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**NAVIGATING THE NEW NORMAL: WHICH FIRMS HAVE
ADAPTED BETTER TO THE COVID-19 DISRUPTION?**

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Abstract

The COVID-19 pandemic has significantly impacted businesses worldwide by lowering demand, impeding operations, stressing supply chains, and limiting access to finance. Yet we still lack an understanding of how firms can successfully adapt to this disruption. We examine this issue theoretically by combining arguments around dynamic capabilities and managerial cognition and developing several hypotheses concerning firm innovation, knowledge sources, management practices, and gender issues in relation to firms' adaptation to this crisis. We test these assertions using data from two rounds of surveys involving more than 11,000 firms from 28 countries both before and after COVID-19 was officially declared a global crisis. Our results provide *prima facie* evidence that innovators, in particular those who are younger (i.e. start-ups) and those who rely on internal sources of knowledge, are more likely to adapt to COVID-19 than non-innovators. Our results suggest that firms with better management practices have also greater ability to adapt. We did not find systematic gender differences upon examining firms managed by women versus men. Following these findings, we set out several implications for research and policy.

Keywords: *COVID-19; Crisis; Innovation; Adaptation; Knowledge Sources; Management practices; Start-ups; Gender inequality*

'Adversity has the effect of eliciting talents which, in prosperous circumstances, would have lain dormant.'

Horace (65–8 B.C.)

1. INTRODUCTION

On 11 March 2020 the World Health Organization officially declared COVID-19 a pandemic, confirming its rapid spread and global reach. As this health crisis unfolded, governments around the world responded to the virus by putting in place stringent lockdowns meant to flatten rates of infection, hospitalizations and ultimately deaths (Alvarez, 2020). While these restrictive measures have been highly effective, they have come with some steep social and economic costs which will likely culminate in a global recession (Baker et al., 2020; Baldwin and di Mauro, 2020).

There has been significant variation across countries in terms of the type of lockdowns imposed, their duration and the stimulus packages introduced to curb unemployment and business failures (Hasan et al., 2020). In addition, many firms, particularly those in non-essential industries, have faced a reduced demand for their goods or services, supply chain disruptions or unavailability of workers, due to regulations designed to reduce the spread of the virus. Thus, from both an academic and a policy standpoint, it is important to understand how businesses can adapt to this new environment (Vergne and Depeyre, 2016), since successful adaptation is a prerequisite for both performance and, more importantly, firm survival (Helfat and Winter, 2011).

Prior research on the effects of crises on organizations has overwhelmingly examined the consequences of the global financial crisis (GFC) of 2008 on a variety of aspects, such as diversification strategies (De Figueiredo, Feldman and Rawley, 2019), corporate takeovers (Wan and Yiu, 2009), research and development (R&D) investments (Paunov, 2012), public subsidies (Hud and Hussinger, 2015) and financial leverage (Nemlioglu and Mallick, 2021). While the COVID-19 pandemic shares certain features with the GFC (e.g. its exogenous nature,

its effect on cash flows, uncertainty levels, monetary and fiscal responses), it is also very different in many ways, e.g. mechanisms (housing bubbles versus lockdowns), speed and type of economic recovery (V-shaped versus U-shaped) or the type and extent of public policy responses (local vs. national; coordinated vs. ad-hoc). This complexity warrants further investigation into the responses and strategies of firms in tackling the unique implications of this crisis and operating successfully in the post-COVID-19 environment.

In this study, we focus on the ability of firms to adapt to this crisis. We examine the characteristics of firms and the role that innovation plays in their success. Combining theoretical elements from cognition studies and dynamic capabilities, we argue that firms that engage in innovation activities are more likely to cope well with the challenges of COVID-19 as they benefit from better managerial know-how and increased attention to environmental conditions (Kiesler and Sproull, 1982; Eggers and Kaplan, 2009) that allows them to efficiently reconfigure their assets and re-calibrate market operations (Teece et al., 1997; Helfat et al., 2007). In addition, firms that rely on internal knowledge sources as opposed to external ones are able to reallocate them more easily to adapt to COVID-19 (Zouaghi, Sanchez and Martinez, 2018). We posit that start-ups (Ebersberger and Kuckertz, 2021) and firms with good management practices (Bloom et al., 2016) are better equipped to adapt to the crisis. Finally, given the disproportionate impact of the pandemic on women in the labour force, we suggest that firms with female managers will be less likely to adapt to COVID-19.

We test these theoretical predictions using a large dataset of more than 11,000 firms across 28 countries. We construct this dataset by combining data from the World Bank on the latest rounds of Enterprise Surveys (2018/2019) with a new COVID tracker follow-up survey (May–June 2020) to find out which firms are more likely to adapt successfully to COVID-19. These standardized surveys benefit from a large international representation and from a representative, stratified sample of firms for each of the economies included. Given these

attributes, we are able to achieve better generalizability of our results across different countries and sectors around the world. We use econometric analyses to empirically test our hypotheses. Our results provide broad support for our theoretical conjectures, except for the hypothesis concerning gender and adaptation.

We provide several contributions. First, we add to the innovation management literature in two ways: (1) by expounding the benefits of innovation for firms, not only in terms of increased sales or economic performance, but also in terms of flexibility and adaptability to crises; and (2) by showing that start-ups and firms that invest in internal knowledge capabilities benefit more from innovation when adapting to environmental conditions post COVID-19. While prior literature that has focused on the effects of crises on firms' ability to innovate (Filipetti and Archibugi, 2011; Paunov, 2012), our findings complete this circle and reinforce the idea that 'innovation matters' by providing an additional element to this manifesto, namely the ability to successfully adapt to crises. In addition, we provide explanations for when innovation pays off, by focusing on otherwise well-researched subjects such as start-ups (Gries and Naudé, 2009) and internal knowledge sources (Colombo et al., 2016) in the context of adapting to crises.

Second, we contribute to ongoing conversations in the field of organizational behaviour and strategy on what makes firms more resilient and more adaptable to change. In this way, we treat COVID-19 as a global natural experiment and examine the significance of management practices and the gender of top managers as two important elements that can affect a firm's chances of adapting successfully. In doing so, we complement previous research in this area which has focused on diversification (Helfat, 1997), strategic renewal (Reymen et al., 2015), the exploitation of strategic opportunities (Wan and Yiu, 2009) and more recent work (Young et al., 2017; Manolova et al., 2020) that has explicitly examined the role of gender in relation to responses to crises.

Finally, this article aims to act as a catalyst for future research on the implications of COVID-19 for individuals, businesses and society overall. While COVID-19 has generated significant academic interest across multiple disciplines, the body of knowledge on the strategic and organizational implications of this crisis remains limited to editorial or conceptual pieces (Muzio and Doh, 2020) that need empirical validation. Our study is one of the few that is able to test theoretical conjectures in a large and international setting of 28 countries and more than 11,000 firms, which gives it greater generalizability in light of the global and sudden nature of the COVID-19 crisis. As more detailed data on firms' activities and responses becomes available, management scholars will be able to test existing theories and propose new ones in relation to resilience, adaptation and, more generally, mechanisms for organizations and countries to cope in a crisis.

2. BACKGROUND AND LITERATURE

2.1 Firms' responses to crises

Crises of different types (financial, environmental, political or social) and magnitudes (local, regional, international and global) occur periodically around the world, affecting business operations. Formally defined as 'unexpected events that disrupt the normal functioning of societies', crises have significant consequences for businesses that require both strategic planning and responses (Smart and Vertinsky, 1984). With few notable exceptions (e.g. Oh and Oetzel, 2011; Darendeli and Hill, 2016; Oetzel and Oh, 2021), most research into crises has focused on financial events (such as the GFC of 2008 or the Asian financial crisis of 1997) that have affected a large number of firms across the world (e.g. Filipetti and Archibugi, 2011; Paunov, 2012; Hud and Hussinger, 2015; Zouaghi et al., 2018; De Figueiredo et al., 2019; Nemlioglu and Mallick, 2021).

A review of this literature reveals that organizations resort to several types of strategic response to crises (Wenzel, Stanske and Lieberman, 2020). Broadly, these strategies can be grouped into four categories: (1) retrenchment, (2) perseverance, (3) exit and (4) innovation. *Retrenchment* involves contracting the firm's activities by reducing costs, assets, and products in markets in which it is involved (Robbins and Pearce, 1993). While this is intuitive from a cost and risk minimization point of view, empirical findings regarding its usefulness for performance, particularly in the long run, are mixed. For example, De Figueiredo et al. (2019) showed that a reduction in business scope due to a crisis may result in losses for firms, and these losses increase with the degree of relatedness between business units that are closed and those that continue. This resonates with other scholarly arguments regarding the lack of viability of such measures, and the negative externalities of firms' internal values and capabilities (Ndofor, Vanevenhoven and Barker, 2013).

Perseverance involves measures to preserve the status quo of the firm and minimize the impact of the crisis. It achieves a more stable and predictable operation, which is especially useful when there is a lot of volatility due to the crisis (Stieglitz et al., 2016). In such instances firms that persevere (or 'keep a steady course') are less exposed to risk and failure, ultimately improving their chances of survival in the post-crisis period (Chakrabati, 2015). Firm-specific capabilities such as core competences (De Carolis et al., 2009) and flexible managerial practices (Lim, Das and Das, 2009) remain paramount in this process.

Exit refers to instances in which a firm stops its activity, either because it has become impossible to operate, or because managers and owners do not believe the organization will survive the crisis (Argyres, Bigelow and Nickerson, 2015). An interesting study by Oh and Oetzel (2011) examined under which circumstances multinational firms chose to exit international markets: they found that firm exit was more likely in the case of terrorist threats or technological disasters than natural disasters, and that the quality of institutional

environments in these host countries mitigates this relationship. While exit is perceived as a negative outcome for the firm, it also has some positives, as it allows for resource conservation and strategic renewal and avoids the stigma of bankruptcy or market failure (Ren, Hu and Cui, 2019; Wan, Chen and You, 2015).

Finally, a more proactive – albeit riskier and costlier – response to crises is to innovate in an attempt to match the current environmental conditions and changes in demand due to the crisis. As brilliantly put by Winston Churchill, we should ‘never let a good crisis go to waste’. A crisis presents a perfect opportunity to modify or change strategic and operational parameters of a firm (Bryson, 1981). As such, innovations relating to products, processes, organizational practices, strategies and priorities are all feasible in the context of a crisis (Tripsas, 1997). In line with this argument, prior studies document that crises are conducive to increasing business innovation in terms of scope and scale (Reymen et al., 2015), investments in complementary or substitute technologies (Helfat, 1997), and making use of financial slack to engage in strategic, high-payoff actions (Wan and Yiu, 2009). Thus, innovative approaches can be an effective response to mitigate the negative effects of a crisis and to potentially emerge stronger from a challenging period.

2.2 Innovation during a crisis

Despite the enabling role innovation plays in tackling crises, most of the literature has focused so far solely on the effects of crises on firm innovative performance. Thus, crises increase the concentration of innovative activities within a small group of fast-growing firms and favour those that pursue explorative technological strategies (Archibugi, Filippetti and Frenz, 2013a), reduce overall investment in innovation and incentivize start-ups to engage in more radical innovations (Archibugi, Filippetti and Frenz, 2013b). The effects of crises on firm innovation are also mediated by the quality of a country’s innovation systems (as reflected by human

resources (HR), high-tech sector specialization, or financial development) (Filippetti and Archibugi, 2011). A firm's involvement in innovative activities during a crisis appears to be contingent on its access to public funding (Paunov, 2012) or R&D subsidies (Hud and Hussinger, 2015), the quality of its management (Nemlioglu and Mallick, 2021), and its focus on R&D investments and radical innovations (Antonioli and Montessoro, 2021).

Very recent studies on the effects of COVID-19 complement this body of knowledge through qualitative evidence regarding the role of exaptation¹/repurposing (Ardito, Coccia and Petruzzelli, 2021; Liu, Beltagui and Ye, 2021) and open innovation via crowd funding (Vermicelli, Cricelli and Grimaldi, 2021) in developing innovations to cope with the medical, social and economic challenges raised by COVID-19. However, as discussed in the previous section, while innovation remains one of the most lucrative and impactful strategies firms have at their disposal to combat the negative effects of a crisis, we still lack knowledge on the reversal of this relationship: that is, *whether firms that innovate stand a better chance of adapting to crises*, and in particular to complex, global crises such as COVID-19.

2.3 Innovation and firms' adaptation to a crisis

In this section we will argue that innovating firms stand a better chance of adapting to the COVID-19 crisis, combining theoretical rationales from the literature on dynamic capabilities and management.

Defined as the ability 'to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result' (Helfat and Peteraf, 2003: 999), dynamic capabilities are often seen as responsible for the advancement of firms' long-term objectives (Zollo and Winter, 2002). Innovation represents changes in terms of market offering and organizational practices and has direct effects on firm performance through the

¹ A process by which features acquire functions for which they were not originally adapted or selected.

reconfiguration of organizational resources and routines (Eisenhardt and Martin, 2000). Hence, conducting *in-house R&D* (Pisano, 1994) or acquiring external knowledge through *external R&D* (Beneito, 2006) contributes directly to firms' learning and innovation, offering greater potential for recombination of resources, which in turn facilitates adaptation to a new environment (Schumpeter, 1934). In this way, engagement in formal R&D efforts yields valuable know-how that can easily be redirected towards dealing with the consequences of an unexpected crisis, such as the COVID-19 pandemic.

Second, product and process innovations are invaluable dynamic capabilities (Piening and Salge, 2015), providing firms alternative ways to deal with the crisis (Helfat, 1997). While product innovation is commonly regarded as a key prerequisite for market entry, following the Schumpeterian argument of creative destruction, process innovation helps firms to secure their market position, given the available pool of products and resources (Damanpour et al., 2009). Having complementary assets provides firms with alternative business segments or niches that can provide 'escape routes' for innovating firms. For instance, Helfat (1997) shows that in the oil crisis of the 1970s, firms that engaged in innovations around coal conversion were more successful in the long run than those that didn't. This also resonates with the idea that engagement in strategic renewal and widening of the scope of a business are creative, efficient responses to a crisis (Ettlie, Bridges and O'Keefe, 1984; Reymen et al., 2015).

Third, the degree of responsiveness and the speed of adaptation depends very much on the type of manager a firm has and how much attention they pay to changes in the environment. Managers should notice environmental changes, interpret them and react strategically to best position their organization (Cho and Hambrick, 2006). In particular, managers of innovative firms need to be aware of the latest technological trends in their markets to successfully oversee strategic investments in innovation and product development in these areas (Tushman and Rosenkopf, 1996). Subsequently, managers directly trigger organizational changes, initiating

changes in R&D strategies or the development of new products (Kor, 2006; Eisenhardt and Tabrizi, 1995), thereby determining a firm's ability to adapt to a turbulent or changing environment.

Finally, managers of innovative firms need to pay attention to changes in technology or consumer behaviour that might impact their businesses (Tripsas and Gavetti, 2000). While investment and innovation outputs provide opportunities for firms to adapt and create a demand for their products or services, positive outcomes are always subject to uncertainty. This is where managerial skills and attention prove to be very useful, in terms of both picking a strategic direction and acting fast and efficiently to re-combine existing resources to serve a new objective or goal (King and Tucci, 2002). Hence, good managerial skills and attention – which are commonly found in highly innovative firms – are particularly useful for dealing with rapid technological changes and shifts in taste or consumer preference (Khanagha, Volberda, and Oshri, 2017), such as those that have taken place since COVID-19.

In conclusion, both managerial attention and dynamic capability arguments suggest that innovative capabilities provide avenues through which firms can strategically reorient or adapt to a different environment as a result of the recent pandemic, albeit using different mechanisms. We therefore hypothesize that:

H1: Firms that engage in innovation will be more likely to successfully adapt their activities in response to COVID-19.

2.4 Different sources of knowledge

While most of the literature on the link between innovation and crises has focused on the consequences of crises for innovating firms (Archibugi et al., 2013; Paunov, 2012; Filipetti and Archibugi, 2011), the role of internal versus external knowledge in the process of innovation remains largely uncovered (Colombo et al., 2016). The notable exception remains the study by

Zouaghi et al. (2018), which examines the role of external versus internal knowledge sources on innovative performance of Spanish small and medium-sized enterprises (SMEs). Their study suggests that both internal and external knowledge sources lead to higher levels of innovation, in terms of both radical and incremental innovations. Moreover, these knowledge sources appear to mitigate the negative effects of a crisis on the innovative performance of Spanish SMEs.

Building on this work, we examine how different knowledge sources for innovating firms affect their chances of successfully adapting to COVID-19. Specifically, we argue that reliance on, and development of, strong internal knowledge capabilities gives firms a better chance of adapting, for the following reasons. First, internal investments in knowledge generation, such as R&D activities, improve firms' learning capabilities as well as their absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002). In turn, strong capabilities in these areas will provide these firms with internal resources they can employ to deal with an unexpected crisis (Zouaghi et al., 2018). Second, such investments would also include hiring staff and training them to carry out skilled R&D activities, which often brings a strong, tacit component to knowledge creation inside a firm (Song, Almeida and Wu, 2003). Highly educated, skilled human capital is essential to translate tacit knowledge and innovation into practical ways that a firm can adapt to new environmental conditions (Martínez-Sánchez, Vicente-Oliva, and Pérez-Pérez, 2020). Such skills and expertise are particularly useful in dealing effectively and innovatively with crises.

Greater reliance on external sources of knowledge will leave firms more exposed to the crisis, and less likely to successfully adapt to it. One obvious drawback of heavy reliance on external sources of know-how during a crisis such as COVID-19 is the breakdown of ties between firms and nations across the globe. While the rise of globalization has shifted the 'make versus buy' debate relating to knowledge creation in favour of having both internal and external

sources via ambidextrous strategies (Im and Rai, 2008; Krammer, 2016), COVID-19 has led to severe disruption to global value chains, exports, foreign direct investments and collaboration, particularly across national borders (Gereffi, 2020; Verbeke and Yuan, 2021). Thus, firms that rely more heavily on such strategies for acquiring knowledge are less likely to secure it, and thus also less likely to use it for adaptation. A second important reason for the diminishing importance of external knowledge sources for a firm's adaptation is the strategic importance of knowledge as a competitive advantage during a crisis, which makes knowledge 'creators' less inclined to share it with other firms in their value chains (Caloghirou et al., 2021) As such, we can see large disparities in terms of knowledge creation between high-tech and low-tech industries, but also between firms within an industry (Berchicci, Tucci and Zazzara, 2014).

Given the above, we hypothesize that:

H2: Firms that rely on internal rather than external sources of knowledge for innovation will be more likely to successfully adapt their activities in response to COVID-19.

2.5 Start-ups versus established firms

In addition to focusing on innovation and investment in internal resources and capabilities, we expect older, more established firms to have inherently lower chances of adapting to COVID-19 than newer firms, including start-ups. This is supported by several reasons.

First, the COVID-19 crisis has emphasized the need to adapt fast and appropriately to the challenges of the new environment. This is reflected in the strategic response time: that is, the gap between the identification of new needs or requirements and the time taken by a firm to meet them (Ellwood et al., 2017). Older, more experienced organizations usually exhibit stricter (i.e., precise, scheduled), more cyclical (i.e. evolving around regular boom–bust business cycles) and internally focused (i.e. focused on the firm itself rather than on external

conditions) time orientations than start-ups. Given the significant degree of uncertainty introduced by the COVID-19 crisis, such time orientation norms would put established firms at a disadvantage compared to start-ups when it comes to adapting their innovative activities to respond to the crisis (Enersberger and Kuckerts, 2021).

Second, by definition, start-ups use exploratory, iterative organizational approaches to define their business model. As such, when compared to established firms, they often have a leaner structure (Frederiksen and Brem, 2017), stronger external and stakeholder orientation (Kuckertz, 2019) and more pragmatic business approaches (Sarasvathy, 2001), which allow them to better align to the needs of a post COVID-19 market. Lower rigidity and leaner hierarchies also result in outward-looking, innovation-focused approaches to their business, putting start-ups in a better position to engage in discovery and experimentation in response to COVID-19. These provide them with better chances of adaptation than well-established firms. We therefore hypothesize that:

H3: The benefits of innovation for successfully adapting a firm's activities post-COVID-19 will be greater for start-ups than for established firms.

2.6 Managerial factors: best practices and female managers

Managerial factors enhance existing organizational strengths and assets and facilitate the ability of firms to successfully adapt to new challenges (Eggers and Kaplan, 2009). Thus, managers can provide powerful explanations for why firms in the same industry, and with similar pools of resources, may respond very differently to external shocks (Osborne Stubbart, and Ramaprasad, 2001) or fail to adapt to environmental changes (Tripsas and Gavetti, 2000). In this study, we focus on two managerial factors that we believe to be particularly salient for firms' adaptation to COVID-19: best management practices and the role of female managers.

Comprehensive, well-defined management practices are a prominent reason behind performance differentials across firms in the same industry or region (Bloom and Van Reenen, 2007). These measures of managerial practice vary significantly across firms, industries and countries, and have been strongly associated with a firm's productivity, profitability and chances of survival (Bloom and Van Reenen, 2011). While studies have focused on linking individual management practices (e.g. incentive pay, performance feedback, teamwork, autonomy and performance measures) to a firm's performance across multiple domains (such as economic, social, innovative), there is also a strong case to be made for the complementary nature of these practices in jointly affecting positively a firm's performance (Chadwick, Super and Kwon, 2015). Building on this perspective, we argue that good management practices (broadly defined) give firms a much better chance of adapting to crises, in accordance with dynamic capabilities theory.

To survive and thrive, firms need to renew their competences by 'appropriately adapting, integrating and reconfiguring internal and external organization skills, resources and functional competences to match the requirements of a changing environment' (Teece et al, Pisano and Shuen, 1997: 515). This has implications for the type of management practices introduced. For instance, better communication and higher autonomy for employees leads to greater cohesion and congruence between organizational and individual goals (Lee and Kelley, 2008), while well-defined incentives and performance-monitoring policies leads to more learning and experimentation within organizations (Zollo and Winter, 2002). Overall, well-defined, sophisticated management practices that cater to the organizational needs and profile of the firm in any way (appraisal schemes, training, recruitment, selection and induction practices, etc.) will support exploration, knowledge sharing and proactive risk taking (Shipton et al., 2005; Barros and Lazzarini, 2012; Zoghi et al., 2010), which will increase a firm's chances of adapting to a crisis. We therefore hypothesize that:

H4a: Firms with well-defined HR management practices will be more likely to successfully adapt their activities in response to COVID-19.

Another salient factor regarding the role of management practices is the characteristics of the individual managers who oversee a firm's operations and strategic responses. From the limited knowledge we have, the gender of a manager appears to have particular relevance for crisis management. Prior research into gender of managers and firms' performance suggests that women are less likely to become managers (Jennings and Brush, 2013) than men and, when they do, their firms face more resource constraints (Boden and Nucci, 2000) which often results in underperformance (Jennings and McDougald, 2007). Nevertheless, the evidence on a potential gender gap in terms of managerial performance is far from conclusive: there have been multiple calls in the literature to expand on research and seek clarification with regards to gender issues and management in organizations (Kalnins and Williams, 2014). In this study we take this advice and examine this issue in the context of COVID-19.

We contend that firms with female managers are less likely to adapt successfully to this crisis for three reasons. First, the current crisis has involved an unprecedented change in the work-home boundary (Alon et al., 2020). The closure of schools and nurseries and the imposition of lockdown by local and national governments has resulted in huge pressure on parents to tackle education, childcare and work-related tasks at the same time at home (Derndorfer et al., 2021). While these conflicting work-family demands have all affected firms in general, as employees having to juggle their jobs while acting as parents and educators, we expect that this strain would have been more accentuated for females than for males. The limited evidence we have on this issue suggests that, during the pandemic, the average time spent on childcare and household chores has increased more for women than it has for men (Hupkau and Petrongolo, 2020; Dang and Nguyen, 2021). This implies, on average, that women who are managers would have less time to deal with work issues and the aftermath of the crisis

(Manolova et al., 2020), thus decreasing the chances of female-managed firms to successfully adapt to COVID-19.

Second, scholars have documented significant behavioural differences between men and women in terms of risk aversion, which in turn affects the decisions they make in high-uncertainty scenarios (Jennings and Brush, 2013). For instance, some studies suggest that women respond very differently to large, external shocks such as a natural disasters or crises (Bradshaw, 2013), often by overestimating the probability or consequences of such catastrophic events (Young et al., 2017). Moreover, female managers and business owners tend to be more risk averse than male managers, and tend to take a long-term view, which prompts them to implement measures to build organizational resilience in the long run rather than coming up with short-term, unplanned solutions to a crisis (Danes et al., 2009). As such, female managers or owners might be less likely to adapt quickly their business model and operations, but rather adopt a ‘wait and see’ approach before making any strategic commitments (Morrow and Enarson, 1996; Gimenez-Jimenez et al., 2020).

In light of all the above arguments, we posit that:

H4b: Firms that have female managers will be less likely to successfully adapt their activities in response to COVID-19.

3. METHOD

3.1 Data sources and sample

To test our hypotheses we employ a novel dataset of more than 14,000 firms across 41 countries, including both developed and developing nations. We put together this dataset by combining World Bank’s *COVID Survey* administered in the period May-June 2020 with the latest wave of *Enterprise Surveys* (also from the World Bank) from either 2018 or 2019 (pending on the

country). These are stratified firm-level surveys which include questions on firm innovative capabilities as well as their impact of the COVID-19 pandemic, and ability of firms to cope with it. Moreover, the implementation of the questionnaire is designed to retain representativeness of firms across regions and sectors for these countries. After removing all missing observations for our main variables of interest (i.e., innovation and adaptation to COVID-19) we are left with a sample of roughly 11,000 firms across 28 countries worldwide². A breakdown of observations by country and industry is provided in Appendix A (**Tables A1** and **A2**). In addition, **Table 1** presents a short description of the variables with descriptive statistics, while **Table 2** displays pairwise correlations.

Dependent variable. Our main measure for firm adaptability captures firm responses in terms of production and as a result of learning processes (Levy, 1965). We use the following item in the survey (*“Has this establishment adjusted or converted, partially or fully, its production or the services it offers in response to the COVID-19 outbreak?”*) and code it into a binary variable *covid19_adapt* which equals 1 if the firm has adjusted its production in response to COVID-19, and zero otherwise. In addition, we consider more proxies for firm adaptability in our robustness checks.

Independent variables. Our main proxy for a firm’s innovative capabilities is R&D investments. In this way we are also able to distinguish whether the R&D focus is on internal sources or external ones. We code firm’s responses to the question (*“During the last fiscal year did this establishment spend on research and development activities?”*) into a binary variable (*R&D*) for our analysis. In the robustness section we will employ also other proxies for firm innovation to check the relationship between innovation and firm adaptation to crises.

² The notable exception in this regard is the availability of management practices questions which is confined to only about 4,000 firms.

We measure reliance on external (and respectively internal) knowledge sources using two questions in the surveys (“*Over the last three years, did this establishment spend on research and development activities contracted with other companies?/ within the establishment?*”). These are coded as two binary variables (*R&D external* and *R&D internal*) capturing a firm’s reliance on these two sources. In addition, we measure *acquisition of external knowledge* (also binary) using the following question “*During the past three years has the establishment spent on acquisition of external knowledge?*”.

We also code *start-ups* as those firms that have been established in the past five years (Ebersberger and Kuckertz, 2021) and firms with a female top manager (*female mgm*). Finally, to capture best management practices we follow the conventions in this literature and employ Principal Component Analysis (PCA) and derive a composite indicator using multiple questions from the Enterprise Surveys (Laursen and Foss, 2003; Beugelsdijk, 2008). We include 5 potential variables to the relevant management policies using PCA with orthogonal varimax rotation to better fit the data (Abdi and Williams, 2010). For a detailed description of these variables please see **Table A3** (Appendix A). Three of these factors (performance monitoring, strategic agility and target awareness) load into a factor with Eigen value of 1.18 which label *Mgm practices* (**Table A4**) and subsequently use in our econometric analyses.

Controls. To account for any idiosyncratic effects between different industries in terms of their natural propensity to be affected by (and thus adapt to) COVID-19, we employ industry fixed-effects through all our estimations. Moreover, we include a wide range of firm-level controls to ensure that firms’ ability to adapt is correctly identified in relation to firm innovative capabilities.

The first such control variable is *firm size*. Larger firms tend to be both more innovative and successful compared to smaller firms, as they often have more resources and dedicated capabilities to utilize in their activities. Firm size is measured as the total number of employees

at the end of the year preceding the survey (in logarithmic form, *lnsize*). Moreover, older firms may have more experience with such crises and hence might be better equipped to deal with these disruptions (Huergo and Jaumandreu, 2004). We therefore control for firm age (*lnage*) in all our regressions, by using a measure derived from the year of the survey minus the reported first year of operations. Another important boost in terms of resources, ideas and new knowledge is engagement in exports via learning-by-exporting (Golovko and Valentini 2011). To account for any learning effects from exposure to other markets we include a variable (*exporter*) measuring whether the firm exports or not either directly or indirectly. In addition, as experienced managers poses significant know-how and possibly experience in dealing with these crises as their tenure increases, we control for managerial experience as an important source for know-how which has been strongly correlated with firm performance (Bloom and Van Reenen 2010). We therefore control for managerial experience (*manexp*) as the number of years the manager has been working in this industry. Furthermore, access to finance remains paramount for a firm's growth and innovation (Krammer, 2019). *Finance* is a dummy variable that has a value of 1 for firms that have a credit line from a private bank and 0 otherwise. Finally, foreign participation in both public and privately owned enterprises has positive effects on firm performance (Girma, Gong, and Görg 2009). To account for these effects we use *foreignown*, a dummy variable that takes a value of 1 a firm has a majority foreign ownership (greater than 50 percent), and 0 otherwise.

3.2 Estimation strategy and econometric issues

To estimate the impact of innovation capabilities and other firm characteristics on its adaptability to COVID-19 as a binary outcome (*cov19_adapt*) we employ a probit model and estimate the following equation:

$$\begin{aligned}
cov19_adapt_{fsc} &= \Phi\{\alpha_0 + \beta_1 Innovation_f + \beta_{2iea} Knowledge_{i,e,a}_f + \beta_3 Startup \\
&+ \beta_4 Mgmpractices_f + \beta_5 Femalemgm_f + controls_f + \lambda_{sc} + error\}
\end{aligned}$$

where *cov19_adapt* is a dummy variable which equals 1 if the firm has adapted its production to COVID-19 challenges in 2020 or not; Φ denotes the cumulative standard normal distribution; *Innovation* refers to a firm's innovative capabilities (as proxied by its ability to introduce new products, processes, invest in R&D, etc.), *Knowledge* refers to sources of knowledge being either internal (*i*), external (*e*) or acquired (*a*) while the rest of the DVs follow our hypotheses testing whether start-ups, management practices and having female managers affects firm's chances to adapt to COVID19. *f*, *s*, *c* are indexes for firms, industries and countries; *controls* include all the firm-specific variables detailed in the previous section; λ_{sc} are the industry (sector) and country fixed effects.

By design, endogeneity is reduced in this setting. All our explanatory variables come from Enterprise Surveys carried out either in 2019 or 2018 (pending on the country) which asks firms of their product, process and R&D investments, knowledge sources in the past three years of that date (i.e., 2016-2019), while the management practice questions refer to the previous financial year (i.e., 2017-2018). In turn, our DV (i.e., firm's ability to adapt to COVID-19) comes from the follow-up *COVID Survey* carried out in May 2020, so reverse causality is highly implausible. Nevertheless, we have successfully conducted additional analyses (listed under Robustness checks section) to deal with potential endogeneity at the firm level (i.e., the non-random nature of the distribution of innovation and adaptation capabilities across firms).

In addition, common-method bias (CMB) is often investigated when dealing with survey data. Our main source of data (the ES) has embedded in it a few procedural remedies to tackle CMB, namely: 1. All respondents and firms are anonymized 2. The questions about innovation potential and firm-specific aspects are in different sections in the survey thus

preventing respondents to answer them strategically; 3. The questions about the impact of covid-19 have been asked as a follow-up of the survey in May 2020 which further reduces the risk of respondents biasing their answers to serve a certain objective. Furthermore, we have also investigated this issue empirically by conducting Harman's one factor test and the results confirm that more than one factor is responsible for the bulk of variance in our variables. In addition, the results of a common latent factor analysis (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003) reveals similarly that multiple factors are responsible for the variance behind these variables, supporting the idea that CMB is not an issue in this case.

4. RESULTS

4.1 Main results

Our results are presented in **Table 3**. We start with Model 1 where all controls are introduced alongside industry and country fixed effects to control for any unobserved heterogeneity among industries and nations in terms of adapting to COVID-19. In line with our expectations, larger firms (more resources) and younger (more agile, open to change) firms appear to be better equipped to adapt their production to these new challenges. Interesting enough, managerial experience appears to be negatively correlated with adaptation and mildly statistically significant suggesting that extensive experience in the industry might actually cause sluggish responses, particularly in the case of massive disruptions like COVID19 which require a shift in paradigm and responses which are farther from usual ones. Finally, foreign owned firms appear to be at disadvantage as most of the responses would be tailored to the national needs of multiple countries where they operate.

Next, Model 2 tests our baseline hypothesis, namely that innovating firms will be more likely to adapt successfully to COVID-19 than non-innovating firms using R&D investment as a proxy. Indeed, the coefficient of R&D dummy variable is positive and significant confirming

our intuition. This effect is also further enhanced by the size of the respective firm, so that the effect is more pronounced for larger firms than for medium and smaller ones. Model 3 tests our second hypothesis by decomposing a firm's R&D efforts by sources of knowledge employed (i.e., internal R&D, outsourced/contracted-out R&D and acquisition of external knowledge). The coefficients of these variables indicate clearly that firms which rely on internal R&D have a much higher and statistically significant probability to successfully adapt to COVID-19. Model 4 tests our 3rd hypothesis and the coefficient of the interaction between R&D and the start-up dummy is both positive and highly significant confirming that the benefits of innovation will be greater for start-ups than incumbent firms. Model 5 examines the role of management practices and results confirm our Hypothesis 4a namely that firms employing best practices will stand a better chance to adapt. In turn, we do not find any significant differences in terms of adaptation between female-managed and male-managed firms. The coefficient of female manager in our Model 6 and also throughout is positive but statistically insignificant. Finally, we include all orthogonal variables (R&D and components of R&D by knowledge sources do not meet this criteria as they are a linear combination of each other, and thus cause multicollinearity) in Models 7 and 8 to show that all these factors do contribute jointly to higher probability of adaptation to COVID-19.

4.2 Robustness checks

To further check the validity of our conjecture regarding the importance of innovation activities to COVID-19 successful adaptation, we employ several additional proxies for adaptation which come also from the follow-up surveys. These variables measure whether firms have adapted or enhanced their business activities in other ways than production (*“Did this establishment experience any of the following changes in response to the COVID-19 outbreak?:”*) from one which is based on physical interaction to one which is more online (*“Started or increased business activity online?”*), adoption of delivery or carry-out (*“Started or increased delivery or*

carry-out of goods or services?”) and adoption of remote work (“Started or increased remote work arrangement for its workforce?”).

Furthermore, we also follow prior innovation management literature and employ different proxies for firm innovativeness by complementing our existing indicators on R&D and its sources (which mostly qualify as “inputs” into the innovation process) with additional proxies on the “outputs side” by examining whether firms engage in product and process innovations (Goedhuys and Veugelers, 2012; Fritsch and Görg, 2015; Krammer, 2019). Thus, using the answers to the questions *“During the last three years, did your establishment: introduce into the market any new or significantly improved products (goods or services)? and respectively “... any new or significantly improved production processes including methods of supplying services and ways of delivering products?”* we compute two binary dependent variables (*New product* and *New process*), which take the value of 1 for positive (“yes”) answers, and 0 otherwise.

These additional regressions include full-specifications of controls as the main results, including country and industry fixed-effects. For brevity, we only report the coefficients of interest (i.e., for different innovation proxies used) in **Table 4** (Panels a, b, and c) and they are consistent with our main estimations, namely regardless of the proxies used to capture innovation capabilities, their coefficients are positive and highly significant confirming that innovators are much likely to adapt their businesses (across multiple dimensions) in response to COVID-19.

Furthermore, as discussed in the prior section, while the DV and IDVs are temporally-segregated thus reducing significantly the chance of reverse causality, endogeneity may still arise due to other factors as adaptation and innovative capabilities could be jointly determined by industry- (e.g., competition), country- (e.g., institutions), and regional factors (e.g., industrial heritage). While we control for these effects on the DV in the form of country and sector fixed-

effects, we also investigate these formally by using an instrumental variable probit where sector-region-country averages are used to instrument each of the proxies we use for capturing innovative capabilities. However, the values of the Wald tests suggest that exogeneity cannot be rejected statistically and that our probit results are unbiased.

5. DISCUSSION AND CONCLUSIONS

COVID-19 has had serious negative societal consequences worldwide. In addition to its immediate impact on health, it has also significantly impaired economic activities in many countries. As governments worldwide begin to ease lockdowns, firms' resilience and their ability to adapt to a new, very different, environment will be paramount if we are to avoid a deep, long-lasting recession. Our research aim revolves around this issue and asks the question: which firms are better equipped to deal with radical disruptions such as those that the COVID-19 crisis has caused?

In particular, building on insights from dynamic capabilities, managerial cognition and organizational responses to crises, we are keen to examine the role of innovators in this adaptation process. Our core tenet is that innovators should be better equipped than non-innovators to deal with the radical changes introduced by COVID-19. This reasoning is supported by theoretical arguments from dynamic capabilities and managerial attention theories. Dynamic capabilities theories emphasize the ability of organizations to reconfigure their assets and resources to adapt to changes in their business environment. Innovating firms by definition need to build such capabilities to create innovation (through invention, imitation or recombination of existing knowledge). As a result, innovating firms are inherently endowed with dynamic capabilities that help them to thrive in fast-moving technological environments (Teece et al., 1997; Helfat et al., 2007). In addition, innovating firms tend to pay more attention to their external environment. Changes in this environment, in terms of new products or

processes, require significant attention (to changes in the environment, consumers' taste and the competitive landscape), know-how (the evolution of technologies and products) and strategic behaviour (combining knowledge from internal and external resources). As a result, innovative firms have higher managerial diligence (Eggers and Kaplan, 2009), which is useful when dealing with a global crisis such as COVID-19.

In addition to our main finding regarding the enabling role of innovative capabilities in dealing with the COVID-19 crisis, our findings confirmed several other factors that are important for firms' adaptation. First, the source of know-how. We found that, although all innovations significantly improve a firm's chances of adaptation, firms that rely on internal knowledge sources stand a better chance of adapting than those that depend on external sources (such as contracted-out R&D or licensed/acquired technologies). This is consistent with the current picture of the post-pandemic world: most countries have suggested national (uncoordinated) responses and financial stimuli in response to the crisis, and external connections (e.g. global value chains or distribution chains) have suffered significant disruption and an overall reduction in traffic and importance. An interesting future line of research in this area could be examining the pros and cons of reliance on external links (to knowledge, markets, resources) in the post-pandemic world.

Second, the relative importance of innovation and knowledge in different firms. Our findings suggest that innovation helps many more start-ups to adapt than established firms. These results have policy implications, as start-ups are often seen as the future of an economy, tapping into new areas that present opportunities for economic growth and development (Gries and Naudé, 2009; Frederiksen and Brem, 2017). As such we showcase the importance of supporting start-ups and innovative young firms through dedicated policy mechanisms as a way to build-up resilience in an economy and also ensure faster recovery from future crises.

Third, the important role of management in tackling a crisis. We looked at the management practices that have been implemented and the gender of the managers in charge. Regarding the former, we found strong evidence that firms with better management practices are more likely to adapt successfully to COVID-19. This lends weight to the argument that implementing good management practices (through human resource management (HRM) policies) matters. There are also other well-established benefits, mentioned in the literature, such as higher productivity, profitability and innovation performance (Laursen and Foss, 2003; Beugelsdijk, 2008; Bloom and Van Reenen, 2011). With respect to the gender of the manager, contrary to our expectations, we did not find, *ceteris paribus*, any statistical differences between firms managed by men and women.

While overall there has been increased pressure on women during COVID-19 as a result of having to work from home, blurring the work–home boundary (Alon et al., 2020), and increased childcare and household duties (Landivar et al., 2020), our explanation for this result is that female managers are less affected by the pressures introduced by COVID-19 than regular, non-management female employees. Female managers are more likely to prioritize their careers (e.g., have few or no children, and be the main earner in the household) and have the financial resources (e.g., higher income, bonuses, etc.) to circumvent COVID-19 induced problems via private solutions (e.g., hire a private nanny for childcare). Future research in this area that examined whether gender biases are generic or depend on the level and experience of the individual (worker, administrative, managerial, top management, etc.) would be very interesting. Similarly, strategy and international business scholars could explore the relationship between exports and foreign ownership on one hand, and firm adaptation on the other. While this is beyond the scope of the present study, our analyses in which we have used these variables as controls suggest systematic effects that can further explain organizational responses to the current pandemic.

With this work we propose a couple of contributions. First, to the innovation management literature by providing robust, large-scale evidence that innovating firms are more likely to cope successfully with COVID-19 challenges than non-innovators. While the bulk of studies in this area have examined the consequences of a crisis for innovative performance (e.g. Filipetti and Archibugi, 2011; Paunov, 2012), we focus on the other side of this relationship by highlighting the importance of innovation for firms' ability to cope and adapt to crises.

In addition, we also showcase a couple of contingencies that make innovation more valuable for adaptation. Specifically, our findings – that firms that rely on internal knowledge sources as opposed to external ones and very young firms (i.e. start-ups) that innovate have a better chance of adapting to COVID-19 – are invaluable insights for both managers and policymakers in these countries. They also augment existing research on the importance of knowledge-sourcing strategies (Fainshmidt et al., 2017; Zouaghi et al., 2018) and the role of start-ups (Enersberger and Kuckerts, 2021; Archibugi et al., 2013a; Bessant et al., 2015) during turbulent periods or crises.

Second, this work contributes to previous studies in the organizational behaviour and strategy literature (e.g. Helfat, 1997; Reymen et al., 2015; Wan and Yiu, 2009; Wenzel et al., 2020) by highlighting the importance of management practices in the adaptation process. Best practices have long been associated with a firm's performance, productivity and innovation, and we provide another reason (i.e. a better chance of adapting to a crisis) for valuing them and employing them on a wide scale. We also contribute to the conversation on gender bias and the role crises can play in exacerbating this (Young et al., 2017; Manolova et al., 2020) by examining adaptation in enterprises run by women in comparison to enterprises run by men.

Finally, we hope that this study acts as a catalyst for future empirical investigations into these issues, taking advantage of COVID-19 as a global, natural experiment. While the bulk of intellectual contributions in management remains editorial and conceptual in nature (Muzio and

Doh, 2020), we hope to motivate more scholars to propose new theories and test existing ones in the context of the COVID-19 pandemic, itself a unique and complex crisis (Alon et al., 2020).

Our findings also have implications for managers and policymakers. Obviously, building innovative capabilities, in particular in-house ones, via investments in R&D, training and the recruitment of highly skilled R&D personnel, will pay off in multiple ways – by making firms more efficient, profitable and innovative, and by allowing them to adapt successfully to crises. Thus, managers need to emphasize this strategic response to a crisis while policymakers need to facilitate this process (via financial instruments such as tax breaks, subsidies or grants and by improving the quality of national innovation systems via collaborative consortia, investments in higher education, etc.). In addition, start-ups need to make formal investments in innovation (i.e. R&D activities). Without it, given the post-COVID-19 credit and market crunch, they are less likely to adapt successfully. Stimulating start-ups to be innovative and agile has been a policy objective for decades now, and our findings reinforce this mantra by adding an extra element to the list of benefits: namely, the successful adaptation of firms in response to a significant crisis. Governments around the world are currently spending huge amounts of money on preserving public health, and our findings suggest that such stimuli during or after a crisis should focus on boosting firms' innovative capabilities, not just to promote economic growth and competitiveness but also to improve the resilience and adaptability of businesses.

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Table 1. Descriptive statistics

Variable	Details	Obs.	Mean	Std. Dev.	Min	Max
cov19_adapt	Has the firm adapted its production to covid-19?	14,650	0.34	0.47	0.00	1.00
Insize	Log firm size (no. employees FT)	20,477	3.32	1.31	0.69	10.31
Inage	Log firm age (2020-year establish)	20,396	2.88	0.69	0.00	5.31
manexp	Manager's years in the industry	20,575	20.60	11.61	1.00	70.00
finance	Does the firm have access to loans?	20,575	0.40	0.49	0.00	1.00
exporter	Is the firm exporting any of its products?	20,316	0.26	0.44	0.00	1.00
foreignown	Majority foreign owned (>50%)	15,605	0.21	0.41	0.00	1.00
R&D	Has spent on R&D activities?	20,575	0.08	0.28	0.00	1.00
R&D internal	Has made internal R&D investment?	15,555	0.19	0.39	0.00	1.00
R&D external	Has made external (contracted-out) R&D investment?	15,550	0.09	0.29	0.00	1.00
Acquisition external	Has spent on acquisition of external knowledge?	15,673	0.13	0.33	0.00	1.00
Start-up	Established in the last 5 years?	20,575	0.06	0.24	0.00	1.00
Mgm practices	Composite indicator for best management practices (PCA)	5,707	0.00	1.09	-3.28	1.67
Female mgm	Is the top manager female?	20,575	0.18	0.39	0.00	1.00

Table 2. Pairwise correlations

No	Variable	1	2	3	4	5	6	7
1	cov19_adapt	1						
2	Insize	0.0486*	1					
3	Inage	-0.0491*	0.2340*	1				
4	manexp	-0.0534*	0.0883*	0.4724*	1			
5	finance	-0.0111	0.1803*	0.1014*	0.0764*	1		
6	exporter	-0.0119	0.3094*	0.1220*	0.0936*	0.1492*	1	
7	foreignown	0.0062	0.2266*	-0.0264*	-0.0652*	-0.0473*	0.1734*	1
8	R&D	0.0267*	0.2314*	0.0526*	0.0201*	0.1486*	0.2235*	0.0983*
9	R&D internal	0.0354*	0.2203*	0.0520*	0.0279*	0.1411*	0.2157*	0.0852*
10	R&D external	0.0165	0.1934*	0.0266*	-0.0043	0.1157*	0.1466*	0.0923*
11	Acquisition external	0.0304*	0.1563*	0.0092	0.0004	0.1003*	0.1293*	0.0942*
12	Start-up	0.0324*	-0.1151*	-0.5732*	-0.2183*	-0.0549*	-0.0467*	0.0152*
13	Mgm practices	0.0446*	0.1829*	0.0587*	0.0062	0.0605*	0.1335*	0.1534*
14	Female mgm	0.0270*	-0.0935*	-0.0570*	-0.0845*	-0.0198*	-0.0504*	-0.0162*

No	Variable	8	9	10	11	12	13	14
8	R&D	1						
9	R&D internal	0.9378*	1					
10	R&D external	0.6256*	0.4860*	1				
11	Acquisition external	0.3736*	0.3548*	0.3320*	1			
12	Start-up	-0.0092	-0.0082	-0.0032	0.0127	1		
13	Mgm practices	0.1770*	0.1779*	0.1264*	0.1482*	-0.0268*	1	
14	Female mgm	-0.0380*	-0.0347*	-0.0248*	-0.0066	0.0213*	0.0178	1

Note: * significant at 5 percent or better.

Table 3. Main results. Probit estimations

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Insize	0.048*** [0.010]	0.038*** [0.012]	0.038*** [0.012]	0.038*** [0.012]	-0.003 [0.022]	0.049*** [0.010]	-0.006 [0.022]	0.004 [0.023]
Inage	-0.042** [0.020]	-0.068*** [0.024]	-0.066*** [0.024]	-0.073*** [0.028]	-0.068+ [0.038]	-0.042** [0.020]	-0.078+ [0.042]	-0.089** [0.043]
manexp	-0.002+ [0.001]	-0.002 [0.001]	-0.002+ [0.001]	-0.002 [0.001]	-0.002 [0.002]	-0.002+ [0.001]	-0.002 [0.002]	-0.002 [0.002]
finance	0.035 [0.025]	0.031 [0.028]	0.034 [0.028]	0.031 [0.028]	0.058 [0.045]	0.035 [0.025]	0.055 [0.045]	0.063 [0.046]
exporter	0.056+ [0.031]	0.039 [0.034]	0.039 [0.034]	0.042 [0.034]	0.068 [0.053]	0.056+ [0.031]	0.068 [0.053]	0.069 [0.053]
foreignown	-0.108** [0.046]	-0.104+ [0.055]	-0.113** [0.056]	-0.107+ [0.055]	-0.163** [0.071]	-0.108** [0.046]	-0.177** [0.071]	-0.187*** [0.072]
H1: R&D		0.071** [0.034]		0.068+ [0.035]			0.041 [0.043]	
H2: R&D internal			0.102** [0.040]					0.129** [0.057]
R&D external			-0.012 [0.052]					-0.073 [0.068]
Acquisition external			0.008 [0.043]					-0.066 [0.059]
Start-up				-0.106 [0.075]			-0.302+ [0.154]	-0.323** [0.155]
H3: R&D x Start-up				0.351*** [0.136]			0.598** [0.239]	
H4a: Mgm practices					0.069*** [0.021]		0.063*** [0.021]	0.064*** [0.021]
H4b: Female mgm						0.015 [0.031]	0.034 [0.059]	0.031 [0.059]
H3: R&D internal x Start-up								0.559** [0.242]
constant	0.370*** [0.136]	0.425*** [0.149]	0.384** [0.150]	0.450*** [0.155]	0.600** [0.266]	0.366*** [0.136]	0.622** [0.274]	0.549** [0.276]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	14,341	11,331	11,236	11,331	4,196	14,341	4,187	4,140
Log Likelihood	-8010.73	-6184.89	-6127.97	-6181.46	-2364.64	-8010.60	-2357.36	-2324.72
LR Chi Square	2416.07	1935.64	1933.84	1942.50	748.94	2416.32	753.18	759.25

AIC	16179.46	12497.78	12387.94	12494.92	4853.28	16181.21	4846.72	4785.44
BIC	16777.56	12967.24	12871.52	12979.05	5246.48	16786.88	5265.14	5215.77

Notes: DV is cov19_adapt. All models include country- and industry- fixed effects. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, +p<0.1.

Table 4. Robustness checks: different proxies for firm adaptation to COVID-19

Panel a. DV: In response to COVID-19- Started or increased business activity online?

Variables	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
R&D	0.139*** [0.037]					
R&D internal		0.150*** [0.038]				
R&D external			0.046 [0.050]			
Acquisition external				0.058 [0.044]		
New product					0.167*** [0.028]	
New process						0.143*** [0.033]
N	11,508	11,483	11,473	11,571	14,469	14,465
Log Likelihood	-5039.83	-5026.79	-5022.58	-5090.80	-6734.77	-6741.27

Panel b. DV: In response to COVID-19- Started or increased delivery or carry-out of goods/services?

Variables	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20
R&D	0.139*** [0.037]					
R&D internal		0.150*** [0.038]				
R&D external			0.046 [0.050]			
Acquisition external				0.058 [0.044]		
New product					0.167*** [0.028]	
New process						0.143*** [0.033]
N	11,508	11,483	11,473	11,571	14,469	14,465
Log Likelihood	-5039.83	-5026.79	-5022.58	-5090.80	-6734.77	-6741.27

Panel c. DV: In response to COVID-19- Started or increased remote work arrangements for workforce?

Variables	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26
R&D	0.251*** [0.033]					
R&D internal		0.250*** [0.034]				
R&D external			0.238*** [0.044]			
Acquisition external				0.177*** [0.040]		
New product					0.217*** [0.027]	
New process						0.216*** [0.031]
N	11,560	11,534	11,525	11,632	14,497	14,493
Log Likelihood	-6098.81	-6090.40	-6091.36	-6145.10	-7659.14	-7657.06

Notes: All models include, but do not report, the full batch of control variables listed in Table 3. *** p<0.01, ** p<0.05, +p<0.1.

APPENDIX A.

Table A1. Breakdown of the dataset by country

Country	Observations	Percent of total
Albania	333	2.96
Belarus	523	4.65
Bulgaria	502	4.47
Croatia	339	3.02
Cyprus	161	1.43
Czech Republic	397	3.53
Estonia	266	2.37
Georgia	488	4.34
Greece	523	4.65
Hungary	612	5.44
Italy	402	3.58
Jordan	443	3.94
Latvia	221	1.97
Lebanon	360	3.2
Lithuania	213	1.89
Macedonia, FYR	287	2.55
Malta	185	1.65
Moldova	259	2.3
Mongolia	281	2.5
Montenegro	145	1.29
Morocco	354	3.15
Poland	795	7.07
Portugal	718	6.39
Romania	496	4.41
Russian Federation	1,040	9.25
Serbia	335	2.98
Slovak Republic	322	2.86
Slovenia	243	2.16
<i>Total</i>	<i>11,243</i>	<i>100</i>

Table A2. Breakdown of the dataset by industry

Country	Observations	Percent of total
Food	1,494	13.29
Tobacco	2	0.02
Textiles	173	1.54
Garments	607	5.40
Leather	87	0.77
Wood	205	1.82
Paper	91	0.81
Publishing, printing, and Recorded media	179	1.59
Refined petroleum product	8	0.07
Chemicals	160	1.42
Plastics & rubber	297	2.64
Non-metallic mineral products	332	2.95
Basic metals	97	0.86
Fabricated metal products	870	7.74
Machinery and equipment	717	6.38
Electronics	136	1.21
Precision instruments	59	0.52
Transport machines	94	0.84
Furniture	288	2.56
Recycling	36	0.32
Construction Section F:	896	7.97
Services of motor vehicles	292	2.60
Wholesale	876	7.79
Retail	2,027	18.03
Hotel and restaurants	602	5.35
Transport Section I	369	3.28
Transport Section II	4	0.04
Transport Section III	7	0.06
Transport Section IV	31	0.28
Transport Section V	6	0.05
IT	201	1.79
<i>Total</i>	<i>11,243</i>	<i>100</i>

Table A3. Variables employed in the Principal Component Analysis for management practices

Variable	Original variable ES and coding strategy	Range (re-coded variables)
Perf_monitoring	Did This Establishment Monitor Any Production/Service Performance Indicators? 1 – Yes 2 – No -9 – I do not know	0/1
Prov_targets	Did This Establishment Have Production/Service Provision Targets? 1 – Yes 2 – No -9 – I do not know	0/1
Strat_agile	What Best Describes The Time Frame of Production/Service Provision Targets? - Main focus was on short term, less than one year (1) - Main focus was on long term, one year or more (2) - Combination of short-term and long-term targets (3) - Do not know (-9) Strat_agile equals 1 if main focus is combination (i.e., 3)	0/1
Awareness	Who Was Aware of The Production/Service Provision Targets At This Establishment? - Only senior managers (1) - Most managers and some production workers (2) - Most managers and most production workers (3) - All managers and most production workers (4) - I do not know (-9)	1–4
Promotion	How underperformers are dealt with: - Based solely on performance and ability (1) - Based partly on performance and ability, and partly on other factors (for example, tenure or family connections) (2) - Based mainly on factors other than performance and ability (for example, tenure or family connections) (3) - Non-managers are normally not promoted (4) - I do not know (-9) - Does not apply (-7)	1–4

Note: All these items come from questions in the Enterprise Survey administered to a subset of countries. All observations with negative values (-9 or -7) are recorded into missing observations.

Table A4. Principal component analysis (PCA) rotated using orthogonal varimax method

Variables	Factor1 <i>(Mgm practices)</i>
Perf_monitoring	0.542
Strat_agile	0.572
Awareness	0.477
Promotion	-0.389
<i>Eigen value</i>	<i>1.180</i>

Note: Prov_targets was dropped from the analysis because of zero variance.