Management practices and resilience to shocks: Evidence from COVID-19[*]

Andrea Lamorgese
Bank of Italy

Andrea Linarello
Bank of Italy

Megha Patnaik
LUISS University & CEPR

Fabiano Schivardi
LUISS University, EIEF & CEPR

March 30, 2021

Abstract

Do management practices help or harm firms when facing large shocks? Organizational practices can facilitate firms' responses to shocks through structured decision making, but also hinder them by constraining flexibility. We use the spread of COVID-19 in Italy, the first Western country hit by the pandemic, to investigate the role of management practices in responding to a large shock. We find a sizable, positive effect of management practices on firm performance: a one-standard deviation increase in the management score reduces the drop in year-ahead expected sales by 30 percent. Evidence points to the fact that better managed firms were more likely to implement changes in the organization of labor, and in particular to use remote work more intensely.

Keywords: Management, Firm Performance, COVID-19

---

1   Introduction

A large body of evidence indicates that structured managerial practices are an important determinant of firm performance. Cross-country studies such as Bloom & Van Reenen (2007) suggest that management practices explain up to a third of the cross-country differences in firm productivity. Within-country studies based on randomized control trials show that management indeed has a causal effect on performance (Bloom, Eifert, Mahajan, McKenzie & Roberts 2013, Bruhn, Karlan & Schoar 2018). Based on these studies, a consensus is emerging that scaling up management practices can boost firm productivity (Bloom, Sadun & Van Reenen 2016, Giorcelli 2019, Schivardi & Schmitz 2020).

While the relationship between management and performance is well-established in "normal times", little is known about whether management practices help or hinder the response of firms to large shocks. From a theoretical perspective, the effect could go either way. On one hand, management practices may provide firms with tools and information to better direct firm strategy in the face of the shock. On the other hand, these practices may impose excessive structure and constraints compared to a less formalized management style, hindering the firm at a time when flexibility is valuable. Understanding the effects of managerial practices on firm resilience to shocks is clearly important: if management practices reduce flexibility, their adoption implies a trade-off between performance in normal times and resilience to shocks during times of crises. Conversely, if management practices help firms even in times of crises, this is an additional reason for investing in and putting into place management and organizational practices. More generally, these insights have implications for firms in fast-changing environments, such as highly innovative sectors, and for the debate on the merits of SMEs versus large firms. In the policy debate, SMEs are often associated with greater flexibility and resilience with respect to large, more structured organizations (see, for example, European Commission 2020, Hicks & Breitzman 2003).

We analyze how management practices affect firm resilience to shocks exploiting an ideal setting to address this question: the spread of the COVID-19 pandemic in Italy. Italy was the first Western country to be affected by the pandemic and the policy measures during COVID-19 could neither be known to nor anticipated by Italian firms. This was in contrast to the subsequent spread of the pandemic in other industrialized countries, where the Italian experience served as a precedent. The virus spread from the end of February 2020 with a speed and virulence that was completely unexpected. The Italian government responded through a bundle of measures that included widespread social distancing and school closures

from the 8$^{\text{th}}$ of March, and a country-wide lockdown from the 22$^{\text{nd}}$ of March to the beginning of May. Firms had to adapt to a completely new and dramatically different environment within a very short period of time.

We study the role of management in the Italian experience using extremely rich information from three firm surveys conducted by the Bank of Italy through the evolution of the pandemic. Our primary data source is the 2020 INVIND survey, an annual survey conducted since 1984 and representative of firms with at least 20 employees. The 2020 vintage of the INVIND survey includes a module on structured management practices based on the survey instrument developed in Bloom, Brynjolfsson, Foster, Jarmin, Patnaik, Saporta-Eksten & Van Reenen (2019). The INVIND module explicitly refers to practices in place in 2019, that is, before the spread of the pandemic, and we use this to derive a management score. The survey reports, among other things, expected sales growth. Expectations have the advantage of being highly reactive to changes in the economic environment. The survey was conducted between February and May, which allows us to track how expectations change week by week across the evolution of the pandemic, and to relate such changes to management practices.
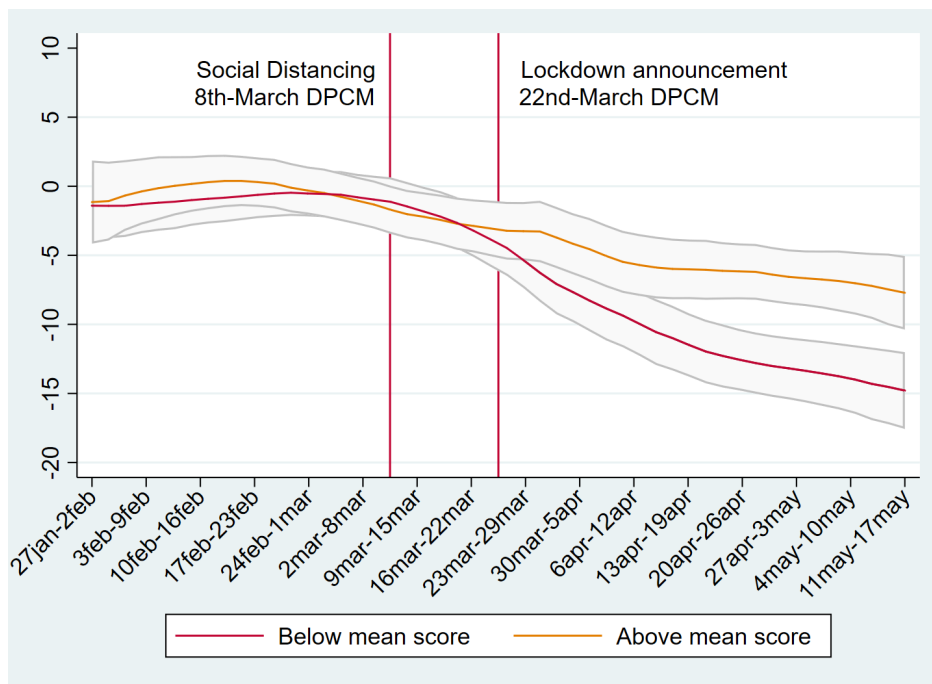
Figure 1 illustrates our key result. We plot the evolution of the average expected sales growth in 2020 by week of response separately for firms with management above and below the mean score. Before the lockdown, no difference in expected sales is visible between the two groups.[1] As the pandemic spread, firms' expectations about sales growth quickly deteriorated. However, this decline was not uniform: rather, better managed firms reported substantially lower declines in expected sales.[2] This suggests that managerial practices were particularly useful during the pandemic: rather than hindering firms, they turned out to be an asset in tackling the shock.

The graphical evidence seen in Figure 1 is fully confirmed in a regression setting. In the lockdown, managerial practices are associated with lower expected sales drops: in our preferred specification, a standard deviation increase in the management score increases expected sales growth by 2.4%, about 30 percent of the average drop (-8.3%). We use the richness of our data to corroborate this basic result by addressing various empirical concerns. First, ex-

---

[1] This is not at odds with the literature cited above that shows that firms with structured practices perform better. That evidence, in fact, shows that such firms are more productive, larger, more profitable etc. *in levels*. This does not imply that they also constantly growth more, a much stronger requirement in terms of performance.

[2] For firms that responded in the last two weeks (from May 4$^{\text{th}}$ to May 17$^{\text{th}}$), the drop in sales is twice as large for the firms with below average management scores relatively to the firms with above average scores: -15% against -7.5%

Figure 1: Sales growth over the evolution of COVID-19 split by management score

Note: The y-axis of the graph shows smoothed values of mean YoY sales growth from the 2020 INVIND survey across weeks reported on the x-axis for firms in two groups: those with above mean management score, and those with below it. The outcome variable is calculated through kernel-weighted local polynomial regressions of YoY expected sales growth on week of response for firms. The bands shown are 95% confidence intervals and the vertical lines correspond to the announcement dates of widespread social-distancing restrictions in Italy (March 8th) and country-wide lockdown (March 22nd).

pectations might reflect systematic differences in expectation formation, possibly correlated with managerial practices. We show that our finding is robust to this concern by using early information on realized sales growth from the SONDTEL survey, conducted by the Bank of Italy in September. In addition, we exploit the panel dimension of the dataset to show that forecast errors are not correlated with managerial practices in our setting, validating the use of expectations in sales to capture the immediate response to the COVID-19 shock. Second, we control for a rich set of firm characteristics that are typically correlated with managerial practices and might also affect the response to the shock. These include size, productivity, export status, human capital and technology adoption. Our results are extremely robust: even when we allow for the effects of each of these characteristics to differ before *and* after the lockdown, the estimated coefficient of the managerial practices in the lockdown period remains unchanged. In fact, the managerial score is the only feature that consistently emerges as significant in all specifications. Finally, we show that the *channels* through which the COVID-19 shock affected firm operations (lack of demand, labor issues,

finance, etc.), as reported in a short ad-hoc survey (the ISECO survey) conducted at the onset of the country-wide social distancing campaign, are orthogonal to our management measure, limiting the concern that the shock may be systematically correlated with management practices.

Next, we examine the *strategies* firms put in place to counteract the shock using qualitative information from the ISECO survey. Relative to doing nothing, a high management score is significantly associated with the the adoption of strategies related to demand management, supply chain management, labor management, and investment planning. This suggests that better managed firms responded more to the COVID-19 shock overall. Finance strategies bear no relationship with the management score, suggesting better managed firms relied more on responding to the shock with actual changes in their operations rather than on liquidity and debt management.

A group of strategies highly associated with good management were labor policies, including remote work. We posit that remote work may be easier to implement for firms with structured management practices: when managers can't track the input of workers through direct monitoring, output-based incentives may work better. This is easier when the firm has in place practices that set goals, measures outcomes and reward workers accordingly. Our analysis confirms this. Management is positively and significantly associated with increases in the share of employees engaged in remote work in 2020, controlling for the corresponding share in 2019. Specifically, we find that the monitoring and incentives components of the management score are driving the results, consistent with our hypothesis.

The extreme conditions of the Great Recession and COVID-19 have spurred interest in understanding the role of firm organization in responding to large shocks. The growing body of recent work in this area demonstrates that we cannot naively extrapolate off of our knowledge of normal times. Aghion, Bloom, Lucking, Sadun & Van Reenen (2021) find that, during the Great Recession, decentralization of decision making became particularly useful to tackle the increase in turbulence firms faced. Using stock market data for Italy, Amore, Quarato & Pelucco (2020) show that firms owned and managed by a family, usually associated with poorer performance, had higher abnormal returns during the lockdown. For the US stock market, Alfaro, Chari, Greenland & Schott (2020) find that investors valued firms with high labor intensity, which could more easily cut costs by shedding labor.

Our paper also contributes to the recent but rapidly growing literature on management and firm performance (Bloom, Sadun & Van Reenen 2012, Bloom et al. 2013, Bruhn et al.

2018, Bender, Bloom, Card, Van Reenen & Wolter 2018, Schivardi & Schmitz 2020), and we focus of the role on management practices in responding to large shocks. Evidence on this from the Great Recession is inconclusive. Cette, Lopez, Mairesse & Nicoletti (2020) find results that are in line with ours, with cross-country evidence that structured management practices were associated with firm resilience and lower declines in productivity in the period following the Global Financial Crisis. Englmaier, Galdon-Sanchez, Gil & Kaiser (2020) find that flexible management styles dominated structured management for firm performance during 2007-2009. The COVID-19 pandemic in Italy offers us a unique opportunity to study this question.

The rest of the paper is structured as follows. Section 2 describes the timeline of outbreak of COVID-19 in Italy. Section 3 describes the three data sources and present summary statistics of the variables used in our analysis. In Section 4 we describe our empirical strategy. Section 5 documents our results on the role of management in firm performance in the lockdown along with robustness results. In Section 6, we examine firm strategies associated with better management during lockdown, especially the adoption of remote work. In Section 7 we conclude.

2   The COVID-19 shock in Italy

The outbreak of the COVID-19 pandemic required extreme measures limiting freedom of movement, which culminated in the decision of most countries to impose a lockdown of non-essential economic activities.[3] While some Far Eastern countries, which had gone through the experience of the SARS, were more prepared to face the COVID-19 pandemic, Western industrialized countries had not witnessed an event of such magnitude since the Spanish Influenza of the beginning of the 20th century. These countries had to draft and enact plans to contain the effects of COVID-19 in a very narrow time frame with limited information.

Italy was the first Western country to be badly affected by the pandemic. The first official case of COVID-19 in the country was found on February 21st, after which the virus spread in a few densely populated provinces with a speed and virulence that was completely unexpected. The first restrictions to mobility were introduced with the Prime Ministerial Decree[4]

---

[3]Notable exceptions are Sweden as well as UK and Brazil in the early phase of the outbreak.

[4]A decree is a provisional measure having the force of law. According to the Italian Constitution, the Government may not, without an enabling act from the Houses, issue decrees having the force of ordinary law. When in extraordinary cases of necessity and urgency the Government adopts such provisional measures, it must on the same day present said measures for confirmation to the Houses which, even if dissolved, shall

–henceforth DPCM– of February 23rd, more than two weeks before any such measures in the other big European countries (Poland and Spain followed on March 9th). Initially, the measures were confined to 11 municipalities in Lombardy and Veneto, which were declared *red-zones*. The red-zone status limited mobility to and from these municipalities and imposed *measures of social distancing*, i.e., it shut schools, suspended social events, closed retailing shops selling non-essential goods and services, instituted the quarantine for people affected by the virus, and imposed the use of masks and other individual protection devices. In the following days, the Government issued a series of emergency decrees (DPCM) that demonstrate the mounting attempt to keep up with the spread of the pandemic. On March 8th, the red zone status was extended to fifteen additional provinces,[5] and within three days the measures of social distancing were applied to the whole country (the "stay at home" campaign).[6] On March 22nd the measures to counteract of the pandemic were scaled up with the introduction of the *lockdown*, consisting of the shutting down of plants producing any goods and services excepts the ones in a list of essential goods or those belonging to related value chains. Firms were still allowed to continue activities which could be performed by workers at home (the so called remote working).[7] The same list was revised on March 25th.[8] Mobility across regions was also suspended, except for work or health reasons. Eventually, the efforts to contain the spread of the virus were successful, and the restrictions were progressively lifted. In particular, on May 4th the reopening of suspended activities started.[9] At the beginning of June, mobility across regions was resumed.[10]

The fact that Italy was the first Western country to be affected makes it a particularly interesting case to study firm response to the pandemic, as for Italian firms the national lockdown was an entirely unanticipated shock. For the initial part of the pandemic, Italy constituted a lab other countries looked at to prepare their policy response as the pandemic spread. For firms in other countries, the lockdown in Italy served as a precedent for the government policies they could anticipate. For example, Buchheim, Krolage & Link (2020) find that,

---

be summoned especially for this purpose and shall convene within five days. The decrees lose effect from their inception if they are not confirmed within sixty days from their publication. The Houses may however regulate by law legal relationships arising out of not confirmed decrees.

[5]Five in Emilia Romagna (Modena, Parma, Piacenza, Reggio Emilia, and Rimini.) two in Marche (Pesaro and Urbino), five in Piedmont (Alessandria, Asti, Novara, Verbano-Cusio-Ossola, and Vercelli), three in Veneto (Padova, Treviso, and Venezia). See DPCM March 8th 2020.

[6]DPCM March 9th and March 11th 2020, which shut down all retail shops, except those in a restricted list.

[7]DPCM March 22nd.

[8]DM-MISE, Decree issued by the Ministry of the Economic Development, March 25th 2020.

[9]DPCM April 26th 2020.

[10]Decree-law May 16th 2020, No. 33.

despite the prior spread of the pandemic in Asia, firms in Germany revised their expectations about business conditions twice: first, when COVID-19 began to spread in Europe for the first time, with the increasing restrictions in Northern Italy, and second, following the announcement of the German national lockdown. Italian firms on the other hand, had to adapt very quickly and without any guidance to a dramatically different business environment.

In Italy, the pandemic took a heavy toll on economic activity both directly, through the nation-wide lockdown, and indirectly, through declines in aggregate demand. The lockdown has directly impacted over one fourth of economic activity (27.7% of the value added). When input-output linkages are also considered, one third of economic activity has been affected by the lockdown.[11] In the first quarter of 2020 Italian GDP decreased by 5.5% QoQ (5.6% YoY); in the second quarter it dropped by 13% QoQ (18% YoY), while increasing by 15.9% QoQ in Q3 (but still decreasing by 5% YoY). As of the end of the year, the GDP forecast for the whole of 2020 is -9.0%, which includes a drop in the fourth quarter of 2020 (Istat 2020, Bank of Italy 2020*b*).

3   Data

The Bank of Italy administered three firm surveys during 2020 that we use to analyze the response of firms to COVID-19: the INVIND Survey, with expectations about sales growth and a management module, the ISECO survey, to measure the impact of COVID-19 restrictions on firms, and the SONDTEL survey, on realized performance outcomes. This section describes each of our three data sources, the construction of our key variables, and summary statistics of our baseline sample.

3.1   The INVIND Survey

The INVIND survey is the annual business survey conducted by the Bank of Italy since the early 1980's.[12] It collects high quality data on firms and is regularly used in research (see, among others, Guiso & Parigi 1999, Pozzi & Schivardi 2016, Rodano, Serrano-Velarde & Tarantino 2016). The survey is administered to approximately 5000 firms and is a representative sample of manufacturing and services firms with at least 20 employees.[13] It is

---

[11]The provision that the value chain of essential activities may continue to operate has reduced the share of value added suspended; conversely, essential activities have not worked at full capacity because the demand coming from non-essential activities plummeted (Bank of Italy 2020*a*, chapter 6, page 80).

[12]Details about the survey can be found here.

[13]The sample of interviewed firms is quite stable: the same firms are interviewed every year, adjusting only for attrition and to balance the age profile against that of the population.

conducted directly by the regional branches of the Bank of Italy and the data collected are used for the official statistics and the econometric models of the Bank of Italy, ensuring high quality of data.

Among other things, the INVIND survey collects firm expectations about various outcomes, such as sales, investment, employment. The survey has been collecting expectations since the early nineties, and such questions have been extensively used in previous research, which shows that they track actual performance well.[14] We use expectations of sales growth in 2020 as our preferred performance measure, first because actual performance measures are difficult to obtain in real time, particularly for unlisted firms. Second and more importantly, as we argue more at length when discussing our empirical strategy in Section 4, expectations are very reactive to changes in the economic environment, a feature crucial to our identification strategy. We later also augment our results using measures of actual performance from the SONDTEL survey for robustness. We focus on sales because sales depend on the extent to which the firm was subject to the exogenous COVID-19 shock and on its capacity to contain its effects, while other variables such as employment or investment are more directly under the control of the firm, and therefore more a measures of firm strategy than performance.[15]

The second key ingredient of our analysis is the level of structured management practices present in firms. We obtain this from a module of eight questions on management included in the INVIND survey of 2020. The design of the module is based on a specialized survey instrument developed and administered by the US Census Bureau. Crucially for us, the questions explicitly refer to the management practices that were *already existent* in the organization in 2019, that is, strictly before the pandemic.

The survey investigates the use of structured management practices along three dimensions: monitoring, targets, and incentives. The monitoring questions ask firms about the collection and use of information such as Key Performance Indicators to monitor and improve the production process. The targets questions ask about the design, dissemination and realism of production targets, and the incentives questions ask about bonuses, promotions, reassignment and dismissal practices, and how closely they are linked to employee and team performance.

To retain comparability with previous work, we closely follow Bloom et al. (2019) in the

---

[14]See Guiso & Parigi (1999) for early work and more recently Ma, Ropele, Sraer & Thesmar (2020).

[15]In addition, the evolution of employment was heavily influenced by government policies introduced in this time that forbade layoffs and offered an encompassing employment protection scheme.

construction of a management score from the survey responses. In particular, we restrict our sample to firms with complete responses to the management module, which we define as answering at least 5 of the 8 questions. We construct an aggregate management score for a firm as follows. Each question is first scored on a 0-1 scale (low scores indicating lower use of structured management practices). The scores for individual questions are then aggregated by taking the average of the question-wise scores. Next, we standardize this aggregate measure across firms, which transforms the measure to have mean zero and standard deviation 1. This is the score we will use in our analysis. Similarly, we create standardized sub-scores on monitoring, targets and incentives of management for each respondent using specific questions in the module. Appendix B reproduces the original module included in the INVIND 2020 survey, along with the question-wise scoring scheme.

The MOPS survey instrument has been used to assess the use of structured management practices in diverse settings and can be considered fairly standardized.[16] Prior to using the measure for analysis, we nevertheless validate it for our context, and confirm that it aligns with previous work. Details on the validation procedure are in the Appendix B.

Table 1 Panel A reports summary statistics for the 1803 firms in the baseline sample used in our analysis, which is defined as all firms responding to INVIND 2020 with complete responses to the management module. We show the mean, median, standard deviation and the 5th and 95th percentiles of the main variables from INVIND. Firms are larger than the average Italian firm (the INVIND mean is 482 employees against 4 on average in Italy), since INVIND does not survey firms with less than 20 employees. Firms in our sample are also large as measured by the volume of sales, averaging more than 160 million Euros in 2019. Three-quarters of the firms reported positive profits in 2019.[17] About two thirds of them are exporters. About two thirds of the surveyed firms are in manufacturing. Table 1 includes the distribution of the standardized management score we use in our analysis. A heavy left tail in the distribution of management practices is clear from the 5th and 95th percentiles of the score. Throughout the analysis, we trim the expected sales growth variable within five standard deviations.

---

[16]See for example Vyas (2018) and Choudhary, Lemos & Van Reenen (2018).

[17]Firms in the INVIND survey are asked to report profits choosing among five possible categories: strong profits, modest profits, substantial break-even, modest loss, and strong loss. We define the indicator of positive profits to take value one for firms reporting either strong or modest profits and zero otherwise.

Table 1: Summary statistics: INVIND and SONDTEL Surveys

	Mean	Std. deviation	5th percentile	Median	95th percentile
			Panel A: INVIND		
Sales (2019, million EUR)	163.70	1192.79	2.20	20.18	446.69
YoY sales growth 2019	2.50	18.37	-20.84	1.22	28.03
Expected YoY sales growth, 2020	-4.49	17.06	-38.43	0.00	16.20
Management score (2019)	0.00	1.00	-1.90	0.10	1.50
Employees (2019)	482.16	3570.22	22.00	79.00	1185.00
$\mathbb{1}_{Exporter}$	0.66	0.47	0.00	1.00	1.00
$\mathbb{1}_{Profits>0}$	0.74	0.44	0.00	1.00	1.00
			Panel B: SONDTEL		
YoY sales growth 2020 (Q1-Q3)	-10.06	14.69	-30.00	-9.50	17.00
% Remote work (2019)	1.85	6.41	0.00	0.00	7.50
% Remote work (2020)	11.72	15.62	0.00	2.50	50.00

Notes: Panel (A) describes summary statistics for variables used in the analysis computed over the baseline sample of 1803 firms, who responded to the INVIND survey with complete responses to the management module. Sales are measure in million of EUR in 2019. Expected sales growth is trimmed to within 5 standard deviations. A detailed description of the managment score is in the text and Appendix B. Employment is measured by headcount. $\mathbb{1}_{Exporter}$ is equal to 1 for firms reporting in 2019 positive export sales, $\mathbb{1}_{Profits>0}$ is equal to one for firms that reported having strong or modest profits in 2019. Panel (B) reports the summary statistics for variables used in the analysis from the SONDTEL survey. Sales growth refers the the first 3 quarters of 2020, see footnote 19 for a detailed description of this variable. Remote working in 2019 and 2020 refers to the average share of employees working from home in each year as a share of the total workforce.

3.2 The SONDTEL survey

To complement our measures of expected performance from the INVIND survey, we use data from the SONDTEL survey on *realized* performance in 2020.[18] The SONDTEL survey is conducted once a year in September on the same firms that comprise the INVIND sample. The survey measures short-term dynamics of the Italian economy with the objective of updating end-of-year forecasts. It elicits a qualitative assessment of the dynamics of firm sales in the first three quarters of the current year with respect to the same period in the previous year. Firms are asked to choose among different intervals of sales growth. We construct a measure of growth comparable to the INVIND by taking the midpoint of the range of each interval.[19] While the SONDTEL survey is less granular than the INVIND, it provides us valuable early information on realized performance to cross-check our findings

---

[18]Details on the SONDTEL survey can be found at this link.

[19]Firms were asked to choose among the following intervals of sales growth (values are in %): 1:<-30; 2:(-30,-15]; 3:(-15,-4]; 4:(-4;-1.5]; 5:(-1.5,1.5]; 6:(1.5,4]; 7:(4,30]; 8:>30. We transform this intervals in a quantitative variable to use in our regression by taking mid-points of the answers 2-7 and the lower and upper bound of answers 1 and 8, respectively. The final values assigned to each answer are: (-30, -22.5, -9.5, -2.75, 0, 2.75, 17, 30).

from the more detailed expected sales data of the INVIND.

The overall expected YoY sales growth in 2020 for the INVIND sample is -4.5%. However, this varies over the course of the spread of the pandemic and the imposition of restrictions: the average expected sales growth for firms answering after the lockdown announcement is -8.3%. This value is much closer to the realized YoY sales growth in 2020 Q1-Q3, which averaged -10%, seen in the first row of Panel B of Table 1.

The next two rows of Panel B show the incidence of remote working from the SONDTEL sample. Once again, firms were asked to choose among different intervals; and we build our measure of remote working by considering the midpoints of the range of each interval.[20] The share of remote working increased by almost a tenfold from 2019 to 2020. On the extensive margin, in 2019, only 13% of firms in our sample used remote work; in 2020 this increased to 75%. On the intensive margin, the share of remote work went from 1.8 to 11.7 percent. These figures are in line with official statistics: according to the Italian Labor Force Survey, the share of private sector workers in remote working increased from 1.4% in the second quarter of 2019 to 14.4% in the same quarter of 2020.

3.3 The ISECO Survey

To provide a timely qualitative assessment of extent of the effects of the pandemic on Italian firms, the Bank of Italy decided to conduct an additional survey, the ISECO (*Indagine Straordinaria sugli Effetti del Coronavirus*, Extraordinary Survey on the Effects of the Coronavirus) survey. This was administered between March 16th and May 14th, starting from when there were already initial restrictions, and continuing into the period of total lockdown. The ISECO survey directly elicits the channels of impact of COVID-19 on Italian firms as well as the strategies adopted by firms to tackle the impact of the pandemic.[21]

We exploit two unique pieces of information. The first is from the question asking: "In relation to the diffusion of the COVID-19, what factors are negatively affecting your operations in Italy?" with the following seven options: 1. Drop in domestic demand; 2. Drop in foreign demand; 3. Problems with logistics and infrastructure; 4. Lack of labor force; 5. Slowdown in the supply of intermediate goods; 6. Problems of liquidity and or in the financial struc-

---

[20]Specifically, the firm was asked to choose among the following intervals: a) none: 0; b) modest: (0-5%]; c) little relevant: (5%-10%]; d) fairly relevant: (10%-20%]; e) relevant: (20%-35%]; f) very relevant: (35%-50%]; g) extremely relevant: (>50%; h). To obtain a quantitative measure, we used the mid point for the interior intervals and the lower limit (50%) for the highest category.

[21]The methodology for the ISECO survey can be found here and the questionnaire can be accessed here.

ture; and finally 7. None of the above. This question can be interpreted as investigating the channels through which the pandemic affects firm operations. Firms were required to list at most three factors, ranking them in descending order of importance. We group together answers pointing to drop in either domestic or foreign demand as "Demand", and answers pointing to "Problems with logistics and infrastructure" and "Slowdown in the supply of intermediate goods" as "Supply", so that we end up with only five possible responses.[22] Next, we assign to each possible response the maximum rank obtained by each option.

Panel A of Table 2 tabulates responses of the 1582 firms in our baseline sample that answered the above question, with responses listed by order of importance across the sample. Among them, 1060 firms indicated three factors, 301 firms indicated only two, and 221 just one. As clear from the table, demand was the most important driver affecting firms in Italy during this period, with about 63% of firms listing the factor with highest rank. Following demand, firms indicated supply as the second-most important factor, with 35% assigning it the second rank. The last column shows the share of firms never mentioning the particular strategy in any of their responses. For example, labor as a driver is very rarely listed, with about 80% of the firms never mentioning it as a factor.

The second key piece of information captured in the ISECO survey is from question "What strategies have you adopted or are thinking to adopt to counter the negative effect of the spread of the Coronavirus in Italy on the activities of your firm?". Firms were given a series of 10 alternative answers. Following the same procedure as before, we group these into five categories: demand policies, production policies, labor policies, investment plans policies and finance. We report the details of the aggregation procedure in Appendix D.

Overall, 1579 firms answered the strategy question described above. Among them, 1024 firms listed 3 strategies, 279 firms listed 2 strategies, while 276 listed only 1 strategy. Panel B of Table 2 shows the share of firms indicating each response by importance. Note that labor related strategies are the most chosen option: only 25% of firms did not mention labor in one of their possible strategies.[23]

---

[22]Our final drivers are: Demand, Supply, Labor, Finance and None. See appendix table D1 for further details.

[23]Applying to the same data a Bayesian Mallow model, a statistical model to analyze ranking data, including those in the form of top–k rankings, Crispino (2021) concludes that labor policies were the most adopted corporate strategy to tackle the effects of the pandemic.

Table 2: ISECO survey: Drivers and Strategies during COVID-19

| | Panel A: Drivers | | | |
	1st rank	2nd rank	3rd rank	Never Chosen
Demand	63.08	10.75	1.96	24.21
Supply	18.84	35.27	6.07	39.82
Labor	6.07	9.86	4.42	79.65
Finance	5.18	15.36	6.64	72.82
None	6.83	9.80	4.93	78.45

| | Panel B: Strategies | | | |
	1st rank	2nd rank	3rd rank	Never Chosen
Demand	3.55	3.48	6.90	86.07
Supply	8.30	20.46	13.24	58.01
Labor	6.08	14.31	54.02	25.59
Investment	10.70	12.67	4.18	72.45
Finance	16.40	20.58	14.12	48.89
None	7.98	3.86	7.54	80.62

Notes: Panel A shows responses to the question: "In relation to the diffusion of the COVID-19, what factors are negatively affecting your operations in Italy?". Panel B shows responses to the question "What strategies have you adopted or are thinking to adopt to counter the negative effect of the spread of the Coronavirus in Italy on the activities of your firm?". Each value is the share of firms in the ISECO sample with the response shown in the row for the order of importance for the given column.

4 Empirical strategy

Our goal is to determine if management practices constitute an asset or a liability when facing a large, unexpected shock that requires immediate and profound changes in the functioning of the firm. Ex-ante, the effect of managerial practices could go both ways. On one side, the practice of constantly setting and reviewing goals and monitoring progress towards achieving them could be useful to redirect firm strategy when facing the shock. On the other hand, following these practices require such targets to be set, shared and monitored in a structured way in the firm. This might be difficult to change abruptly, decreasing the firm's capacity to promptly respond to the shock, whereas a less formalized management style might possibly allow for a faster response in a situation of crisis.

Answering this question is fraught with empirical challenges. First, one needs a large and unexpected shock that materializes quickly and requires immediate action from firms. Sec-
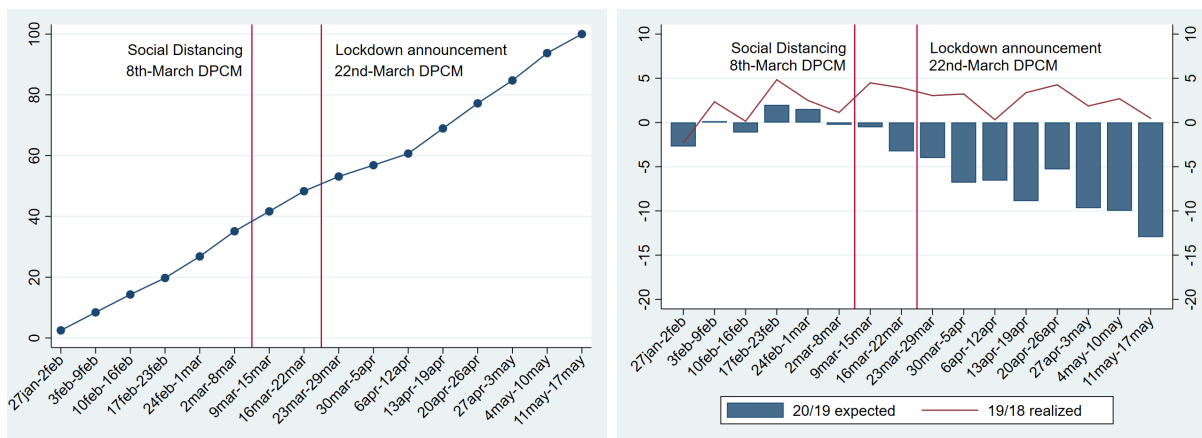
ond, it is important to have real-time measures of performance as the effects of the shock unfold. Data on actual firm performance for 2020, collected after the end of the year, can be polluted by many effects that go beyond the initial shock. For example, the initial shock can generate second-wave effects through financial contagion. Moreover, policy measures put in place in response to the pandemic might target firms differently, possibly in ways correlated with managerial practices (for example, measures directed to SMEs, which typically have lower management scores). Third, it is by now well established that the quality of managerial practices strongly correlates with firm performance in general (Bloom & Van Reenen 2010, Syverson 2011). A better response by well-managed firms might simply be a reflection of a general superior performance of such firms, rather than something specific to their different reaction to the shock. Finally, one also needs to control for correlated effects, such as that better managed firms also are on average larger, and size might be a factor in determining the response to the shock.

We argue that the outbreak of the COVID-19 pandemic in Italy represents an ideal setting to address these challenges. As seen in Section 2, the COVID-19 shock was large, it took Italian firms by surprise, and it caused dramatic changes in the business environment over the course of a few weeks. Firms had to immediately respond, and their responses were crucial to their subsequent performance. In addition, our preferred measure of performance is expectations of sales growth in 2020 with respect to 2019. Expectations incorporate all information available to the respondent at the time of the response. They therefore can track sharp changes in expected performance as the business environment evolved. Finally, managerial practices were measured in the 2020 INVIND with explicit reference to practices in place in 2019, strictly before the pandemic started. They therefore represent the stock of practices the firm was already endowed with when hit by the pandemic.[24]

We also exploit the dates of collection of the INVIND survey, which occurs every year between February and May. For 2020, this distributes our observations over the course of the COVID-19 outbreak, providing us a unique opportunity to observe how the evolution of the pandemic changed the expectations of future sales and whether there were differences according to management practices. Specifically, we can compare expected performance between firms with different levels of MOPS adoption that reply to the INVIND survey before and during the spread of the COVID shock. The identifying assumption is that in the absence of COVID-19, the expected performance of firms with different levels of MOPS would

---

[24]One potential concern is that firms can also change MOPS during the pandemic. We believe this not to be a real concern in our setting, since we exploit a short time span of 16 weeks for our empirical analysis.

Figure 2: Cumulative share and sales growth by week of response to the 2020 INVIND survey

Note: The blue line in the left panel represents the cumulative density function of responses to the INVIND 2020 survey by week of response shown on the x-axis. The sample consists of 1803 firms which responded to the survey. In the right panel, the y-axis represents the mean YoY sales growth from INVIND of the firms that responded during the week reported on the x-axis. The blue bars are the average 2020 YoY expected sales growth, while the red line is the average 2019 YoY sales growth. The vertical lines correspond to the announcement dates of widespread social-distancing restrictions in Italy (March 8th) and country-wide lockdown (March 22nd).

have continued to run parallel by week of response to the INVIND survey. The plausibility of this assumption relies on the fact that neither MOPS nor other firm characteristics can explain the week of response to the INVIND survey. In appendix figures A1 and A2, we plot average MOPS, firm size and productivity by week of response, not finding any evidence of a trend. Finally, the richness of the INVIND data and the possibility to match it to other administrative datasets allows us to control for a great deal of correlated effects that may affect firms' responses to the pandemic.

The left panel of Figure 2 plots the cumulative density function of responses to the 2020 IN-VIND survey by week of response, along with two key dates: the announcement of widespread social distancing in Italy on March 8th, and the nationwide lockdown announcement on March 22th. A little less than half of the firms answered the survey before the announcement of the lockdown, and the rest after it. By analyzing firm expectations by the date they submitted the response to the questionnaire, we can observe whether firm's expected performance changed before and after the lockdown, and whether these changes are related to management.

The right panel of Figure 2 shows realized sales growth in 2019 (red line) and expected sales growth in 2020 (blue bars) by the week when the INVIND survey was returned by the firm to the Bank of Italy. Before the lockdown, realized sales growth in 2019 and expected sales

growth in 2020 are similar and modest, reflecting the fact that, before the pandemic, the Italian GDP was expected to grow in 2020 by 0.6%. After the lockdown announcement, firms expectations over sales growth in 2020 quickly deteriorated: while expected sales growth were still close to zero for firms answering up to March 15$^{\text{th}}$, it progressively plummeted during the next three weeks. This confirms that our measure of performance responds immediately to the changing environment. The expected growth rate in sales averaged -8.3% in the post-lockdown period.

We want to test if the drop in expectations of sales growth, formulated during and before the lockdown by otherwise similar firms, depends on their managerial score. To do so, we use the following regression:

$$\text{SalesGr}_i = \alpha_0 + \alpha_1 \text{Manag}_i + \alpha_2 \text{Manag}_i * \mathbb{1}_{LD} + \alpha_3' \mathbf{X}_i + W_i + (S_i + P_i) * (1 + \mathbb{1}_{LD}) + \epsilon_i \quad (1)$$

where SalesGr_i is the measure of firm's i sales growth, Manag_i is the management score, $\mathbb{1}_{LD}$ is a dummy equal to one for the lockdown period and $\mathbf{X}_i$ is a vector of firm controls, measured in 2019. As shown by Figure 2, expected sales are heavily dependent on the week of response. To account for this, we always include fixed effects for the week of response W_i in our analysis. A major concern is that the management score might vary systematically for firms in essential sectors relative to others, as these sectors were allowed to operate even during the lockdown. To control for this, we also include 3-digit sector fixed effects S_i. This is by and large the same detail of classification that was used to define essential goods and services.[25] Given the pandemic had a very differentiated spread geographically, we control for local effects with a set of province fixed effects (P_i). To fully account for the differential change in performance both at the sectoral and geographical level occurring with the lockdown, sector and province dummies are also interacted with the lockdown dummy. We also include an indicator for whether the survey was conducted over the phone or through email. Given the strong sectoral component of the pandemic shock, standard errors are clustered at the 3-digit industry level.

---

[25]A list of essentials sectors as defined by the Italian government can be found in the annexure 1 of the DPCM of March 22$^{\text{nd}}$, available here.

5   Results

We now present our key results on the relationship between performance and management, and then explore robustness and extensions.

5.1   Main results

Figure 1 showed evidence on the relationship between performance and management quality during pandemic. The trends of expected sales growth by week of response for firms above and below the mean value of management score did not differ before the lockdown, but diverged as the shock spread and restrictions were introduced, becoming statistically different by mid-April.[26] However, this evidence is just suggestive, because management quality can be correlated with other determinants of performance. We employ the richness of our data to address this concern through estimating regression 1. In addition to the sector, area, and week fixed effects (suggested to be important from Figure 1), we now include a set of firm controls that may be correlated with both the management score and expected performance. First, we include size (log of the number of employees) and labor productivity (log of revenues per employee), as larger and more productive firms may be better equipped to face the pandemic relative to smaller and less productive ones.[27] We also include indicator variables that capture if the firm has positive exports and if it recorded positive profits in 2019. The selected variables are those which may be correlated with with managerial practices and the ability of firms to react to the shock, and which are readily available in INVIND, allowing us to maximize the size of our baseline sample. In the robustness exercises we will expand on the controls linking the survey to another source of information, at the cost of losing a few observations.

In Table 3 we report the regression analysis. We first estimate a version of Equation 1 without distinguishing between the pre-lockdown and the lockdown period. The result is shown in column (1). There is positive and significant effect of management on expected sales growth: a one standard deviation increase in the management score is associated with 1.72 percentage point increase in expected sales growth. This supports the evidence suggested by Figure 1 that structured management practices enabled rather than hindered firms in withstanding the pandemic.

---

[26]Figure 1 uses smoothed values of the average expected sales growth to take into account the fact that the week in which firms mail back the survey could also differ from the week in which they actually filled it.

[27]In the context of the US, Bartik, Bertrand, Cullen, Glaeser, Luca & Stanton (2020) show that small firms experienced a significantly negative impact of COVID-19.

Table 3: Management and expected sales growth

| | (1) | Interaction | | Sample split | |
| | | Full sample | Excl. week 12&13 | Before | After |
	(1)	(2)	(3)	(4)	(5)
Management	1.725***	1.111**	0.905	1.026	2.407***
	(0.467)	(0.553)	(0.660)	(0.666)	(0.651)
Management*$\mathbb{1}_{LD}$		1.202*	1.686**		
		(0.702)	(0.784)		
log(employment)	0.0821	0.0540	-0.226	-0.723	0.257
	(0.357)	(0.359)	(0.405)	(0.564)	(0.529)
log(revenue/employment)	0.658	0.649	0.648	-0.793	2.209**
	(0.548)	(0.555)	(0.596)	(0.886)	(0.908)
$\mathbb{1}_{Exporter}$	-0.409	-0.430	-1.521	-1.763	-1.593
	(1.112)	(1.107)	(1.389)	(1.653)	(1.700)
$\mathbb{1}_{Profits>0}$	-1.619	-1.626	-2.082**	-0.432	-4.153**
	(0.996)	(0.988)	(1.029)	(1.125)	(1.709)
Fixed effects					
Sector	Y	Y	Y	Y	Y
Province	Y	Y	Y	Y	Y
Week of response	Y	Y	Y	Y	Y
Sector*$\mathbb{1}_{LD}$	Y	Y	Y		
Province*$\mathbb{1}_{LD}$	Y	Y	Y		
H_0: Management before=Management after (p-value)				0.087	
Observations	1741	1741	1530	717	813
R^2	0.381	0.382	0.390	0.312	0.373

Note: The dependent variable is the expected YoY sales growth in 2020 sourced from INVIND. $\mathbb{1}_{LD}$ is an indicator variable that takes value 1 if the firm answered the 2020 INVIND survey after 22nd March. Employment is based on headcount; revenues refer to total sales, for both we take the 2019 value. $\mathbb{1}_{Exporter}$ is equal to 1 for firms reporting in 2019 positive export sales, $\mathbb{1}_{Profits}$ is equal to one for firms that reported having strong or modest profits in 2019. Sectors are defined according the 3-digit Nace rev. 2 classification. Provinces refers to NUTS3 Eurostat classification. Regressions include type of interview fixed effects (conducted over phone or email). Column (4) includes week up to the 15th of March (i.e. week 11), column (5) include week starting from the 30th of March (i.e. week 14). Standard errors are clustered at the 3-digit industry level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The correlation between expected sales growth and management score might arise if firms with higher management scores have higher expected sales in normal times as well. In this case, the difference in expected sales growth would not be due to a better ability of these firms to deal with the COVID-19 shock but it would simply reflect structural differences in growth. To address this important concern, we exploit the fact that firms answered the survey both before and after the outbreak of the pandemic. Therefore, we can check if the correlation between expected sales and management is stronger before the lockdown –the "normal" period– or after it, i.e. when the shock materializes. Columns (2)-(5) of Table

3 elaborate in a regression framework the evidence suggested by Figure 1, which showed significant divergence in expected sales growth with management following the lockdown announcement. Column (2) adds an interaction with an indicator variable that takes value 1 for the lockdown and the management score. The coefficient on management practices is 1.1 in the pre-lockdown period, significant at 5%, but its value more than doubles during the lockdown to 2.3, with the difference between the two estimates statistically significant at the 10% level. As the average decline in expected sales growth in the post-lockdown period is -8.3%, the effect of a one standard deviation increase in management is almost a 30 percent increase in the expected growth. None of the other controls are significant.

The left panel of Figure 2, which plots expected sales growth by week, shows that the two weeks around the beginning of the lockdown recorded sales growth that are halfway between the pre-lockdown and the lockdown period. The week of March 16th-22nd is right before the lockdown announcement, when the situation was deteriorating quickly and firms started to revise the expectations in the light of the escalating restrictions, for example by incorporating the possible introduction of a nation-wide lockdown. Moreover, firms that returned the questionnaire the following week (March 23th-29th) might have filled it in before the announcement of the lockdown and filed it afterwards, and therefore with a different outlook on the future sales dynamics than once the lockdown was already in place. Data for these two weeks are not clearly classifiable as referring to before or after the moment in which the severity of the shock was fully understood and might attenuate the results. In column (3) we therefore exclude firms that answered in those weeks (211 out of 1803 firms). As expected, the coefficient in the pre-lockdown period remains positive but decreases in magnitude and loses statistical significance, while the coefficient on the interaction term increases in magnitude (from 1.20 to 1.69) and becomes significant at the 5% level. In what follows, we therefore focus our attention to this restricted sample (all our results hold and are only slightly weaker when we include all firms).

In columns (1)-(3) of Table 3, we controlled for a series of firm characteristics potentially related to sales growth and correlated with management. However, we imposed a unique coefficient in the two periods for these characteristics. One possible concern is that the effect of these characteristics on performance too changed during the pandemic with respect to normal times. To level the playing field, in columns (4) and (5) we report the results of two regressions in which we separately estimate the model for the pre-lockdown and the lockdown period, therefore allowing *all* the coefficients to vary between the two periods. The results

are fully in line with those of column (3): management is positive but not significant in the pre-lockdown period, and more than twice as large and significant at the 1% level during the lockdown. Moreover, we reject the hypothesis that the two coefficients are statistically equal (p-value 0.087). During the lockdown, the coefficient of productivity becomes positive and significant, indicating that more productive firms were able to limit the effects of the shock. However, accounting for this does not decrease the coefficient on management.

The evidence of Table 3 thus corroborates the descriptive evidence of Figure 1. They both lend support to the hypothesis that that structured management practices were particularly helpful to firms in tackling the economic effects of the pandemic. Next, we analyze the robustness of this result.

5.2   Robustness

We check the robustness of our results in terms of the use of expectations, selection on the timing of response and confounding factors.

Use of expectations.   We argued that expectations have the advantage of reacting immediately to shocks, a crucial feature in our setting. At the same time, expectations are not actual performance. In particular, firms with higher management scores may differ systematically in the expectation formation process (Bloom, Davis, Foster, Lucking, Ohlmacher & Saporta-Eksten 2020), so that we might be capturing differences in expectations formation rather than in performance. We perform a series of exercises to determine if forecast errors are systematically related to managerial practices in our setting. We combine past waves of the INVIND survey, which allow us to compute the expectation error for each firm as the difference between actual sales growth in year t and the prediction of sales growth in year t formed in $t - 1$. We then regress the prediction error on the management score, using multiple specifications. The results of these exercises, reported in Appendix C, clearly indicate that in our setting, there is no systematic relationship between expectation errors and the management score.

Realized sales.   Firms' ability to forecast may vary with management practices in abnormal times but not in normal times, invalidating forecast error estimates based on data from past years. To ensure this is not driving our results, we use data on realized sales in 2020 from the SONDTEL survey. The SONDTEL survey was conducted in September, when the first wave of the pandemic was over, business operations had gone back to a large extent

to normal and firms could assess the actual sales losses they experienced during the first three quarters of the year. Compared to expectations, realized sales might be affected by the confounding effects discussed in Section 4. Moreover, as the survey was conducted and collected within a short time frame in September, there is no possibility to compare the effects on firms' realized outcomes prior to versus during the COVID-19 outbreak. Nevertheless, realized sales can help corroborate our main results from the INVIND data. Column (1) of Table 4 uses as dependent variable as growth of sales in the first three quarters of 2020 with respect to the same time range in 2019. Firms with higher management scores show sizable larger sales growth in realization as well, in line with the results of Table 3. The magnitude is smaller that for expected sales growth. This could be due both to the mentioned confounding elements and well as the fact that realized sales growth values are obtained as approximations from qualitative answers, as described in Section 3.

Timing of responses   A separate concern is that lower quality firms, that have lower sales growth in general, might tend to file their response to the annual survey later than other firms, which would result in an overestimation of the effects of the shock on firm performance. While this is accounted for by the week of response dummies, which imply that our estimates are only based on within week variability, we anyway show that this is not the case. The red line in the right panel of Figure 2 reports realized sales growth in 2019 according to the week of response to the 2020 INVIND survey. There is no discernible trend, suggesting the absence of selection effects in the timing of response by firm performance. A related concern is the possibility that the management score is correlated with the timing of response to the survey, i.e. for example firms who score high on structured management may file their survey responses sooner. This is not a threat to the consistency of our estimates, as they are based on the comparison of performance for firms with different managerial practices before and after the outbreak of the pandemic. However, it may generate selection across the split of the sample, if for example high management practices firms respond disproportionately more in the period prior to the lockdown announcement. To check this, Appendix figure A1 shows the mean management score across the weeks of response with the 95% confidence interval around the mean score in the given week. We do not find any significant difference in the management scores across the weeks of response to the INVIND survey.

21

Table 4: Robustness results

	Realized	Expected sales growth				Sample split	
		Interaction				Before	After
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Management	0.732*	0.893	1.197*	1.179*	1.107*	1.205*	2.903***
	(0.416)	(0.660)	(0.614)	(0.648)	(0.663)	(0.651)	(0.915)
Management*$\mathbb{1}_{LD}$		1.695**	1.595*	1.884**	2.153**		
		(0.790)	(0.809)	(0.802)	(0.837)		
log(employment)	0.328	-0.276	-0.286	-0.532	-0.632	-1.297**	0.108
	(0.365)	(0.409)	(0.421)	(0.450)	(0.448)	(0.574)	(0.619)
log(revenue/employment)	1.157	0.531	-0.0282	-0.255	-0.368	-1.730	1.494
	(0.700)	(0.587)	(0.650)	(0.715)	(0.715)	(1.070)	(1.109)
$\mathbb{1}_{Exporter}$	-0.450	-1.271	-2.074	-2.034	-1.727	-1.758	-1.536
	(1.030)	(1.384)	(1.366)	(1.373)	(1.440)	(1.536)	(2.113)
$\mathbb{1}_{Profits>0}$	1.869*	-1.952*	-1.437	-1.301	-1.309	-0.491	-3.216
	(1.059)	(1.014)	(1.112)	(1.097)	(1.145)	(1.081)	(2.004)
closed sector		0.249	-0.326	-1.003	-1.456	-2.294	-10.84***
		(2.566)	(2.434)	(2.395)	(2.342)	(2.136)	(3.497)
closed sector *$\mathbb{1}_{LD}$		-8.172**	-8.622**	-7.882*	-9.421**		
		(3.732)	(4.000)	(4.036)	(3.947)		
log(average wage)			2.498	2.990*	2.685	2.592	3.624
			(1.864)	(1.688)	(1.730)	(2.295)	(3.342)
share white collar				0.0329	0.0312	-0.0117	0.0782*
				(0.0287)	(0.0297)	(0.0353)	(0.0464)
Average human capital				-5.125	-5.867	-12.84	1.265
				(6.737)	(6.769)	(9.298)	(10.38)
Manager human capital				2.832	3.414	8.301	-1.020
				(5.360)	(5.445)	(8.646)	(6.936)
$\mathbb{1}_{cloudtechnologies}$					1.021	1.667	0.285
					(1.222)	(1.364)	(1.914)
Fixed effects							
Sector	Y	Y	Y	Y	Y	Y	Y
Province	Y	Y	Y	Y	Y	Y	Y
Week of response		Y	Y	Y	Y	Y	Y
Sector*$\mathbb{1}_{LD}$		Y	Y	Y	Y		
Province*$\mathbb{1}_{LD}$		Y	Y	Y	Y		
H_0: Management before=Management after (p-value)						0.080	
Observations	1570	1530	1360	1326	1284	630	654
R^2	0.294	0.394	0.414	0.422	0.421	0.328	0.415

Note: In column (1) the dependent variable is realized sales growth in the first 3 quarters of 2020 relative to the same period in 2019, sourced from the SONDTEL survey. The dependent variable in columns (2)-(7) is the expected YoY sales growth in 2020 sourced from INVIND. $\mathbb{1}_{LD}$ is an indicator variable that takes value 1 if the firm answered the 2020 INVIND survey after 22nd March. Employment is based on headcount; revenues refer to total sales, for both we take the 2019 value. $\mathbb{1}_{Exporter}$ is equal to 1 for firms reporting in 2019 positive export sales figures, $\mathbb{1}_{Profits}$ is equal to one for firms that reported having strong or modest profits in 2019. Closed sector is a dummy for 4-digit sectors whose activities were not permitted during the lockdown. Average wage is measured in 2019 and the share of white collar is taken from social security data from 2019. Average human capital and manager human capital is the mean level of individual fixed effect measured over the period 2005–2018. Managerial human capital is the mean employee ability in the top quartile of the within-firm distribution (see Bender et al. (2018) for further details). Sectors are defined according the 3-digit Nace rev. 2 classification. Provinces refers to NUTS3 Eurostat classification. Regressions in column 2-7 include type of interview fixed effects (conducted over phone or email). Column (6) includes week up to the 15th of March (i.e. week 11), column (7) include week starting from the 30th of March (i.e. week 14). Standard errors are clustered at the 3-digit industry level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Essential sectors Our three digit sector dummies account for most of the essential sector status, with a few exceptions in which the definition went finer that at the three digits.[28] Given that essential sector status is expected to have a substantial impact of sales, we used the list from the government and constructed an indicator variable to control for it. In column (2) of Table 4 we include both this variable and its interaction with the lockdown dummy. The estimate shows that the indicator for non essential sectors is insignificant in the period prior to the lockdown announcement and becomes negative (-8.1) and highly significant following the announcement, confirming that the status of the industry the firm operates in is a fundamental determinant of sales growth during this period. However, the coefficient of the interaction between management and the lockdown dummy is virtually identical to that of column (3) in Table 3 (for which the only difference is the absence of the essential sector dummy).

Additional firm controls The final issue we address is that management might be correlated to other firm characteristics that might allow for a better response to the pandemic. This is indeed a serious problem, as it challenges the causal interpretation of our estimates. Ideally, one would need an instrument to fully address this concern. Unfortunately, the management literature has yet been able to identify suitable instruments, and the causality issue has been addressed so far in experimental settings in developing economies (Bloom et al. 2013, Bruhn et al. 2018). Lacking an instrument, we increase the number of controls, in addition to those already included in the basic regression (size, productivity, export status and profitability).

We see two main sources of correlated effects that can threaten our causal interpretation. The first is human capital. Using matched employer-employee data for Germany, Bender et al. (2018) show that management and human capital are positively associated and that the association between management and productivity decreases by 30-50% when including measures of human capital. Human capital might also be a factor in the response to the COVID-19 shock, for example because more educated workers can more efficiently work remotely. The second is technology. In particular, it is well know that management is complementary to IT (Bloom, Sadun & Van Reenen 2012, Schivardi & Schmitz 2020). It might then be that the better management firms also have invested more in IT, and the level of IT in the firm was a factor in determining the firm response to the shock, confounding

---

[28]In our sample, firms cover 159 different 3-digit sectors. In 71 of these 3-digit sectors all 4-digit industries are closed, in 71 3-digit sectors all 4-digit industries are open, and in the remaining 17 3-digit sectors around 70% of 4-digit industries are closed. A complete list of essential sectors can be found here.

the role of management.

INVIND has not direct measure of the workers' human capital. We first use as proxy the average wage of the employees, based on the assumption that, conditional on controls, firms that pay higher wages also employ more skilled workers. In column (3) we add this measure, and find that the coefficient of the interaction for the lockdown period remains very similar while the average wage is not significant. The only difference is that the coefficient on the management score in the pre-lockdown period becomes significant at the 10% level.

Average wage is an imperfect measure of human capital.[29] To obtain alternate measures, we use the matched employer-employee version of INVIND, for which we have workers data up to 2018.[30] The administrative data do not report the education but only the occupational status. We compute the share of white collar workers. Accounting for occupational status is important both because typically white collar workers have higher human capital and because they are more likely to be able to work remotely, an important factor during the lockdown. We also estimate the workers fixed effects from a standard two-way fixed effects regression following Bender et al. (2018). The worker effect captures the average worker's wage over her career, and therefore is a summary measure of ability, under the (reasonable) assumption that workers with higher skills earn on average higher wages (Card, Heining & Kline 2013). Following Bender et al. (2018), we construct two measures: the average worker effects and the average effects of the top 25% of the skill distribution. In fact, Bender et al. (2018) show that the latter is more strongly correlated with the quality of management practices. Column (4) of Table 4 includes these three additional controls. None of them is significant, and we in fact find the coefficient of the interaction for the lockdown period to increase, both in magnitude and significance. This indicates that management is not just proxying for worker skills. Finally, the 2020 INVIND elicited the use of advanced technologies, asking if firms were using cloud computing, big data or artificial intelligence. We construct a dummy which is equal to 1 if the firm uses at least one of these technologies. Table 4, Column (5) includes this measure. Again, if anyting, the effect of management in the post lockdown period increases slightly.

Finally, as in columns (4) and (5) in table 3, we allow the coefficient of all variables to differ between the pre-lockdown and the lockdown period by estimating the model separately for the two sub-periods. Results are reported in column (6) and (7). Even with this fully flexible

---

[29]For example, a large employer-employee literature shows that there is a wage component at the firm level that is not explained by workers skills (Abowd, Kramarz & Margolis 1999).

[30]We lose 34 observations of firms that are not matched with the INPS database.

specification, we obtain exactly the same results. The coefficient on management is much larger in the lockdown period (2.90 against 1.11), significant at the 1% level, and we reject the hypothesis that the two coefficient are equal (p-value 0.08). Overall, we conclude that the correlation between sales and the management score during the lockdown is extremely robust and survives the (flexible) inclusion of the most likely confounding effects. The evidence on the pre-lockdown period is instead more mixed.

5.3 Was the shock really uncorrelated with managerial practices?

Despite being an aggregate shock, the COVID-19 pandemic hit different firms with different intensities, most notably in terms of belonging to an essential sector, but also along other dimensions. The key assumption for the consistency of our estimates is that these differential effects are not systematically related to the quality of managerial practices. Ex-ante, this is unlikely to be the case, as the effects were heterogeneous at the sectoral level, and our regressions always control for sectoral differences through fixed effects. Still, there might be within sector effects that are not captured by our controls. We use a unique piece of information contained in the ISECO survey to test this assumption directly. The ISECO asks firms about the factors related to COVID-19 that negatively effected the firm operations in Italy, that we grouped into factors related to demand (domestic and foreign), supply (logistics, supply chain), labor, finance and none (as described in Section 3). Firms where asked to choose up to three factors, ranking them according to their relevance. The setting of the question is suitable to be analyzed with the conditional logit model of McFadden (1974), where each factor corresponds to a choice and "none" represents the outside option; there are no characteristics specific to the factors, while we do observe firm characteristics.

Our objective is to ascertain if the probability of choosing a factor is significantly related to managerial quality. Compared to the standard model, in this case a firm can rank up to three options. To exploit this additional information, we proceed as follows. The factor that is chosen as most important is preferred to all the others. The second is preferred to the others, once the first factor is excluded from the choice set, and correspondingly for the third factor. To build our data for estimation we stack all these alternative choices and to account for the fact that a firm can choose more than one factor, standard error are clustered at the firm level. In Appendix D we report the details of how we construct the model, and also discuss the conditions under which the model produces consistent estimates, arguing they are likely to be met in our setting.

Table 5 report the odds ratios from the estimation, where a coefficient larger than one indicates that the corresponding variable is positively correlated with the probability of choosing that alternative. No correlation between the management score and the likelihood of indicating any particular factor emerges. This is consistent with the assumption that the shock was exogenous with respect to the quality of managerial practices in place in a firm. The only determinant that is consistently significant across factors is exporter status: Being an exporter increases the likelihood of reporting any factor as important. One possible explanation for this is that exporting is a more complex activity than selling on the domestic market, and therefore more generally susceptible to shocks.

Table 5: Drivers of negative effect of COVID-19

	Demand	Supply	Labor	Finance
Management	1.050	1.077	1.106	0.964
	(0.082)	(0.074)	(0.096)	(0.075)
log(employment)	0.894	0.961	1.088	0.811***
	(0.053)	(0.050)	(0.063)	(0.050)
log(revenue/employment)	0.753***	0.854*	0.733***	0.658***
	(0.057)	(0.053)	(0.059)	(0.049)
$\mathbb{1}_{Exporter}$	2.838***	1.922***	2.194***	1.788***
	(0.446)	(0.266)	(0.368)	(0.280)
$\mathbb{1}_{Profits>0}$	0.876	0.871	0.763	0.540***
	(0.155)	(0.136)	(0.140)	(0.091)

Note: The table shows results of the conditional logit regression. Drivers are displayed at the top of each column. The coefficients shown are odds ratios, where the omitted category is *"None of the above drivers"*. Standard errors are shown in parentheses and clustered at 3-digit sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6 Why did firms with structured management practices perform better?

Having shown that the impact of the pandemic through different channels is orthogonal to the management score, we leverage the ISECO survey to investigate the strategies the firms adopted or considered adopting to counter the negative effects of the pandemic. As explained in detail in Section 3, we construct five categories: demand policies, production policies, labor policies, investment plans policies and financial policies. We estimate the same conditional logit model introduced in the previous section and report the results in Table 6. Interestingly, in this case we find that better management increase the chance of adopting any of the strategies, except financial strategies. This indicates that management was instrumental to reorganize the "real" part of the firm activity, rather than relying on financial factors. The results are consistent with the assumption that firms with better

management expected a better sales performance because they were more likely to act to counter the effects of the COVID-19 shock.

Table 6: Strategies adopted to counteract the COVID-19 shock and management

	Demand	Supply	Labor	Investment	Finance
Management	1.329**	1.375***	1.298**	1.260**	1.053
	(0.134)	(0.106)	(0.105)	(0.105)	(0.077)
log(employment)	0.861	1.124	1.194**	1.243***	0.959
	(0.079)	(0.071)	(0.079)	(0.081)	(0.060)
log(revenue/employment)	0.933	0.791**	0.743***	0.901	0.838*
	(0.087)	(0.059)	(0.056)	(0.073)	(0.060)
$\mathbb{1}_{Exporter}$	2.007***	1.476*	1.010	1.138	1.232
	(0.414)	(0.230)	(0.160)	(0.187)	(0.178)
$\mathbb{1}_{Profits>0}$	0.730	1.013	0.921	1.072	0.709*
	(0.153)	(0.167)	(0.156)	(0.196)	(0.112)

Note: The table shows results of the conditional logit regression. Strategies are displayed at the top of each column. The coefficients shown are odds ratios, where the omitted category is *"No strategy will be adopted"*. Standard errors are shown in parentheses and clustered at the 3-digit sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We now focus on one specific strategy that is positively related to management quality and that might have been particularly important during the pandemic: labor policies, which, as shown in Section 3.3, was the one most often cited by firms. The question on labor policies explicitly mentions as an example changes in the use of remote work. Indeed, during the most acute phase of the pandemic, as well as also after it, many companies moved massively to remote work.

Management practices might be a fundamental asset to successfully move a substantial amount of workers to remote work very quickly, and with no possibility to plan the move in advance. In fact, one of the fundamentals of structured management practices is to assign workers clearly defined responsibilities, systematically keeping track of outcomes and taking decisions based on the information collected. This "organization philosophy" enables delegation and worker autonomy ex-ante and assessment of outcomes ex-post.[31] This approach to human resource management reduces the need to monitor progress and effort by direct interaction and allow for a more productive use of remote work. Our hypothesis is therefore that better-managed firms were more ready to shift abruptly and substantially to remote work.

We test this hypothesis in Table 7 using the information on remote work from the SONDTEL

---

[31]In fact, early studies on changes in firm organization related to the diffusion of IT stressed the importance of the decentralization of authority, the "delayering" of managerial functions, team-based work organization (Caroli & Van Reenen 2001, Bresnahan, Brynjolfsson & Hitt 2002).

Table 7: Remote work and management in 2020

	Overall		Monitoring	Targets	Incentives
	(1)	(2)	(3)	(4)	(5)
Management	1.469**	1.350**	1.098***	0.700	0.886**
	(0.582)	(0.546)	(0.399)	(0.501)	(0.440)
log(employment)	2.924***	2.619***	2.703***	2.836***	2.739***
	(0.449)	(0.421)	(0.409)	(0.375)	(0.407)
log(revenue/employment)	2.436***	2.250***	2.268***	2.307***	2.237***
	(0.601)	(0.543)	(0.541)	(0.559)	(0.542)
$\mathbb{1}_{Exporter}$	0.259	0.417	0.333	0.482	0.617
	(0.875)	(0.833)	(0.837)	(0.837)	(0.860)
$\mathbb{1}_{Profits>0}$	-0.00625	0.257	0.428	0.480	0.230
	(0.532)	(0.504)	(0.522)	(0.519)	(0.504)
Advanced technologies	1.727**	1.597**	1.810**	1.895**	1.832**
	(0.735)	(0.738)	(0.752)	(0.756)	(0.782)
Skill (% white collar)	0.179***	0.168***	0.170***	0.169***	0.167***
	(0.027)	(0.025)	(0.025)	(0.026)	(0.025)
% remote work 2019		0.391***	0.389***	0.392***	0.396***
		(0.059)	(0.060)	(0.059)	(0.060)
Observations	1499	1494	1492	1491	1490
R^2	0.508	0.528	0.526	0.524	0.525

Note: The dependent variable is the percentage of employees at the firm working remotely in 2020. The share of white collar workers is measured 2018 from social security data (last year available). Advanced technologies is an indicator variable which takes value one if the firm uses at least one of the following technologies: cloud computing, big data or artificial intelligence. Regressions include 3-digit sector and province fixed effects. Standard errors are shown in parentheses and are clustered at the 3-digit sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

survey. In column (1), we find that management does correlate with remote work usage in 2020: we estimate a coefficient of 1.5, significant at the 5% level. Given that the average remote work in 2020 is 11.7%, one standard deviation increase in the management score implies an increase in the share of remote work of 13 percentage points with respect to the mean. Next, we also control for the usage of remote work in 2019. It might be that firms using remote work already in 2019 were more prepared to increase its usage in 2020. In column (2) we add remote work in 2019 and find that the coefficient on management decreases only marginally (from 1.47 to 1.35) and remains significant at the 5% level.

To delve into this deeper, we examine if the effect is related to any specific component of management practices. To do this, we keep the same specification as in column (2) and now use the management sub-scores on monitoring, targets and incentives as regressors. We report the results in columns (3), (4) and (5) of Table 7. We find the overall result is driven by the monitoring and incentives components of the management scores. This may be expected ex-ante: the monitoring section captures how many KPIs the firm tracks, including worker

absenteeism. Monitoring performance through measurable outcomes may help substitute for direct monitoring of workers at the workplace. The same holds for incentives: using structured incentives-based schemes require some measurable notion of output, that can be used to assess worker performance when working remotely. In contrast, targets are not significant, arguably because this component captures setting medium to longer term targets, which may not be particularly relevant in the acute phase of the pandemic and lockdown.

The overall score bears a larger coefficient than any of the components, suggesting that the different dimensions of management practices are complementary in allowing a more efficient organization of remote work. This is in line with the experimental results of Bruhn et al. (2018) on Mexican SMEs, who show that there is no silver bullet, that is, no single managerial practice that in itself improves firm performance. Our results are consistent with the framework of Brynjolfsson & Milgrom (2013), who emphasize the role of complementarities in practices within organizations, i.e. the added value of clusters of practices working in concordance relative to their independent effects.

7 Conclusion

We study the role of modern structured management practices in responding to a large and entirely unanticipated shock, the COVID-19 pandemic in Italy. We find that structured management practices are associated with lower declines in expected sales growth in 2020, as well as realized sales growth in the first three quarters of 2020. Although the impact on firms through different channels is orthogonal to management practices, the response of firms is not. Management is associated with a higher likelihood of having a response strategy regarding the lockdown, particularly related to human resource management. An important human resource management strategy in lockdown is the move to remote work. The extent to which firms have increased the use of remote work in their organization is significantly associated with structured management. This is driven by the incentives and monitoring practices.

Our results have important implications from a policy perspective. While the fact that management practices have a positive effect on performance in normal times is well established, little was known on their consequences for firm resilience to shocks. Our results indicate that good management practices do not entail any trade off between performance in normal times and the capacity to react to shocks. Rather, they constitute an asset in both situations. This implies that even SMEs, that do not score high on management practices but are supposed

to be particularly flexible and resilient (European Commission 2020), could benefit from a higher adoption of such practices.

An important caveat is that our conclusions are based on a very specific shock, that is, the COVID-19 pandemic. While we stress that this shock constitutes an excellent lab to study the firm capacity to adjust to a sudden, large change in the economic environment, understanding the extent to which our results extend to other types of shocks is an important avenue for future research.
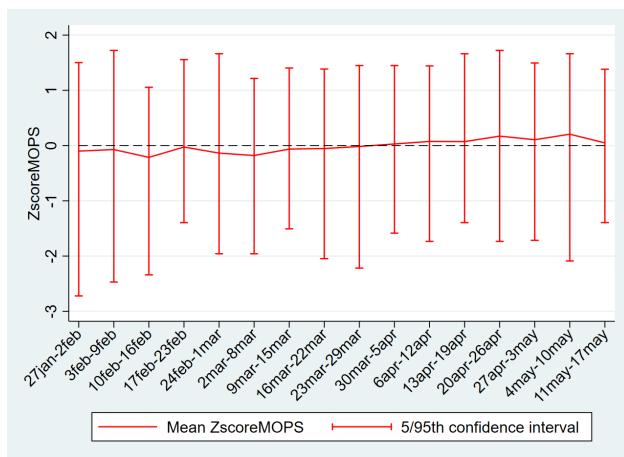
References

Abowd, J. M., Kramarz, F. & Margolis, D. N. (1999), 'High wage workers and high wage firms', *Econometrica* **67**(2), 251–333.

Aghion, P., Bloom, N., Lucking, B., Sadun, R. & Van Reenen, J. (2021), 'Turbulence, firm decentralization, and growth in bad times', *American Economic Journal: Applied Economics* **13**(1), 133–69.

Alfaro, L., Chari, A., Greenland, A. N. & Schott, P. K. (2020), Aggregate and firm-level stock returns during pandemics, in real time. NBER Working Paper No. w26950.

Amore, M. D., Quarato, F. & Pelucco, V. (2020), Family ownership during the covid-19 pandemic. CEPR Discussion Paper No. DP14759.

Bank of Italy (2020a), Annual report on 2019, Technical report, Bank of Italy. https://www.bancaditalia.it/pubblicazioni/relazione-annuale/2019/en_rel_2019.pdf?language_id=1.

Bank of Italy (2020b), Macroeconomic projections for the italian economy, Technical report, Bank of Italy. https://www.bancaditalia.it/pubblicazioni/proiezioni-macroeconomiche/index.html?com.dotmarketing.htmlpage.language=1.

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

Bender, S., Bloom, N., Card, D., Van Reenen, J. & Wolter, S. (2018), 'Management practices, workforce selection, and productivity', *Journal of Labor Economics* **36**(S1), S371–S409.

Bloom, N., Brynjolfsson, E., Foster, L., Jarmin, R., Patnaik, M., Saporta-Eksten, I. & Van Reenen, J. (2019), 'What drives differences in management practices?', *American Economic Review* **109**(5), 1648–83.

Bloom, N., Davis, S. J., Foster, L., Lucking, B., Ohlmacher, S. & Saporta-Eksten, I. (2020), Business-level expectations and uncertainty. NBER Working Paper No. w28259.

Bloom, N., Eifert, B., Mahajan, A., McKenzie, D. & Roberts, J. (2013), 'Does management matter? Evidence from India', *The Quarterly Journal of Economics* **128**(1), 1–51.

Bloom, N., Genakos, C., Sadun, R. & Van Reenen, J. (2012), 'Management practices across firms and countries', *Academy of management perspectives* **26**(1), 12–33.

Bloom, N., Sadun, R. & Van Reenen, J. (2012), 'Americans do IT better: US multinationals and the productivity miracle', *American Economic Review* **102**(1), 167–201.

Bloom, N., Sadun, R. & Van Reenen, J. (2016), Management as a technology? NBER Working Paper No. w22327.

Bloom, N. & Van Reenen, J. (2007), 'Measuring and explaining management practices across firms and countries', *The Quarterly Journal of Economics* **122**(4), 1351–1408.

Bloom, N. & Van Reenen, J. (2010), 'Why do management practices differ across firms and countries?', *Journal of Economic Perspectives* **24**(1), 203–24.

Bresnahan, T., Brynjolfsson, E. & Hitt, L. (2002), 'Information technology, workplace organization, and the demand for skilled labor: Firm-level evidence', *The Quarterly Journal of Economics* **117**, 339–376.

Broszeit, S., Laible, M.-C., Fritsch, U. & Görg, H. (2019), 'Management practices and productivity in Germany', *German Economic Review* **20**(4), e657–e705.

Bruhn, M., Karlan, D. & Schoar, A. (2018), 'The impact of consulting services on small and medium enterprises: Evidence from a randomized trial in Mexico', *Journal of Political Economy* **126**(2), 635–687.

Brynjolfsson, E. & Milgrom, P. (2013), Complementarity in organizations, *in* R. Gibbons & J. Roberts, eds, 'The handbook of organizational economics', Princeton University Press Princeton, NJ, pp. 11–55.

Buchheim, L., Krolage, C. & Link, S. (2020), Sudden stop: When did firms anticipate the potential consequences of covid-19? CESifo Working Paper No. 8429.

Card, D., Heining, J. & Kline, P. (2013), 'Workplace heterogeneity and the rise of West German wage inequality', *The Quarterly journal of economics* **128**(3), 967–1015.

Caroli, E. & Van Reenen, J. (2001), 'Skill-biased organizational change? Evidence from a panel of British and French establishments', *The Quarterly Journal of Economics* **116**, 1449–1492.

Cette, G., Lopez, J., Mairesse, J. & Nicoletti, G. (2020), Economic adjustment during the great recession: The role of managerial quality. NBER Working Paper No. w27954.

Choudhary, A., Lemos, R. & Van Reenen, J. (2018), Management in pakistan. International Growth Center Working Paper.

Crispino, M. (2021), Statistical Learning from ranking data: Italian firms' strategies and preferences during COVID-19 crisis. Mimeo, Bank of Italy.

Englmaier, F., Galdon-Sanchez, J. E., Gil, R. & Kaiser, M. (2020), Management practices and firm performance during the Great Recession–Evidence from Spanish survey data. Mimeo, LMU Munich.

European Commission (2020), An SME Strategy for a sustainable and digital Europe. https://ec.europa.eu/info/sites/info/files/communication-sme-strategy-march-2020_en.pdf.

Giorcelli, M. (2019), 'The long-term effects of management and technology transfers', *American Economic Review* **109**(1), 121–52.

Guiso, L. & Parigi, G. (1999), 'Investment and demand uncertainty', *The Quarterly Journal of Economics* **114**(1), 185–227.

Hicks, D. & Breitzman, A. (2003), Small serial innovators: The small firm contribution to technical change. Mimeo, Rowan University.

Istat (2020), Italy's economic outlook, Technical report, Istat. https://www.istat.it/en/archivio/251218.

Ma, Y., Ropele, T., Sraer, D. A. & Thesmar, D. (2020), A quantitative analysis of distortions in managerial forecasts. Bank of Italy Temi di Discussione (Working Paper) No 1306.

McFadden, D. L. (1974), Conditional logit analysis of qualitative choice behavior, *in* P. Zarembaka, ed., 'Frontiers in Econometrics', New York: Academic Press, pp. 105–142.

Ohlsbom, R. & Maliranta, M. (2020), 'Management practices and allocation of employment: Evidence from finnish manufacturing', *International Journal of the Economics of Business* pp. 1–24.

Pozzi, A. & Schivardi, F. (2016), 'Demand or productivity: What determines firm growth?', *The RAND Journal of Economics* **47**(3), 608–630.

Rodano, G., Serrano-Velarde, N. & Tarantino, E. (2016), 'Bankruptcy law and bank financing', *Journal of Financial Economics* **120**(2), 363–382.

Schivardi, F. & Schmitz, T. (2020), 'The IT revolution and southern Europe's two lost decades', *Journal of the European Economic Association* **18**(5), 2441–2486.

Syverson, C. (2011), 'What determines productivity?', *Journal of Economic Literature* **49**(2), 326–65.

Vyas, J. (2018), Management practices and productivity in British production and services industries-Initial results from the Management and Expectations Survey: 2016. UK Office for National Statistics.
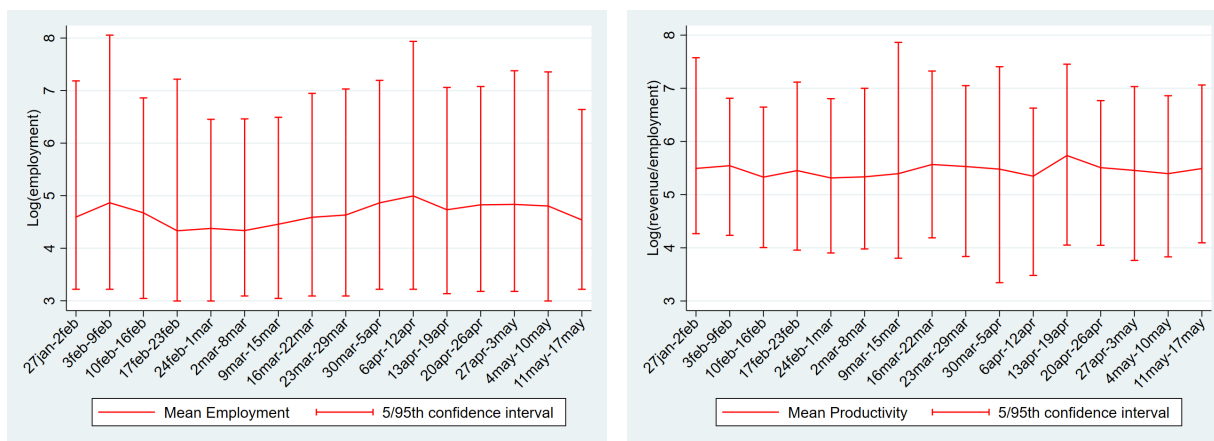
A   Additional figures

Figure A1: MOPS score by week of response

Note: The y-axis shows the average management score with the corresponding 95% confidence interval taken across firms responding in the week reported on the x-axis. The sample consists of 1803 firms which responded to the INVIND survey with complete responses to the management module.

Figure A2: Employment and Productivity by week of response

Note: In the left panel, the y-axis shows the average log of employment with the corresponding 95% confidence interval across firms responding in the week reported on the x-axis. The right panel shows the same for average log productivity, measured by the log of revenue per worker. The sample consists of 1803 firms that responded to the INVIND survey with complete responses to the management module.

B Management score: construction and validation

To measure the use of structured management practices in Italian firms, a module of eight questions following Bloom et al. (2019) was administered through the INVIND survey by the Bank of Italy. The module was administered in 2020, inquiring about the use of structured practices in the organization during 2019.

Table B1 reproduces the "pratiche manageriali" (PM) module included in the INVIND 2020 survey along with the question-wise scoring scheme. We closely follow the scoring mechanism of Bloom et al. (2019) to arrive at an aggregate management score, as well as for three components of structured management: monitoring, targets and incentives. To calculate the aggregate score, we restrict our sample to firms that have "complete" responses, i.e. firms who responded to at least 5 of the 8 questions of the module.[32] Each of the questions is first scored on a 0-1 scale based on the scheme (see Table B1). The scores for individual questions are then aggregated by taking the average of the question-wise scores across all the answered questions. Then, we standardize this aggregate measure across firms, to have mean zero and standard deviation 1. This is the overall management score we use for our analysis. We similarly create standardized sub-scores on monitoring, targets and incentives for each respondent firm, where the monitoring sub-score is constructed from the average of the responses to questions PM1-PM3, the targeting sub-score from the average of responses to PM4 and PM5, and the incentives sub-score from PM6-PM8.

The validity of the management measure developed by Bloom et al. (2019) and adopted to our context is prima facie supported by the findings of the preceding paper-based surveys on management practices that have been conducted in diverse country settings.[33] To validate the measure of managerial practices is meaningful in our context, we first check the distribution of the aggregate score and whether this validates the cross-country comparisons seen for Italian firms in previous work. The management score has a heavier left tail compared to the equivalent score in the US MOPS distribution (44.5% vs 27% firms adopting less than half of the practices), in accordance with the findings of the WMS that, on average, US firms employ more structured management practices than Italian firms (Bloom, Genakos, Sadun & Van Reenen 2012). We also assess the correlation of the score with measures of firm performance, which we expect based on the previous literature to be positive if our measure is meaningful. The management scores does indeed have a positive and significant correlation with labor productivity of 0.03, very similar to the equivalent value of 0.04 found in the average management score across countries in the WMS (Bloom & Van Reenen 2007).

To further validate our management score, we follow the strategy of Bloom et al. (2019), and examine the relationship between the management score and firm performance. We examine the relationship *prior* to the pandemic.[34] If our survey questions meaningfully capture the use of structured management practices in Italian firms, we can expect to find a strong positive relationship with performance in normal times, with magnitudes similar to previous studies. At first glance, we see for example that structured management is positively correlated with firm size and exporting activity. In Table B2, we begin in column (1) of with a basic regression of labor productivity measured as log(output/ employee) on the management score without controls, where output is measured as total revenues or sales. We find a highly significant coefficient of 0.0975. This implies that a one standard-deviation increase in the management score is associated with 10.24 percent (exp(0.0975)-1) increase in labor productivity. In column (2), we follow Bloom et al. (2019) and estimate a specification associated with a production function with management as an input similar to labor and capital, and with total factor productivity substituted with fixed effects for industry and province.

---

[32]This includes firms that missed questions by correctly following the skip pattern encoded in the survey: if option 4 is chosen for PM2, the firm skips PM3 and if option 4 was chosen for PM4, skip PM5 and PM6.

[33]The measurement of management practices in organizations began with phone interviews under the World Management Survey (WMS) and were subsequently adapted through a careful process of cognitive testing into a multiple choice paper-based format in the Management and Organizational Practices survey (MOPS) Bloom et al. (2019). The MOPS instrument has subsequently been used in different countries and across sectors (Vyas 2018, Choudhary et al. 2018, Broszeit, Laible, Fritsch & Görg 2019, Ohlsbom & Maliranta 2020).

[34]We use performance measures from 2019 with the management score of early 2020. Our implicit assumption here is that the management-performance relationship is relatively stable in the short run.

Table B1: Scoring scheme for management module of INVIND 2020

Siamo interessati a conoscere le principali pratiche manageriali utilizzate dalla Vostra impresa **nel 2019**. Per pratiche manageriali si intende l'insieme dei comportamenti e delle prassi utilizzate nella gestione dell'attività di produzione di beni e/o servizi della Vostra Impresa.		
PM1	**Quando si è presentato un problema nella produzione dei Vostri beni e/o servizi, che cosa è avvenuto?**	
1	È stato risolto ma non sono stati presi ulteriori provvedimenti	1/3
2	È stato risolto e sono stati presi ulteriori proveddimenti affinché non accadesse di nuovo	2/3
3	È stato risolto, sono stati presi ulteriori proveddimenti affinché non accadesse di nuovo ed è stato intrapreso un continuo processo di miglioramento per prevenire problemi di questo tipo	1
4	Non è stato preso alcun provvedimento	0
5	Non si è mai presentato un problema nella produzione	0
PM2	**Quanti indicatori di performance sono stati monitorati?**	
1	Da 1 a 2	1/3
2	Da 3 a 9	2/3
3	10 o più	1
4	Nessuno	0
*Se l'impresa **non ha risposto 'Nessuno'** alla domanda precedente:*		
PM3	**Quanto spesso sono stati modificato/aggiornati gli indicatori di performance?**	
1	Annualmente	1/6
2	Trimestralmente	1/3
3	Mensilmente	1/2
4	Settimanalmente	2/3
5	Giornalmente	5/6
6	Ogni ora o più frequentemente	1
7	Mai	0
PM4	**Su quale orizzonte temporale sono definiti principali obiettivi di produzione?**	
1	Breve termine (fina ad un anno)	1/3
2	Lungo termine (più di un anno)	2/3
3	Una combinazione di breve e lungo termine	1
4	Non ci sono obiettivi di produzione	0
*Se l'impresa non ha risposto '4 - Non ci sono obiettivi di produzione', rispondere alle **prossime due domande:***		
PM5	**Quanto è stato facile o difficile perseguire gli obiettivi di produzione dei vostri beni e/o servizi?**	
1	È stato molto facile	0
2	È stato abbastanza facile	1/2
3	non è stato nè facile nè difficile	3/4
4	È stato abbastanza difficile	1
5	È stato molto difficile	1/4
PM6	**Su cosa principalmente basati i premi di produzione?**	
1	Sulle performance del singolo in rapporto agli obiettivi di produzione	1
2	Sulla performance del team in rapporto agli obiettivi di produzione	3/4
3	Sulla performance dello stabilimento in rapporto agli obiettivi di produzione	1/2
4	Sulla performance di tutta l'impresa in rapporto	1/4
5	Non ci sono premi di produzione	0
PM7	**Su quale criterio sono principalmente basate le promozione dei lavoratori?**	
1	Promozioni basate solamente su performance e abilità	1
2	Promozioni basate in parte su performance e abilità e in parte su altri fattori, come l'anzianità sul lavoro	2/3
3	Promozioni basate principalmente su fattori diversi da performance e abilità, come l'anzianità sul lavoro	1/3
4	Generalmente non sono previste promozioni	0
PM8	**Quando un lavoratore (non-manager) di scarsa produttiva è stato spostato dal suo ruolo?**	
1	Entro 6 mesi dall'accertamento della scarsa produttiva dell'impiegato	1
2	Dopo 6 mesi dall'accertamento della scarsa produttiva dell'impiegato	1/2
3	Raramete o mai	0
4	Nessun lavoratore si è rivelato di scarsa produttiva	0

Table B2: Performance and management

	log (output/employment)		profit/sales	EBITDA/assets
	(1)	(2)	(3)	(4)
Management	0.097***	0.033**	0.779*	16.365**
	(0.018)	(0.013)	(0.402)	(6.597)
log(capital/emp)		0.041***	0.422	-8.304
		(0.014)	(0.419)	(7.684)
log(employment)		0.015	0.592**	-8.788***
		(0.014)	(0.263)	(3.337)
log(materials/emp)		0.441***	0.088	13.451
		(0.039)	(0.793)	(8.581)
Skill (% white collar workers)		0.005***	-0.019	-0.306
		(0.002)	(0.016)	(0.291)
Observations	1803	1696	1685	1696

Note: The dependent variable is shown at the top of each column, as measured in 2019. Output is measured by revenue (in thousands of Euros), employment by headcount of employees in 2019. EBITDA is constructed from 2020 INVIND variables. Capital is measured at the book value and the share of white collar workers is taken from the 2018 INVIND survey. EBITDA is measured as value added minus labor costs. The scale of dependent variable in columns (3) and (4) is multiplied by 100 for readability. All regressions include 3-digit sector fixed effects, and standard errors are shown in parentheses and are clustered at the 3-digit sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Capital is measured as the book value of total fixed assets and employment is measured by the headcount of employees. We control for skilled labor, which is positively correlated with the management score in our data. We proxy for skill using the share of white collar workers in the firm (latest measure from 2018). We also include survey fixed effects (week of response of the survey and whether the survey was conducted over phone or email). These controls reduce the coefficient on management on labor productivity from 0.0975 found in column (1) to 0.033, but the value is very similar to the literature. Bloom & Van Reenen (2007) find the equivalent coefficient for the regression to be 0.04 in cross-country data from the World Management Survey, to which our coefficient is reassuringly similar. We also consider profitability, which is an indicator firms care about. In column (3) of Table B2, we consider the profit rate calculated using operating profits scaled by sales as the outcome and estimate the specification of column (2). We find a positive and significant relationship between management and profitability. Finally, in column (4), we consider an alternative measure of the profit rate using Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) scaled by assets. We regress this against the management score following the same specification as columns (2) and (3) and again find a positive and significant relationship between management and profitability.

These correlations suggest the measure of the use of structured management practices in organizations developed by Bloom et al. (2019) has high explanatory power for firm performance in our context, and thus meaningfully captures the use of these practices for firms in Italy, supporting our use the measure for empirical analysis.

C   Forecast error and management score

We construct the forecast error as the absolute value of the difference between expected and realized sales combining INVIND surveys from consecutive years:

$$\widehat{FE_{it}} = |SalesGr_{it} - \mathbb{E}_{it-1}(SalesGr_{it})| \tag{2}$$

where $SalesGr_{it}$ denotes sales growth of firm i in year t over the previous year $t-1$, and $\mathbb{E}_{it-1}(SalesGr_{it})$ represents the expectation of firm i in year $t-1$ of this sales growth. We thus compute expectations

formulated for a given year with the subsequent actual realization. In Table C1, we study the correlation of our constructed forecast error with the management score. In column (1) we begin by examining the correlation between management score and the forecast error for 2019, defined in equation 2. We control for fixed effects at the 3-digit sector and province levels, to account for the common components of the forecast, clustering the standard errors at 3-digit sector level. No evidence of correlation between the forecast error and the management score emerges. Next, we extend the specification in column (2) to include the controls of the baseline specification (log employment, exports, group dummy and dummy for loss). Again, we find that there is no systematic relationship between forecast error and management, controlling for observable characteristics at the firm-level.

The absence of a relationship of forecast error with management score calculated from a single year may be due to the fact that a single observation per firm might not contain sufficient information to detect any relationship . To better capture the stable or persistent component of the firm's formation of forecasts, we leverage data across multiple years. [35] We first estimate the following equation, controlling for common components of the error through sector times province fixed effects as before:

$$\widehat{FE_{it}} = \delta_i + \delta_{jt} \tag{3}$$

where δ_i is a fixed effect for the firm, δ_{jt} represent 3-digit sector times year fixed effects to take account of time-varying sectoral shocks that might affect firm forecasts. The estimate δ_i captures the systematic part of the firm forecast error. We now use the predicted value of δ_i as a dependent variable to examine whether forecast error varies with the management score at the firm level. The results of this exercise are shown in column (3) of Table C1. We replace the dependent variable in the same specification as column (2). Reassuringly, we again find that this relationship is not significant.

Table C1: Absolute forecast error and management

	$\widehat{FE_{2019}}$ (1)	$\widehat{FE_{2019}}$ (2)	$\widehat{\widehat{FE}}_{2019-2015}$ (3)
Management	0.124	-0.190	-0.241
	(0.350)	(0.603)	(0.370)
log(employment)		0.0297	-0.0474
		(0.388)	(0.251)
log(revenue/employment)		-2.794***	-2.549***
		(0.690)	(0.503)
$\mathbb{1}_{Exporter}$		1.046	1.490*
		(1.155)	(0.889)
$\mathbb{1}_{Profits<0}$		-5.726***	-4.024***
		(1.013)	(0.650)
Observations	1598	1598	1496

Note: The dependent variable is the forecast error, defined as the absolute difference between expected and realized sales for the years specified in the column sourced from multiple years of the INVIND survey. All columns include 3-digit sector fixed effects and province fixed effects. Columns 2 and 3 includes fixed effects for week of response and type of interview. Column (3) shows the second stage of an two step estimation process. The first stage estimates the firm-specific forecast error calculated over 2015-2019 through firm fixed effects, controlling for time-varying sectoral shocks with 3-digit industry x Year fixed effects. In the second stage shown in column (3), the firm-specific forecast error is regressed on the management score following the same specification as column (2). For all columns, standard errors are clustered at the 3-digit sector level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

---

[35]We implicitly assume for the sake of the exercise that our management measure is relatively stable over 2015-2019.

D   Details of the conditional logit model

We explain details of the empirical strategy that we adopt for analysis using information from the ISECO survey. The original choice set for the strategy questions ("What strategies have you adopted or are thinking to adopt to counter the negative effect of the spread of the Coronavirus in Italy on the activities of your firm?") was comprised by 10 strategies and a "No strategy has been adopted" option. The options were: 1. Revision of prices; 2. Revision of sales markets; 3. Revision of suppliers; 4. Conversion of productive activities; 5. Changes in the logistic; 6. Personnel policies (for examples changes in the number of employees, in the time schedule, remote work); 7. Reduction in production; 8. Revision of investment plans; 9. Delay in payments to suppliers/from customers; 10. Changes in bank loan usage. demand policies (1 and 2), production policies (3, 4, 5, 7), labor policies (6), investment plans policies (8) and finance (9 and 10) (see Table D2). As before, we assign to each possible grouped response the maximum rank obtained by each option. As before, we assign to each possible grouped response the maximum rank obtained by each option. We build our final dataset by stacking all firms' choice sets. As an example, consider the case of a firm ranking three options. In our final dataset that firms will be represented with three choice sets: the first one will have all options available, the second choice set will exclude the first preferred option and include only the remaining one, and the third will have all combinations excluding the first two choices.

The conditional logit models rests on the Independence of Irrelevant Alternative (IIA) assumption. In practice, this means that the relative odds of choosing one option over another in not affected by the elimination of other alternatives. This is particularly important given our estimation strategy. In fact, to exploit the fact that firms rank up to three alternatives, we use the first choice as the alternative preferred to all others, then we delete this alternative from the choice set and obtain another observation in which the second choice is the preferred alternative when the first choice is not available, and similarly for the third choice. This requires that the second choice would have been preferred to all the others excluding the first choice even in the case that the first choice was not available. We believe that this assumption is reasonable in our setting. In fact, we have aggregated the choices into clearly separated ones: demand, supply (intermediates, logistic and infrastructure), labor, finance, none. If a firm ranks (say) labor above finance when demand is available, it is unclear why this rank could be reversed in the case in which the demand option is not available. The IIA assumption fails when one choice has different degrees of substitutability with each of the other choices. This would be likely if choices have a certain degree of overlap. For example, slowdown in the supply of intermediate and problems with logistic are more similar than drop in demand. Therefore, eliminating one could increase the relative likelihood of the other. But, given our definition of the choice set, we see no overlap, that is, no "Blue bus-Red Bus" choices.

Table D1: Drivers in COVID-19 affecting firms

ISECO Survey Original Options	Aggregate Responses	1st factor	2nd factor	3rd factor	Total
1. Decrease in foreign demand	DEMAND	293	236	87	616
2. Decrease in domestic demand	DEMAND	705	310	63	1078
3. Problems in logistics and/or in the functioning of infrastructure	SUPPLY	200	259	212	671
4. Unavailability of labour	LABOR	96	99	127	322
5. Delays in the supply of raw materials or intermediate goods	SUPPLY	98	225	222	545
6. Problems relating to liquidity or to the financial structure of the firm	FINANCE	82	133	215	430
7. None of the above factors	NONE	108	99	134	341
Total		1582	1361	1060	4003

Note: The first column shows the original options available for firms in in the ISECO survey to answer the question: "In relation to the diffusion of the COVID-19, what factors are negatively affecting your operations in Italy?". The second column shows how we group these options into aggregate categories used in the analysis. The remaining columns show the number of firms that choose each option by their rankings indicated at the top of the column.

Table D2: Strategies of firms in response to COVID-19

	Aggregate Responses	1st factor	2nd factor	3rd factor	Total
1. Revision of prices	DEMAND	59	17	29	105
2. Revision of sales markets	DEMAND	50	56	37	143
3. Rethinking of domestic/foreign suppliers	SUPPLY	15	25	26	66
4. Conversion of production activity	SUPPLY	25	19	13	57
5. Changes in logistics (i.e. different transport modes for supplies/deliveries)	SUPPLY	59	67	48	174
6. Staffing policies (e.g. changes in the number of employees/working hours/rotating schedules/recourse to wage supplementation/remote work)	LABOR	853	226	96	1175
7. Reduction of the degree of utilization of plant and machinery and/or of production	SUPPLY	110	225	92	427
8. Revision of investment plans	INVESTMENT	66	200	169	435
9. Extended payment terms for your clients/by your suppliers	FINANCE	108	214	195	517
10. Extended payment terms by banks and/or granting of new credit lines	FINANCE	115	193	193	501
11. No strategy has been/will be adopted	NONE	119	61	126	306
Total		1579	1303	1024	3906

Note: The first column shows the original options available for firms in in the ISECO survey to answer the question: "What strategies have you adopted or are thinking to adopt to counter the negative effect of the spread of the Coronavirus in Italy on the activities of your firm?". The second column shows how we group these options into aggregate categories used in the analysis. The remaining columns show the number of firms that choose each option by their rankings indicated at the top of the column.