaiser-Meyer-Olkin) test of 86% (thus above the 80% required threshold) confirms the robustness of the factorization.

The final identified three factors are ascribable to different sets of capabilities. The first factor is linked to work organisation, employee training processes, the presence of HPWPs, recruitment mechanisms, technological-organisational skills linked to investments in digitalisation, the use of management software and platforms. The second factor concerns managerial strategies, in terms of both past and future targets, pricing and investment plans. The third is connected to processes of external relations with other firms in terms of contracts or supplies, and processes of internal relations with workers.

4.2 Step 2: Cluster analysis - IMPCI and FRAME-SBS

After studying the latent structure underlying the multi-purpose questionnaire, we map what we defined the "genetic" traits and the strategic orientations of firms into their performances.

Table 2: Firm clusters and organisational-strategic profiles (units with at least 10 workers).

		Organisational-strategic profiles		
		Technological-organisational capabilities	Managerial strategies	Relations
Cl_1	Essential	14,2	69,8	62,5
Cl_1	Managerial	25,6	75,5	64,5
Cl_3	Interdependent	36,3	73,1	64,3
Cl_4	Complex	49,4	65,8	61,5
	Total	**27,4**	**72,4**	**63,6**

We use therefore a database that integrates the information from the IMCPI with that from the FRAME-SBS business register and perform a K-means clusterization. The latter is a non-hierarchical algorithm for partitioning empirical data that allows us to identify four clusters of firms out of the universe. The number of clusters, defined on the basis of the first factor, is selected using the Elbow criterion, with a total explained variance of 88%.

Recall that the first factor captures the complexity of *technological-organisational capabilities* inasmuch it covers practices aimed at fostering the diffusion of knowledge inside workplaces, problem-solving and learning regimes, and it is linked to the technological dimension embodied in digital technologies and management software. Such technological-organisational factor shows a very low weight in the first cluster of firms and gradually it increases its weight in the other clusters. According to the first factor weights (see Table 2), we define as *Essential* the firms belonging to the first cluster (with a 14.2 weight) and, at the opposite, as *Complex* those ones belonging to the fourth cluster (with a 49.4 weight). The two intermediate clusters have a very high weight in both managerial (second factor) and relational strategies (third factor). We label those firms in the second cluster as *Managerial*, since they show the highest value of the factor that incorporates managerial strategies (75.5). While, we label *Interdependent* the firms belonging to the third cluster, as they feature a very high relational factor (64.3) and present the second most relevant contribution in the technological-organisational factor (36.3), which hints at the possibility that those firms might be suppliers and having relationship with more complex firms.

Table 3 presents some descriptive statistics about performance variables regarding the four clusters as measured in terms of labour productivities, profit margins and wages, and their relative frequencies. About two thirds of Italian firms with at least 10 employees are Essential or Managerial – i.e., they belong to the first or second cluster – even though they contribute to less than one third of total value added. By contrast, the group of Complex firms in the fourth cluster, accounting for only 9% of the total universe, contributes for 42% of value added. Figure 2.a complements the picture, showing the share of firms, employees and total value added by cluster. The visual inspection helps in identifying the structural differences characterizing the overall productive structure.

From a macro-sectoral perspective, in manufacturing Complex firms are 12.8% of the total and account for 46.7% of value added; in market services the ratio decreases to 7.8% of total

firms and to the 39.4% of value added. Therefore, first we observe distinct differences among clusters in terms of size (21.2 average number of workers for Essential firms, 146.9 for Complex firms), and, second, remarkable macro-sectoral ones whereby advanced manufacturing firms, even if they are a small portion of the total, have a prominent role and contribute heavily to the overall value added.

Indeed, looking at the average productivity of each cluster, we observe that Complex firms are twice as productive as Essential firms (78 thousand and 36 thousand euros, respectively). Moreover, the intra-cluster variance is greater among the latter group, with a coefficient of variation of 2.1 compared to 1.4 in the former. In other words, the firms in the most productive Complex cluster not only do perform better, but are also more homogeneous among themselves than Essential ones. Additionally, we find a wide gap in average wages that increases by about 5 thousand euros, moving from the Essential to the Managerial cluster, and by 9 thousand euros from the Interdependent to the Complex ones (see Figure 2.b).

4.3   Step 3: Analysis of co-occurrences - IMCPI

To further characterise firm clusters, we look at the association between clusters and dominant co-occurring practices. In this respect, we analyse the co-occurrences in the answers within each cluster. By treating the answers as independent events, for each firm cluster and each question, we look at the positive or negative response frequency of the firms in the cluster and select the answers using a χ^2 test. Our null hypothesis is that the answers are equally distributed, determined only by the number of firms in each cluster.

The simultaneous significance of two or more answers determines the co-occurrence of questions in the circular charts (Figure 4, left column). For each cluster, answers with the higher positive χ^2 tests (those with a greater discrepancy between the observed and theoretical frequency predicted by the null hypothesis) are displayed, and text size is proportional to the answer's significance. The selection of significant questions, i.e. the χ^2 cutoff for each cluster, is carried out with a heuristic approach, close to Elbow's method.

We detect greater diversification in the number of significant questions as the complexity of the clusters increases. Whereby Essential firms display a fundamental lack of any systematic organisational structure and strategic plans, i.e. few significant characteristics in almost every macro-area of the survey, with particular emphasis on the absence of current and future strategic objectives (e.g., no investments in R&D and human resources, defensive strategies in local markets), Complex firms appear to be characterised by the co-occurrence of the majority of practices meant to achieve technological and skills upgrading (4th Industrial Revolution, upskilling).
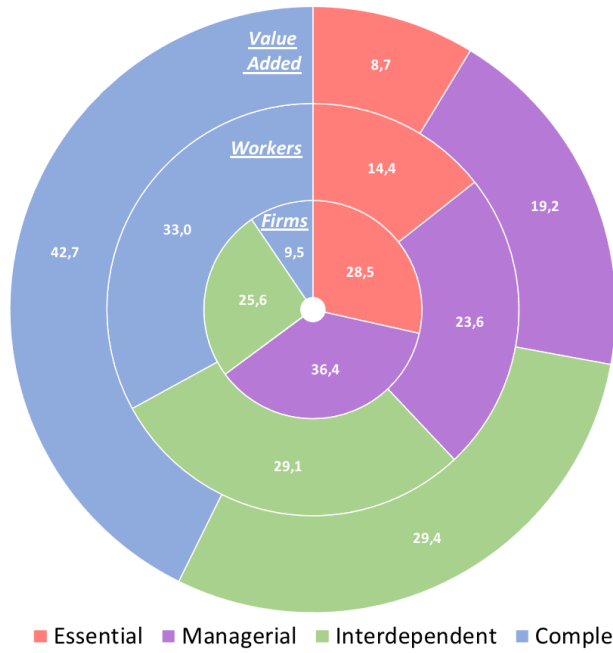
(a) Share of firms, workers and total value added by firm cluster

(b) Wage and productivity levels by firm cluster

Figure 2: Cluster characteristics - Units with at least 10 employees.

Table 3: Characteristics of firm clusters (units with at least 10 employees), *Indagine Multiscopo del Censimento Permanente delle Imprese* data-set carried out by ISTAT in 2019.

	Cluster	Firm		Number of Workers			Value Added		Productivity		Profitability (Mol/Revenues)		Average salary (Cost per employee)	
		Number	%	Number	%	Average	Total (Euros Mln)	%	Average (Euros)	Cfc of Variation	Average (%)	Cfc of Variation	Average (Euros)	Cfc of Variation
Cl_1	Essential	60.380	28,5	1.282.830	14,4	21,2	47.370,0	8,7	36.926	2,1	7,0	149,9	29.403,3	0,7
Cl_2	Managerial	77.040	36,4	2.106.065	23,6	27,3	103.816,5	19,2	49.294	1,1	7,4	60,9	34.714,9	0,5
Cl_3	Interdependent	54.267	25,6	2.595.343	29,1	47,8	159.340,2	29,4	61.395	1,3	7,9	3,5	40.543,2	0,4
Cl_4	Complex	20.070	9,5	2.947.326	33,0	146,9	231.373,3	42,7	78.503	1,4	10,1	35,8	49.655,7	0,5
	Total	211.757	100,0	8.931.563	100,0	42,2	541.900,0	100,0	60.672	1,2	8,7	73,0	40.434,8	0,5

4.4 Step 4: Italian productive structure in pandemic times – Analysis on SPIESC-19

Which was the condition of the Italian productive system in the middle of the pandemic crisis? Below we start presenting some evidence of the status of the business firms in terms of (i) opening, (ii) partially opening, (iii) closure with intentions to reopen, (iv) closure without intentions to reopen.

Figure 3 presents the response rate to the above question regarding the period June - October 2020, grouping firms by the cluster of belonging. From 60% to 80% of firms, according to the cluster of belonging, reports to be fully open. Weaker and more vulnerable firms, which are only partially open or closed with intentions to reopen, are approximately 20% in the Complex and Interdependent clusters, while the share increases in the Managerial cluster and peaks in the Essential one, reaching almost 35% of business units. A positive share of closed firms without intentions to reopen is present as well. Notably, the analysis is focusing on units with at least 10 employees, therefore discarding all small firms, the most exposed to closure. This choice is motivated by the fact that already the IMCPI analysis was restricted to units with more than 10 employees, in order to have a minimal organizational structure. At this stage, the first signal from the SPIESC-19 is that less advanced clusters are also more severely hit by closures.

We now turn to replicate the analysis of co-occurrences, already conducted on the IMCPI, on the SPIESC-19 questionnaire. The analysis allows to study comparatively the attributes of firms in the pre-pandemic phase, the so-called quasi-genetic traits, with the type of responses emerged during the pandemic crisis. As discussed before, our attention is devoted to practices put in place to manage both the workforce and financial issues, expected impacts and foreseen strategies.

With this objective in mind, Figure 4 shows firm attributes as elicited from the IMCPI before the pandemic (left column), and firm responses as elicited from the SPIESC-19 during the pandemic period (right column), cluster by cluster. Recall that such analysis of co-occurrences is meant to detect attributes more distinctive of the response rate by cluster, having as benchmark a theoretical χ^2 distribution, compared with the empirical one. Therefore, whenever a given response appears it does not mean that it was uniquely replied by the cluster of appearance, but rather that such response characterises more than others the cluster, or equivalently that there is more association between the cluster and the elicited answer, compared to the rest.

Across clusters, the number and text size of each response differ: such difference, completely endogenous, tells about the presence of more or less proactive attitudes of firms that in some clusters present a multi-level approach, while in some others only few behavioural responses were put in place (Costa et al., 2022). In addition, few detected actions mean that the deviation from the theoretical and the empirical distribution was not strongly significant for the majority of answers, and as such, it is difficult to identify very specific behavioural traits of the cluster, e.g. firms behave more independently within the cluster. The text size of the answer reflects instead the relevance in characterizing the specific cluster, meaning that a large number of firms has replied using the same response, increasing the answer's significance.

Recall that the IMCPI questionnaire was studied with respect to the following items: ownership structures, personnel management practices, relations with other firms within the supply
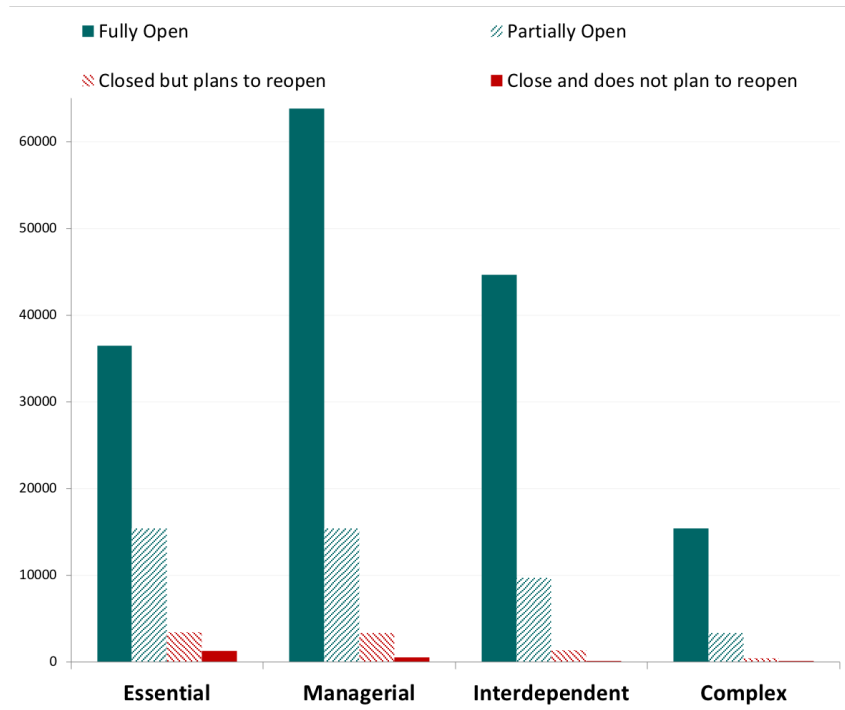
(a) Number of firms by cluster
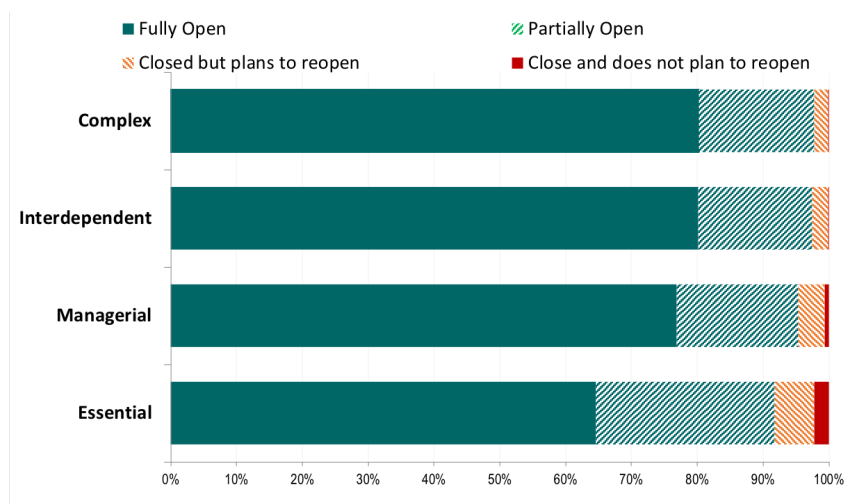
(b) Share of firms by cluster

Figure 3: Distribution by firm cluster and closure/openness status (units with at least 10 employees).

chain and customers, market relations, technological set-ups, future investments and development prospects, social relations, workforce safety and well-being. The latter domains were identified as signalling the specific behavioural traits of the firms.

Starting from the Essential cluster, if in the pre-pandemic phase the cluster was mostly characterised by low investment rates, no attention to design safety policy processes, higher inclination to invest in cybersecurity, data and network security, mostly addressing domestic markets (Figure 4.a), the arrival of the pandemic strongly disoriented such firms, who were actually unable to imagine, define or even think of the need to elaborate a strategy. In many cases, the business activities were not even affected, according to respondents, exactly because of the absence of any strategy and change in behaviour put in place to counteract the crisis (Figure 4.b). Firing, substantial employee reduction, hard reorganization of production and unclear measures are all hallmarks of such Essential firms. A similar picture characterizes Managerial firms (Figure 4.c), which in pre-pandemic times were mainly interested in pursuing defensive strategies, looking at domestic markets, lacking any human resource practice meant to attract talents and personnel, together with no R&D activity neither planned investments. Such attributes were reflected in a quite conservative reaction to the pandemic inasmuch no human-resource management practice was put in place, neither current nor future strategies were envisaged (Figure 4.d).

Moving now to the two upper clusters, we start with Interdependent firms (Figure 4.e) which in the pre-pandemic phase showed strong inclinations to invest in intramuros R&D, developing digital skills, acquisition of professional services, internationalization of investments, marketing, sales and post-sales activities, all this coupled with human-resource retraining and work organization. Such type of firm behavioural attributes have been quite important to address the pandemic crisis. In fact, exactly this cluster of firms, and indeed confirming its interdependent nature, was quite able to reorganize the direction of market destinations, increasing exports both toward EU and non EU countries. Indeed, in a period marked by strong value chain disruptions, reorienting the acquisition of the inputs of production becomes crucial for those firms highly interconnected. In addition, such firms tended to accelerate Industry 4.0 solutions, relied on new business models, changed the ownership structure and reinforced strategic partnerships (Figure 4.f). This behaviour portrays a proactive business attitude, able to counteract and more or less promptly address the pandemic storm. Finally, Complex firms represent the most advanced and dynamic layer of the industrial structure. In the period 2016-2018 these firms were already planning to enter into the 4th Industrial Revolution, promoting processes of upskilling, investing in augmented reality and big-data analytics, and strongly activating R&D collaborations, partnerships, but also ICT provision, with emphasis toward a Smart Factory (Figure 4.g). Such pre-pandemic attributes conflate in a completely different set of responses vis-à-vis Essential and Managerial firms and were instead more aligned to Interdependent firms. In addition, Complex firms not only were able to reorganize their business models and accelerate the digital transformation toward Industry 4.0, but were also capable to device some specific interventions, as improving the logistic performance, change the bundle of acquired inputs, change in good or service sales channels or supply/delivery. Together with the reorganization of the workspace, providing additional training and smart-working, such firms were able to raise capital from external financiers, hiring and renegotiate client payments

terms and conditions (Figure 4.h).

Comparing all clusters, two results appear quite robust: first, firm responses to the pandemic crisis were strongly dependent on their pre-crisis attributes, showing a remarkable degree of stickiness and adaptive persistence in the behavioural attributes, defined as quasigenetic traits. Second, if the emergence of a neodualistic structure was already identified in the pre-crisis period (Costa et al., 2021), a similar behaviour between the two lower and the two upper clusters highlights the presence of a neodualistic pattern also with respect to crisis responses.

5 COVID-19 and corporate crises

Considering the heterogeneous and different strategies put in place by firms, and the potential asymmetric impacts of the crisis across the four clusters as well, we now turn to analyse a specific set of questions concerning some alternative forms of corporate crises, from less to more severe. In particular, we focus on four questions informing about:

- *Operational and sustainability risks*

- *Substantial employee reduction*

- *Change in ownership structure*

- *Closure of company premises*

Such questions are clearly characterised by a different degree of pervasiveness and commonality across firms. In addition, they also report different degrees of riskiness about the status of the company, from more to less burdensome ones, as shown by the response rates in Figure 5.a. Indeed, while firms reporting operational and sustainability risks are approximately 25% of respondents, substantial employee reduction affects 10% of respondents, while more radical actions, as change in ownership structure and closure of the company premises, regard 2.5% of the respondents respectively. If in total approximately 40% of respondents report some form of corporate crisis, more or less irreversible, the distribution across clusters is not as such asymmetric as the previous heterogeneous behaviours in terms of responses would have entailed. Although different shares in the response rate by cluster do emerge, they are not as such distinctive to characterize only specific clusters (Figure 5.b). Even the upper Interdependent and Complex ones, that are also the lion share of employment and value added, report a minimum of 40% up to a maximum of 60% of positive replies across the four questions. Indeed, the share of value added which is affected by some form of corporate crisis, which might go from more manageable operating risks up to closure of company premises, is largely originating (80%-90%) from Interdependent and Complex firms (Figure 5.c). This signals a potential destruction in capabilities of a chunk of quite "good" firms.

According to Table 4, approximately one fourth of those positively replying about sustainability risks reported the intention to fire workers. More reassuring is instead the co-occurrence between the change in ownership structure and the intention to close the company which stands at less than 10%.

(a) Essential in pre-pandemic times

(b) Essential in pandemic times
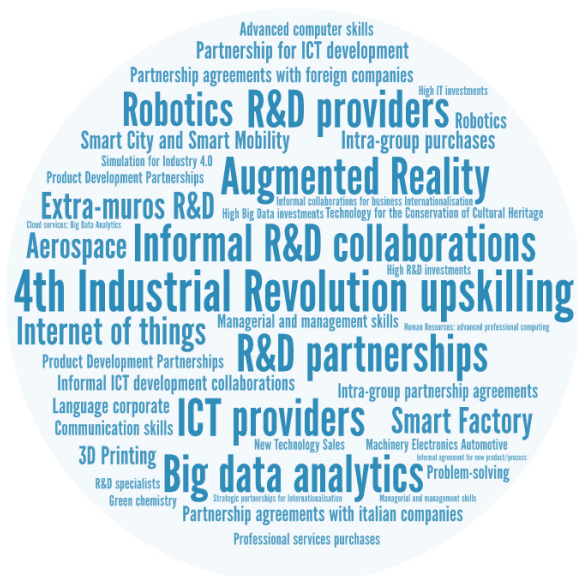
(c) Managerial in pre-pandemic times

(d) Managerial in pandemic times

(e) Interdependent in pre-pandemic times

(f) Interdependent in pandemic times

(g) Complex in pre-pandemic times

(h) Complex in pandemic times

Figure 4: Co-occurrences of firms' strategies within each of the four firm cluster, the set of textual clouds on the left (a, c, f, h) refers to the practices recorded in the *Indagine Multiscopo del Censimento Permanente delle Imprese* data-set, carried out by ISTAT in 2019, while textual clouds on the right (b, d, g, e) reports the strategies (and lack of) undertaken by firms facing the COVID-19 crisis recorded in the *Situazione e prospettive delle imprese nell'emergenza sanitaria COVID-19* questionnaire carried out by ISTAT in November 2020.

In order to have a tentative understanding of the amount of jobs, wages and value added eventually lost, e.g. the entailed social costs, Figure 6.a shows the number of engaged persons affected by such processes of corporate restructuring, going from the lower bound of 150 thousand persons involved in change in ownership structure, to 200 thousands involved in direct company closures, to more than 600 thousand persons engaged in firms affected by forms of employee reduction, up to 1.4 million jobs engaged in firms affected by operational and sustainability risks. Clearly, the latter numbers are not a direct precise estimation, but rather a range of the potential expected job losses, which might end-up even in affecting 1 million jobs. These jobs are obviously remunerated. When coming to the total amount of wages, quite huge figures emerge, up to 30 billions of euros considering firms reporting sustainability risks (Figure 6.b). Finally, the eventual value added lost is all but nil, ranging from 15 billions of euros destroyed in case of company closures to which one should sum-up the eventual reduction in value added of those firms expecting to fire workers, which produce a total value added of more than 40 billions of euros (Figure 6.c).

Considering that the impact is quite likely to be asymmetric across sectors, we finally move toward the breakdown at 2-digit NACE industry classification, both for manufacturing and service. The sectoral analysis is restricted to two questions, namely substantial employee reduction and corporate closure due to the similarity in results of the two remaining questions. Figure 7 depicts a quite polarised picture for standard manufacturing activities like Apparel, Food, Other manufacturing, Rubber and plastics, appearing as the top-five most exposed sectors and accounting for more than forty percent of overall corporate closures. Among the top-exposed sectors to substantial employee reduction also Leather and Machinery appear. When coming to services, Catering and Lodging are the lion share, not surprisingly. Other affected sectors are Building and Landscape, Land transport, and more surprisingly Software and consultancy, Advertising and Other professional services.

Overall, it seems to be confirmed a higher resilience to the crisis of more advanced sectors vis-à-vis standard ones. So called Pavitt downstream sectors (Dosi et al., 2021), as those belonging to the Supplier Dominated class characterised by low learning regimes and poor technological opportunities, are the most exposed to different forms of vulnerability. However, also more advanced sectors belonging to the upstream Specialised Supplier class are affected by risk exposure, although with a different incidence (e.g. Machinery).

To sum-up, the evidence presented warns against a potential widespread restructuring process: the pandemic crisis, rather than being a cleansing mechanism directed toward the least productive firms, is also impinging on more advanced and structured business activities, belonging to the Interdependent and Complex clusters. If the pandemic induced crisis is not only targeting low-value added Essential and Managerial firms but also the most advanced layers of the productive system, expectations of a fast and **V**-shaped recovery are hardly conceivable, whenever accounting for the unfolding of the micro-level effects.
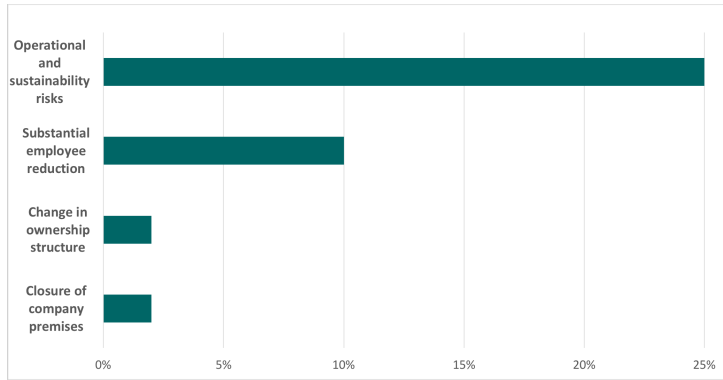
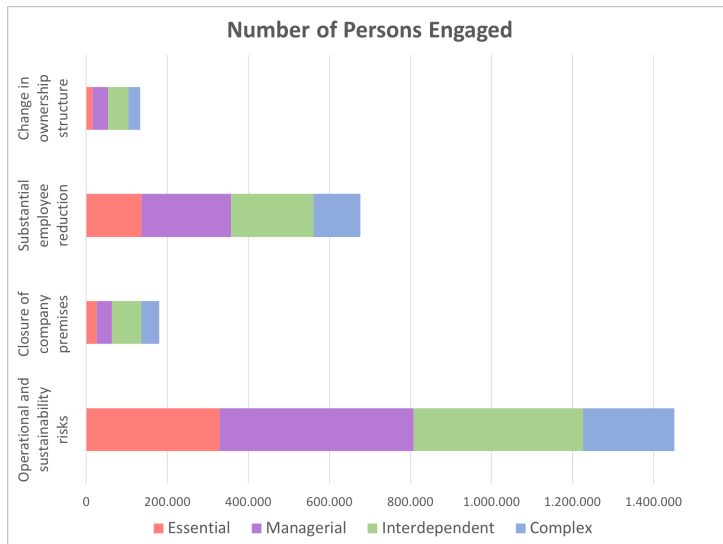(a) Percentage of firms that gave positive answers
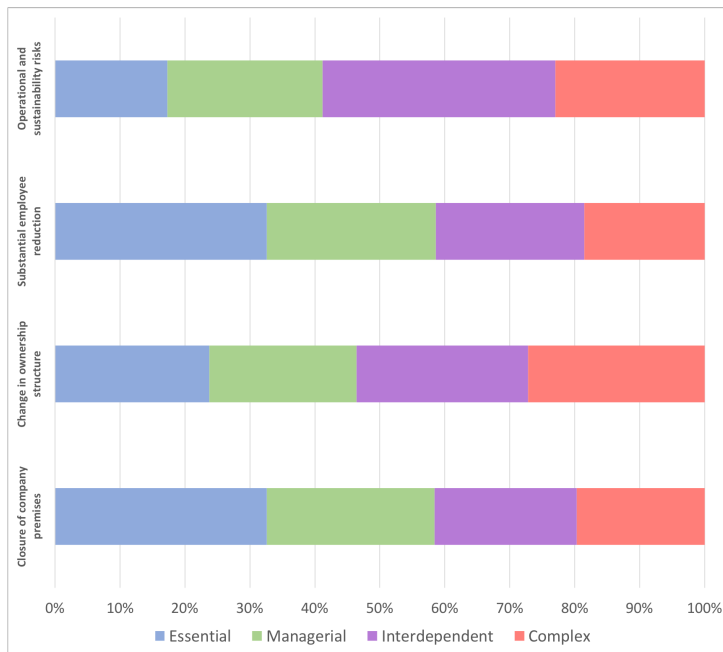
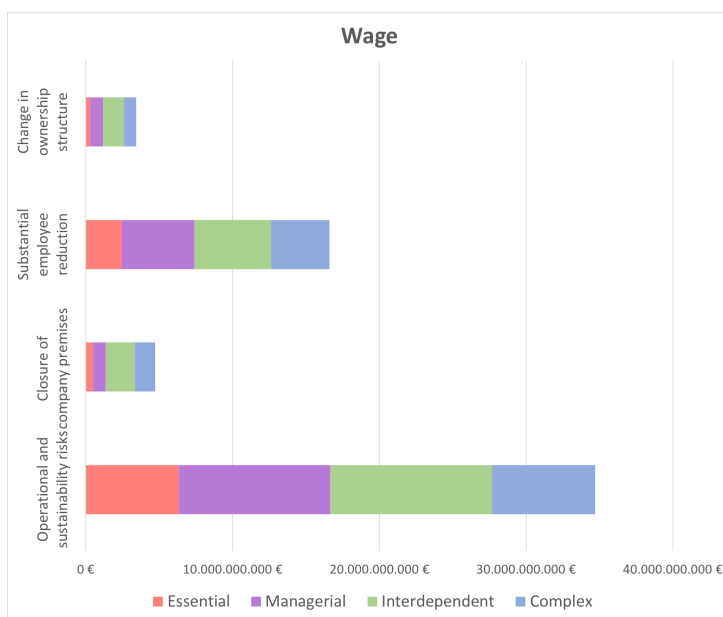(b) Distribution of positive answers by firm cluster

(c) Distribution of value added by firm cluster

Figure 5: Firms reporting risks of corporate crises (units with at least 10 employees).

(a) Number of persons engaged

(b) Total wages

(c) Total value added

Figure 6: Characteristics of the firms reporting risks of corporate crises by firm cluster (units with at least 10 employees).

	Operational and sustainability risks	Closure of company premises	Substantial emp. reduction	Change in ownership structure
Operational and sustainability risks	53734	2584	14297	1781
Closure of company premises	2584	4094	1283	**372**
Substantial emp. reduction	**14297**	1283	22493	1349
Change in ownership structure	1781	372	1349	4829

(a) Manufacturing

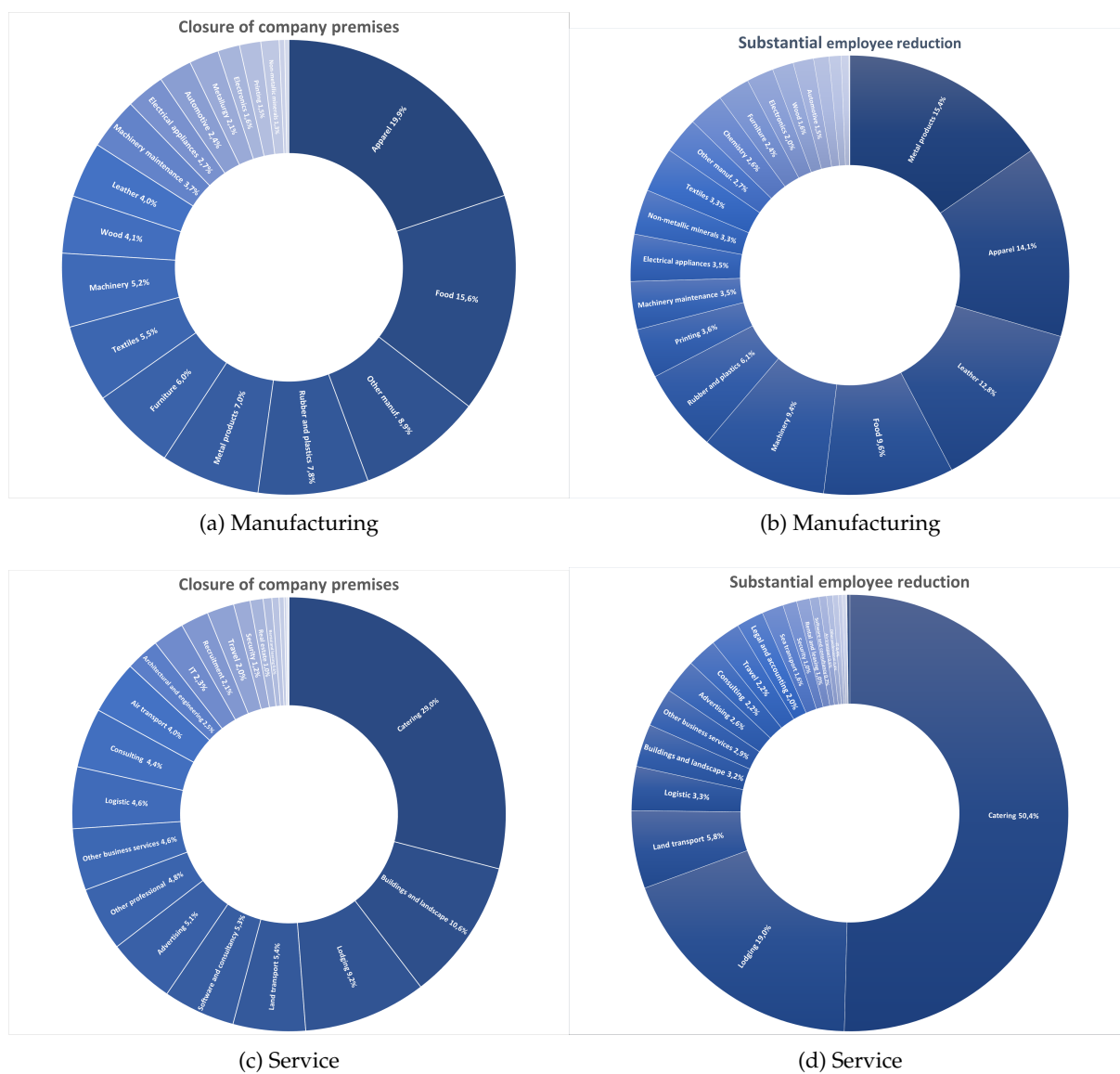(b) Manufacturing

(c) Service

(d) Service

Figure 7: Incidence of corporate crises: closure of company premises and substantial employee reduction, by manufacturing and service NACE industry at 2-digit aggregation level.

6 Discussion and conclusions

This paper is meant to address the status of the Italian productive system in the wake of the most severe crisis economies are facing since WWII. In order to accomplish the latter task we rely on the combination of two high quality level dataset informing about so called firm behavioural traits: the first, the IMCPI (2019), collected information on organizational capabilities, practices, attitudes toward innovation, business models and strategies during the period 2016-2018, in so called usual times. The second, the SPIESC-19 (2020), was able to monitor firm responses to the pandemic crisis, collecting information in the period June - October 2020. The sample design of the two questionnaires was as such that the second is defined as a subset of the first, therefore allowing complete comparability. Remarkably, the SPIESC-19 is among the most detailed, representative, wide coverage surveys currently available, also compared to other advanced countries, and it allows to recover the universe of the firms.

Both questionnaires have been studied by means of textual content analysis: responses to the IMCPI were first factorised in order to reduce the massive dimensionality; then, a cluster algorithm was applied in order to detect the eventual emergence of similar groups of firms, linking the IMCPI with the FRAME-SBS dataset. Four clusters were identified in Costa et al. (2021), quite distinct in a series of performance variables, from employment to value added, to average wages and profitability. Such taxa turned out to be quite important to inform about the behavioural responses of firms during the pandemic crisis. In fact, the analysis of the SPIESC-19 was conducted by first identifying a series of informative variables, in terms of practices put in place to manage the crisis, effects, expectations and strategies. Then, such responses, analysed by using a χ^2 test of co-occurrences, have been projected over the four pre-pandemic clusters. Furthermore, we were able to study the status of the Italian productive system in the middle of the crisis, looking both at direct closures, but also at more long-term and underground expectations of corporate crises.

Two are the bottom lines of our study, complementing those in Costa et al. (2022): *first*, there is strong stickiness and (adaptive) persistence between the behavioural attitudes of the firms in their "business as usual" and "emergency" status, meaning that what they know and how they are organised in the business as usual mode exert huge and remarkable impacts on how they are able to react to unforeseen crises. This first result gives support and strengthens the capability-based theory of the firms, and the overall understanding of the latter as complex, behavioural entities as opposed to maximizing units, uniquely performing operational research calculus to optimize inputs of production in uncertain environments. Whenever an unforeseen event occurs, the safest response is to rely on previous knowledge and experience to adjust and cope with the new environment, mostly applying a heuristic-based behavioural approach (Dosi and Egidi, 1991; Winter, 2000).

The *second* result regards the nature of this crisis. Crises have been, since the Schumpeterian notion of *creative restructuring*, considered a potential source of market-cleansing from unproductive, poorly innovative firms. Crises are indeed often seen as an *opportunity*. However, we already know from the most recent experience on the Great Recession that such market-based mechanism suffers from poor functioning (Dosi et al., 2012; Foster et al., 2016). The pandemic-induced crisis will hardly represent an opportunity to reshape the industrial structure toward a

high-productivity path: as we have seen, diverse, from more to less intense forms of corporate risks are at work and such risks are not only targeting low-productivity, Essential firms. They are also involving quite productive and structured units, responsible for a considerable fraction of value added, employment and wages. This type of evidence warns against potential scenarios of *widespread restructuring processes*, not necessarily resulting in higher growth and productivity and bringing about huge social costs.

The power of the microlevel analysis here conducted, combining qualitative and quantitative information, is indeed both the possibility of having a gauge of the status of the economy, but also to operate with selective and targeted policy interventions, for example impeding closures and delocalizations of important components of the overall Italian production chain. As such, we prompt the policy intervention to be as fast and as selective as possible along two directions, namely (i) providing guarantees and safety instruments to protect those firms belonging to high-level productive clusters, impeding their closure and providing refinancing but also policy guidance, and (ii) creating public instruments able to foster integration of small, often disoriented Essential and Managerial firms toward a reconversion of production able to cope with the challenges of digitization and greening of the economy. Vertical and selective industrial policies, addressing firm clusters rather than sheer sectors of activity, beyond the nth non-selective fiscal incentives, are crucial to cope with an otherwise crisis producing long-lasting hysteresis effects (Dosi et al., 2020).

A limitation of our study is that it might be partially biased by survey respondents. Indeed, future extensions entail the analysis of quantitative measures of firm responses, starting with the hiring and firing flows during the pandemic to tackle both a quite effective measure of corporate behaviour in response to the crisis and the ensuing impacts on labour markets at the micro level of observation.

Acknowledgements

References

Adalet McGowan, M., D. Andrews, and V. Millot (2018). The walking dead? zombie firms and productivity performance in oecd countries. *Economic Policy 33*(96), 685–736.

Adams-Prassl, A., T. Boneva, M. Golin, and C. Rauh (2020). Inequality in the impact of the coronavirus shock: Evidence from real time surveys. *Journal of Public Economics 189*, 104245.

Aguiar, M., G. Dosi, D. A. Knopoff, and M. E. Virgillito (2021). A multiscale network-based model of contagion dynamics: heterogeneity, spatial distancing and vaccination. *Mathematical Models and Methods in Applied Sciences*, 1–30.

Baldwin, R. and R. Freeman (2021). Risks and global supply chains: What we know and what we need to know. Technical report, National Bureau of Economic Research.

Bartik, A. W., M. Bertrand, Z. Cullen, E. L. Glaeser, M. Luca, and C. Stanton (2020). The impact of covid-19 on small business outcomes and expectations. *Proceedings of the National Academy of Sciences 117*(30), 17656–17666.

Bellomo, N., R. Bingham, M. A. Chaplain, G. Dosi, G. Forni, D. A. Knopoff, J. Lowengrub, R. Twarock, and M. E. Virgillito (2020). A multiscale model of virus pandemic: Heterogeneous interactive entities in a globally connected world. *Mathematical Models and Methods in Applied Sciences 30*(08), 1591–1651.

Bloom, N., R. S. Fletcher, and E. Yeh (2021). The impact of covid-19 on us firms. Technical report, National Bureau of Economic Research.

Buchheim, L., J. Dovern, C. Krolage, and S. Link (2020). Firm-level expectations and behavior in response to the covid-19 crisis.

Caracciolo, G., F. Cingano, V. Ercolani, G. Ferrero, F. Hassan, A. Papetti, and P. Tommasino (2020). Covid-19 and economic analysis: a review of the debate. *Banca D'italia 2*, 1–13.

Cerra, V., A. Fatas, and S. C. Saxena (2021). Fighting the scarring effects of covid-19. *Industrial and Corporate Change 30*(2), 459–466.

Cetrulo, A., D. Guarascio, and M. E. Virgillito (2022). Working from home and the explosion of enduring divides: income, employment and safety risks. *Economia Politica*.

Costa, S., S. De Santis, G. Dosi, R. Monducci, A. Sbardella, and M. E. Virgillito (2021). From organizational capabilities to corporate performances: at the roots of productivity slowdown. Technical report, Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies.

Costa, S., S. De Santis, and R. Monducci (2022). Reacting to the covid-19 crisis: state, strategies and perspectives of italian firms. *Rivista di Statistica Ufficiale* (forthcoming).

Delaporte, I., J. Escobar, and W. Peña (2021). The distributional consequences of social distancing on poverty and labour income inequality in latin america and the caribbean. *Journal of Population Economics 34*, 1385–1443.

Dosi, G. and M. Egidi (1991). Substantive and procedural uncertainty. *Journal of evolutionary economics 1*(2), 145–168.

Dosi, G., L. Fanti, and M. E. Virgillito (2020). Unequal societies in usual times, unjust societies in pandemic ones. *Journal of Industrial and Business Economics 47*(3), 371–389.

Dosi, G., M. Grazzi, C. Tomasi, and A. Zeli (2012). Turbulence underneath the big calm? The micro-evidence behind Italian productivity dynamics. *Small Business Economics 39*(4), 1043–1067.

Dosi, G., D. Guarascio, A. Ricci, and M. E. Virgillito (2021). Neodualism in the italian business firms: training, organizational capabilities, and productivity distributions. *Small Business Economics 57*(1), 167–189.

Dosi, G., M. Piva, M. E. Virgillito, and M. Vivarelli (2021). Embodied and disembodied technological change: The sectoral patterns of job-creation and job-destruction. *Research Policy 50*(4), 104199.

Dosi, G., M. E. Virgillito, and X. Yu (2020). The wage-productivity nexus in the world factory economy. *World Development 129*, 104875.

Foster, L., C. Grim, and J. Haltiwanger (2016). Reallocation in the great recession: cleansing or not? *Journal of Labor Economics 34*(S1), S293–S331.

Gottlieb, C., J. Grobovšek, M. Poschke, and F. Saltiel (2021). Working from home in developing countries. *European Economic Review 133*, 103679.

Helfat, C. E. and S. G. Winter (2011). Untangling dynamic and operational capabilities: Strategy for the (n) ever-changing world. *Strategic management journal 32*(11), 1243–1250.

IMF (2021). World economic outlook: Recovery during a pandemic—health concerns, supply disruptions, price pressures.

Industrial Development Report (2022). The impact of covid-19 on us firms. Technical report, UNIDO.

Montenovo, L., X. Jiang, F. L. Rojas, I. M. Schmutte, K. I. Simon, B. A. Weinberg, and C. Wing (2020). Determinants of disparities in covid-19 job losses. Technical report, National Bureau of Economic Research.

Sharma, D., J.-P. Bouchaud, S. Gualdi, M. Tarzia, and F. Zamponi (2021). V–, u–, l–or w– shaped economic recovery after covid-19: Insights from an agent based model. *PloS one 16*(3), e0247823.

Winter, S. G. (2000). The satisficing principle in capability learning. *Strategic management journal 21*(10-11), 981–996.

Zamarro, G. and M. J. Prados (2021). Gender differences in couples' division of childcare, work and mental health during covid-19. *Review of Economics of the Household 19*(1), 11–40.

Zoller-Rydzek, B. and F. Keller (2020). Covid-19: Guaranteed loans and zombie firms. *CESifo Economic Studies 66*(4), 322–364.