



# Resilience to the pandemic: The role of female management, multi-unit structure, and business model innovation

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## ABSTRACT

In this study, we analyse organisational resilience in the context of the recent COVID-19 pandemic. Combining arguments from the resource-based view and ergodicity, we theorise that organisational resilience depends on certain key characteristics of firms and their ability to innovate their business models. Specifically, we focus on female leadership and multi-unit structure as two characteristics that may condition the resource availability of firms during the pandemic and consider firms' innovative actions in response to the pandemic. We test our hypotheses using data from more than 11,000 firms in 34 countries. Our results confirm that female-led firms are less resilient, while multi-unit firms and those that introduced business model innovations are more resilient to the COVID-19 shock. Based on these findings, we suggest management and policy implications for building a firm's resilience to future disruptions.

## 1. Introduction

"If you're going through hell, keep going."  
Winston Churchill.

Defined as the ability to adapt positively (i.e. bounce back) or even emerge stronger (i.e. bounce beyond) from a significant setback (Hoegl and Hartmann, 2021), organisational resilience is an area of great interest for management scholars and policymakers worldwide (van der Vegt et al., 2015; Williams et al., 2017; Menzies and Raskovic, 2020), particularly in the wake of crises. This heightened interest is driven by both the increasing number of exogenous shocks over time (Nguyen et al., 2022)<sup>1</sup> and our limited understanding of companies' reaction to major crises that significantly disrupts their operations (Wenzel et al., 2020). Specifically, recent calls in the literature have highlighted the importance of examining the adjustments made by firms to their business models following crises (Galkina et al., 2023) and the role of firm-specific capabilities (Krammer, 2022a; Behl et al., 2022) that can help them overcome such difficult times.

In response to this need, we focus on the role of business model innovation and key firm resources that can contribute to maintaining resilience in crisis scenarios (Knight and Cavusgil, 2022). The recent COVID-19 pandemic offers a natural experiment to improve our understanding of organisational resilience (Ketchen and Craighead, 2020)

as a key attribute in the post-pandemic, non-ergodic world. Specifically, we focus on two firm resources, namely female management and their diversified (i.e., multi-unit) structure (Coleman and Robb, 2012; Chadwick and Raver, 2020), which we believe will be beneficial for organisations' ability to be resilient in the face of a crisis. We also examined how companies innovated their business models in response to the pandemic.

Managers remain instrumental in achieving resource orchestration and reconfiguration required in a post-pandemic period (Hitt et al., 2021). Routines must adapt to the new normal, and managers' abilities to acquire, develop, and bundle new resources are essential. Managers' gender affects a company's access to external resources, which may be vital for reconfiguring firm resources during crises and avoiding path dependence. Gender debates often highlight female's difficulty accessing financial resources (Allison et al., 2023; Fischer et al., 1993), which are crucial during disruptions (Acharya and Steffen, 2020; Branicki et al., 2018; Gittel et al., 2006).

Similarly, diversified multi-unit firms have been praised by strategy scholars for their superior flexibility compared to that of single-unit firms (Lechner and Kreutzer, 2010). Recent studies suggest that multi-unit firms are also able to cope better with uncertainty, given their superior ability to deploy and repurpose resources across different units (Dickler et al., 2022). Considering the tremendous uncertainty

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generated by the COVID-19 pandemic (Krammer, 2022a; Knight and Cavusgil, 2022), we argue that multi-unit firms will cope better with this crisis, thus exhibiting superior resilience compared with single-unit firms.

Finally, the very nature of the pandemic indicates that a particularly salient role in firms' adaptation might be played by innovation of existing business models (Hitt et al., 2021), as a crucial response towards overcoming disruption and its consequences (Ketchen and Craighead, 2020; Flammer and Ioannou, 2021; Spescha and Woerter, 2019). Innovative firms that rely on internal expertise and start-ups that focus on disruptive and novel approaches have been shown to adapt better and faster to the COVID-19 pandemic (Krammer, 2022a). Therefore, we build on these insights and postulate that business model innovation has a strong and positive effect on resilience as a comprehensive and appropriate response to the business challenges of the pandemic.

To test these assertions, we employed data from the Enterprise Surveys and the COVID-19 Impact Follow-up Survey, both collected from the World Bank. The first survey was conducted before the pandemic and provided information on firm characteristics exogenous to the COVID-19 crisis. The second survey interviewed the same firms on various issues associated with the pandemic. Our empirical analysis, employing more than 11,000 firms operating in 34 countries and across different industries, provides robust support for our hypotheses.

This study makes several contributions. First, we developed a theoretical framework which explains firm resilience during the pandemic as a function of key resources (multi-unit structure and manager gender) complemented by strategic responses via business model innovations. This framework answers recent calls in the literature to provide and test new insights into the drivers of organisational resilience as a valuable capability for long-term survival and success (Ismail et al., 2011; Menzies and Raskovic, 2020; Hillmann and Guenther, 2021).

Second, we provide robust empirical evidence for these conjectures in a generalisable context of several thousand firms across multiple countries and sectors. Our results provide novel insights into the benefits of strong business model innovation capabilities (Shiferaw, 2009) and a diversified (multi-unit) structural form (Foss and Saebi, 2017) when tackling a crisis. Furthermore, they caution against the potential pitfalls associated with the gender of the manager during a major exogenous shock (Knight and Cavusgil, 2022), linking it to prior work on leadership and organisational behaviour, and find that females are more likely to suffer penalties in the wake of a crisis (Ryan et al., 2016; Mukherjee & Krammer, 2022).

Finally, our findings advance the recent literature on the "new normal" (Krammer, 2022a) or "wicked world" (Rašković, 2022) that characterises the current global economic environment, an environment where resilience, adaptability, and innovativeness are more important than ever (Ebersberger and Kuckertz, 2021). In addition, our insights highlight both the enabling and hindering factors of organisational resilience, answering recent calls in the literature for a more balanced approach (Hoegl and Hartmann, 2021). Following these findings, we discuss the potential implications for the literature and practitioners in terms of best dealing with disruptive events.

## 2. Background and literature

### 2.1. Firm resilience

Resilience refers to the "ability of systems to absorb and recover from shocks while transforming their structures and means for functioning in the face of long-term stresses, change, and uncertainty" (van der Vegt et al., 2015, p. 972). As stated by Parker and Ameen (2018), disruptions such as external shocks, environmental jolts, extreme events, and crises (Meyer, 1982; Shepherd et al., 2000; Sullivan-Taylor and Branicki, 2011; Vargo and Seville, 2011) affect firms and their activities and performance. Examples include extreme weather events (van der Vegt,

2015), the 2008 financial crisis (Wenzel et al., 2020), and pandemics such as the Spanish flu (Rao and Greve, 2017). In recent decades, the frequency of certain events (e.g., natural disasters) has increased, significantly affecting firm survival and performance.

Prior literature on resilience has focused on examining the nature of disruptions as well as business responses; however, most analyses in this area remain conceptual in nature (van der Vegt et al., 2015; Parker and Ameen, 2018). A crucial distinction in this literature is the understanding of disruptions as an event or a process (Williams et al., 2017). The first views crises as unanticipated events with discernible sources and high impact (Williams et al., 2017, p. 735). The second definition considers crisis as a process with distinct phases triggered by an extended incubation period (Williams et al., 2017, p. 737). This distinction has implications for both the study approaches and research topics. For example, the event-based view assumes that complete preparation for events is impossible; therefore, research focuses on consequences and organisational recovery. However, the process-based view examines the emergence, development, and impact of crises on organisations (Williams et al., 2017). This study adopted an event-based perspective and explored the aftermath of the COVID-19 crisis. Research on corporate resilience concentrates on (1) a firm's resource endowments, (2) preparedness for crises, and (3) responses to disruptions (Williams et al., 2017). The literature emphasises resources such as financial, cognitive, and relational assets as well as strategies for anticipating, preventing, or mitigating disruptions. We contribute to the literature by examining the resources that reinforce resilience and the most effective business model changes in response to crises. A challenge in this literature is the lack of a theoretical framework to study extreme events' consequences (Agarwal et al., 2009). Although we know that disruptions can significantly impact supply chains, sales, productivity, and lost opportunities (Oetzel and Oh, 2021), we lack the knowledge to understand heterogeneous impacts and guide firms in resource allocation and strategic action design. More research is needed to comprehend managerial responses to disruption-generated circumstances using resources and strategic decision-making (Flammer and Ioannou, 2021; Ketchen and Craighead, 2020; Wenzel et al., 2020).

A key distinction is that disruptions are inherently heterogeneous in origin, scope, intentionality, predictability, and impact duration (Rosenthal and Kouzmin, 1993; Mitroff and Alpaslan, 2003; Gundel, 2005; Loayza et al., 2020), making it difficult to develop and prepare universal strategies to tackle these issues (Gundel, 2005). Recent research focuses on financial crises (Flammer and Ioannou, 2021) and natural disasters (Oetzel and Oh, 2021). Pandemics are likely to differ from both; they are supply<sup>2</sup> and demand-driven, have a domestic/regional or global scope, and are characterised by long duration and high uncertainty (Loayza et al., 2020). International financial crises are demand-driven and global in scope but shorter in duration and lower in uncertainty than pandemics (Loayza et al., 2020). Natural hazards are supply-driven, domestic or regional, short in duration, and less uncertain than pandemics (Loayza et al., 2020). These differences are likely to affect the resources necessary for adjustment and the effectiveness of organisational responses in adapting to the new normal.

### 2.2. The role of resources and business model innovation

We argue that organisational resilience is related to flexibility and strength and is critically dependent on a firm's resources and capabilities (Barney, 1991) to cope with disruptions (van der Vegt et al., 2015). Resources and capabilities can be employed in various ways to interact with the firm's environment during a disruption. Consequently, our study of firm resilience in a non-ergodic world depends on two aspects: the firm's ability to be flexible (i.e., by acquiring new resources and capabilities) and its ability to adapt and innovate its business model (i.e., develop an appropriate business model that fits the needs of the new post-crisis environment).

Research suggests that understanding companies' resistance to crises

requires consideration of their resource endowments (van der Vegt et al., 2015; Williams et al., 2017). Firm resources have been shown to be crucial in facing disruptions. However, resource orchestration and reconfiguration (Krammer, 2022b), together with the importance of flexibly and effectively managing resources, are vital in the non-ergodic world (Hitt et al., 2021). In other words, adapting routines to the new normal and managers' abilities to acquire, develop, and bundle new resources are crucial. In this context, we argue that the gender of the manager and the multi-unit structure are the two characteristics of the firm that determine its ability to access and recombine resources.

The performance of female-led companies has long been a topic of interest in the management literature (e.g., Kalleberg and Leicht, 1991). Female-led firms are characterised as less experienced, less educated, and potentially face discrimination in accessing financing (e.g., Fischer et al., 1993). However, empirical evidence does not consistently support a negative effect on the performance of female-led companies, although it does affect their survival (Kalleberg and Leicht, 1991). In a non-ergodic world, the difficulty of accessing the necessary resources conditions the flexibility of female-led firms and, thus, their resilience.

Another important firm attribute that determines access to resources and flexibility is being part of a multiunit firm. Multi-unit firms can achieve greater flexibility than single-unit firms by sharing resources across units, and the value of redeployment flexibility increases with uncertainty (Dickler et al., 2022), a feature that characterises a non-ergodic world. Additionally, multi-unit firms can transfer skills and relevant knowledge between units (Shiferaw, 2009).

Although the resources and capabilities that a firm possesses are important in determining the potential responses that it may offer, it is the actual organisational response that a firm implements in the face of a disruption which critically determines its performance and survival. Despite the ubiquitous importance of innovation, during crises many companies tend to cut back on these endeavours (Hitt et al., 2021). In turn, this jeopardizes their chances of tackling disruption as this requires leveraging dynamic capabilities (Krammer, 2022a), entrepreneurial actions (Ketchen and Craighead, 2020), or international experience (Puhr and Müllner, 2022).

The heterogeneity of responses opens the door to considering a second core element for our framework, namely business model innovation, and analysing whether it improves resilience. Foss and Saebi (2017, p. 216) define business model innovation as "designed, novel, and non-trivial changes to the key elements of a firm's business model and/or the architecture linking these elements." Andreini et al., (2022) review the literature on business model innovation, concluding that early contributions to business model innovation processes emerged in the early 2000 s, with seminal papers by Malhotra (2002) and Chesbrough (2010). From 2011 to 2015, 28 % of the identified articles on business model innovation processes were published, indicating a growing interest in the field. Since 2016, research on business model innovation processes has surged significantly, with 65 % of the papers that they sampled published from that year. Business model innovation processes have become a rapidly expanding area of focus in the literature, as underscored by Laifi and Josserand (2016).

### 3. Hypothesis development

#### 3.1. Female-led firms and organisational resilience

The analysis of the performance of female-led firms and the differences that these present with respect to male-led firms has generated substantial scholarly interest (see, for example, Kalleberg and Leicht, 1991), particularly in linking it to performance, ethical issues, and firm strategies more broadly. Building on these insights, we argue that female-led enterprises are less resilient than male-led enterprises for several reasons.

First, companies led by females tend to do worse results in terms of accessing financial resources than those led by male counterparts

(Chadwick and Raver, 2020; Coleman and Robb, 2012; Coleman, 2000; Muravyev et al., 2009). This is often attributed to the fact that female managers are consistently discriminated against when accessing external credit (Allison et al., 2023; De Andrés et al., 2020), are more risk-averse (Casprini et al., 2023; Palvia et al., 2015), and are also more socially responsible for placing less emphasis on maximising financial gains at all costs (Casprini et al., 2023; Hyun et al., 2021). This is particularly important for our study since financial resources play a crucial role in facing disruptions (Acharya and Steffen, 2020; Gittel et al., 2006), providing a necessary "buffer in the face of crisis" (Branicki et al., 2018, p. 1247).

Second, the research suggests a gender gap in access to and benefits from professional networks, which affects female-led firms' performance and the resilience of the businesses they manage. There are at least two reasons for this finding. According to Ibarra (1992, 1993), Burt (1998), and Lutter (2015), females have structurally weaker positions in networks with less power and status (see also Ody-Brasier and Fernandez-Mateo, 2017). However, females face negative stereotypes when acting as brokers in networks, leading to lower performance (Brands and Mehra, 2019). It is important to note that networks are particularly important when internal resources are unavailable or insufficient to provide an adequate response to a disruption and external resources are required (Battisti and Deakins, 2015). This is expected to lead to lower performance (Gulati, 2007; Lavie, 2006) and, consequently, lower resilience to external shocks (van der Vegt et al., 2015).

Finally, the non-ergodic post-pandemic environment has disproportionately affected females compared to males, and this is likely to affect their managerial performance. This context is characterised by the unpredictability of events, difficulty in relying on past experiences, and the need to adapt quickly to changing circumstances. For example, the COVID-19 crisis has forced a reduction in face-to-face interactions, which has affected the nature of work. Remote work increased during the pandemic (Milliken et al., 2020). Female's greater domestic workload negatively impacts their professional performance, affecting their companies' resilience (Kipnis and Nauraz, 2020). As females are less integrated into professional networks (Brass, 1985) and are often connected through weak ties (Milliken et al., 2020), working online and reducing face-to-face interactions have further increased the difficulty for females to connect to networks. Weak links are more difficult to maintain in the virtual world (Levin and Kurtzberg, 2020; Milliken et al., 2020), resulting in poor access to resources and resilience in female-led businesses.

Summing up these arguments, our first hypothesis states that:

**Hypothesis 1.** *Female-led firms will be less resilient than male-led firms.*

#### 3.2. Multi-unit firms and organisational resilience

We contend that multiunit firms are more resilient for reasons related to their greater availability of resources and capabilities. Multi-unit firms can benefit from a reduced risk exposure or an increase in the project potential by efficiently distributing their resources and capabilities across multiple units (Dickler et al., 2022). This ability to reorganise resources and capabilities provides multiunit firms with opportunities that are not available to single-unit firms, leading us to argue that the former are more resilient.

First, multi-unit companies are expected to have more diversified resources and capabilities, which may allow them to effectively reconfigure resources in response to unexpected environmental changes. Given their greater diversification, multi-unit firms will enjoy higher flexibility to redeploy resources as they have the choice of using either external or internal resource markets, whereas single-unit firms must rely exclusively on the external ones (Dickler et al., 2022). The value of this additional flexibility exhibited by multi-unit firms is accentuated by volatility or periods of uncertainty (Dickler et al., 2022; Sakhartov and Folta, 2015), such as those experienced during the global financial crisis

of 2007–2009 (Kuppuswamy and Villalonga, 2016). For example, the extreme market conditions caused by a crisis make the access to credit and external capital complicated (Kuppuswamy and Villalonga, 2016). This access would be more difficult and costly for single-unit firms (Shiferaw, 2009) as banks with limited funds may choose safer options for multi-business rather than riskier single-unit firms when credit becomes rationed (Kuppuswamy and Villalonga, 2016). Moreover, in a credit-constrained setting, the reallocation of internal capital toward promising projects is more likely, as corporate managers are forced to compete for scarce funding and increase firm unit incentives to choose the most deserving projects (Stein, 1997). Therefore, in the context of a crisis, multiunit firms' access to internal resources becomes more valuable. Accordingly, we contend that in a non-ergodic environment, the benefits of firm flexibility are greater for multi-unit businesses.

Second, multiunit companies can leverage learning and experimentation across different business units or locations in which they operate. Knowledge of different environments can be transmitted from one unit to another unit of the group, making the cost and time of learning for such multi-unit companies much lower than that for single-unit firms (Shiferaw, 2009). Sharing the experience and knowledge of non-ergodic environments among business units, along with better information processing, will improve their ability to respond quickly to unpredictable changes (Disney et al., 2003). Thus, when coping with periods of crisis, this diversified approach to learning can provide fast and valuable information that single-unit companies are not able to access.

Given the above, our second hypothesis states that:

**Hypothesis 2.** *Multi-unit firms will be more resilient than single-unit firms.*

### 3.3. Business model innovation and organisational resilience

Non-ergodic systems introduce unpredictable changes that are likely to affect the value of current resources and strategies, and innovation in business models is particularly important (Galkina et al., 2023). In the case of the COVID-19 disruption, the reduction in face-to-face interactions and the restrictions imposed by governments have introduced a change in the environmental conditions of firms, especially in non-essential activities (Breier et al., 2021), as these have also been affected by the restrictions and confinement of workers to their homes (Li-Ying and Nell, 2020).

Under these circumstances, resilience depends on a firm's ability to define strategies and develop capabilities to navigate new opportunities for innovation (Li-Ying and Nell, 2020, p. 2). Novelty is, in fact, one of the salient elements of this crisis. Social distancing has increased the acceptance of digital communication along the supply chain and increased in remote work (Bai et al., 2021). Established firms have also used business model innovation to generate new income and improve survival (Breier et al., 2021), which has been confirmed by recent studies that have analysed the consequences of extreme disruptions on firms (Flammer and Ioannou, 2021; Spescha and Woerter, 2019). Subsequently, innovative business models are the cornerstone of resilient and complex organizations (Liu et al., 2021), often providing them with opportunities to “bounce beyond” (not just recover) by taking advantage of new opportunities in different markets (Eriksson et al., 2022).

Research on extreme natural events may also provide clues as to what to expect from innovation in the face of disruption. For example, research on the series of major earthquakes in New Zealand suggests the importance of dynamic capabilities and a proactive stance when it comes to recognising new opportunities in the face of a natural catastrophe (Battisti and Deakins, 2015). Relatedly, an analysis of 37 natural disasters occurring in the U.S. territory between 1989 and 2013 shows that those companies with greater technological diversity suffered less impact from natural disasters than those with lower technological diversity (Hsu et al., 2018).

Roper and Turner (2020, p. 504) argue that innovation is a critical element of recovery post-COVID-19. However, not all firms choose

innovation as an organisational response. For example, approximately 21 % of firms introduced product innovations in response to the COVID-19 crisis (Apedo-Amah et al., 2020). Previous research shows that firms tend to reduce innovation investments during crises (Roper and Turner, 2020), which is expected to increase firm heterogeneity, with firms innovating to increase their competitiveness. Therefore, we hypothesised the following:

**Hypothesis 3.** *Firms implementing business model innovations will be more resilient than firms that adopt a passive stance.*

## 4. Methods

### 4.1. Data and sample

We build our dataset following prior studies in this vein (Lederman, 2010; Krammer, 2019; Nuruzzaman et al., 2020; Krammer, 2022b) and combining information from two main sources to capture firm capabilities pre-COVID-19 and their resilience after COVID-19 became a pandemic. The first was the standard Enterprise Survey (ES) conducted by the World Bank (World Bank's Enterprise Survey, or WBES). This database collects information from a representative sample of the private sector. In particular, WBES topics include firm characteristics (such as age, size, gender participation, exports, or sales) as well as a broad range of aspects related to the business environment (e.g., infrastructure, competition, business-government relations). To collect data, the World Bank uses stratified random sampling in which three strata are identified: firm, industry, and geographic region. An advantage of the questionnaires used by the World Bank is that they are standardised to facilitate comparisons across countries and over time. One drawback of this database is that surveys are usually conducted irregularly over time; therefore, classical panel data (i.e., yearly frequency) are not usually available. Furthermore, large, unsubstantiated differences exist between the number of firms covered in a cross-section and the panel dimension for a given country, raising significant doubts about the representativeness and bias of the panels (Krammer, 2019). In our case, the information available from the WBES refers to the period prior to the beginning of the COVID-19 pandemic, so it serves to characterise firms at a point in time before the pandemic. This ensured the exogeneity of some variables used in the analysis.

The second source of data used in this study was the COVID-19 Impact ES Follow-up Survey developed by the World Bank (COVID-19 Survey). This is a complementary survey implemented by the World Bank Group with the aim of understanding the impact of COVID-19 on firms. The first wave of this survey was conducted in 2020 for all the countries in our sample. We matched backward firms using their unique code (idstd) to the most recent ES conducted in each country and used the latter to capture firm-specific resources and characteristics. The exact timings of the surveys are listed in Table A1 included in an Online Supplementary Appendix (OSA).

Our final sample consists of 11,148 firms from 34 countries<sup>3</sup> in Europe, Africa, America, and Asia. Table A2 (OSA) presents the sample distribution across the countries included in the dataset. It is important to note that the countries considered in our study show significant differences in the impact of the pandemic and the specific government policies implemented to deal with it. In particular, our dataset includes firms that operate in countries where national authorities have taken no measures in relation to the closure of workplaces (e.g. Niger), as well as firms whose business activity has been directly limited, given that a mandatory shutdown has been declared since February 2020 (e.g. Italy). Similarly, our sample comprises organisations that have remained open since the COVID-19 outbreak and organisations that have (voluntarily or mandatorily) closed temporarily for some weeks due to the COVID-19 crisis. This empirical setting allowed us to have control groups within our sample (Flammer and Ioannou, 2021) to overcome potential endogeneity issues.

## 4.2. Variables description

### 4.2.1. Dependent variable

Our study aims to offer a deeper knowledge of firm resilience by evaluating firms' abilities to cope with disruptions. We intended to assess how the endowment of resources and responses offered by firms affects their resilience when a disruption occurs (i.e., the COVID-19 outbreak). We defined the variable *sales variation* as the dependent variable, which measures the percentage change in firms' sales in the last completed month (t) compared with the same month in 2019 (t-1). Using this variable, we proxy for the degree to which a firm has been affected by the COVID-19 crisis (OECD, 2020).

### 4.2.2. Independent variables

**Female-led firms.** We propose that female-led firms are expected to be less resilient than male-led firms because of their access to external resources, as well as some other aspects which have been accentuated during the COVID-19 crisis and affected them to a greater extent (for example, school closures). To test this first hypothesis, we considered managers' gender. Specifically, we define the variable *female manager* as a dummy variable that equals 1 when a firm has a female top manager and 0 otherwise (Krammer, 2022a). According to our proposition, we expect *female managers* to negatively impact firm resilience.

**Multi-unit businesses.** We contend that multi-unit businesses are more resilient than single-unit businesses because they have greater access to additional resources and capabilities. In addition, multi-unit businesses are better equipped to adapt to disruptions such as pandemics because they may have the resources and capabilities to shift production or distribution across business units or tap into different markets or supply chains. To test our second hypothesis, we define the dummy variable *multi-unit business*, which takes the value of 1 if the firm responds to be a multi-establishment firm or to be a part of a larger firm<sup>4</sup>; 0 otherwise.

**Business model innovation.** When measuring changes in the business model, we focus on specific organisational actions realised by firms in response to the pandemic (Li-Ying and Neil, 2020). Our study considers three types of changes that serve as proxies for business model innovation as a response to the COVID-19 crisis.

The first considers the combined use of different channels in a firm's supply chain. We consider online business activity generated as a response to the disruption created by the pandemic and the need to reduce face-to-face contact. In this case, the dummy variable *omni-channel* equals 1 if the firm confirms to have "started or increased business activity online" as a response to the COVID-19 pandemic and 0 otherwise. The second business model change is called "last-mile delivery", i.e., the "transportation and fulfilment of online orders to the consumer" (Esper et al., 2003). Therefore, the dummy variable *last-mile delivery* equals 1 if the firm "started or increased delivery or carry-out of goods or services" as a response to the COVID-19 pandemic and 0 otherwise. The third change is related to workplace organisation and implies the implementation of teleworking as a response to the COVID-19 outbreak. Teleworking is an action of strategic renewal in the context of working methods aimed at improving organisational productivity and performance (Gawke et al., 2019). Operationally, firms are questioned if they have "started or increased remote work arrangements for their workforce" in response to the COVID-19 outbreak. Therefore, our variable *telework* takes a value of 1 if the firm responds affirmatively and 0 otherwise. Therefore, we use these three business changes (*omni-channel*, *last-mile delivery* and *telework*) in a separate way to proxy business model innovation in our main model. In the robustness test section, additional analyses were performed by defining different business model innovation measures based on the three variables.

### 4.2.3. Controls

For firm-level controls, we mainly use information gathered from the Enterprise Survey during the pre-crisis period to define several variables

that capture firm characteristics prior to the COVID-19 outbreak. Therefore, these exogenous firm-level variables reduce potential endogeneity concerns. Younger firms would face greater challenges in adapting when a disruption occurs, as they may experience greater difficulties due to their lack of a solid structure and efficient routines (Haase and Eberl, 2019). Accordingly, we consider firm *age* a continuous variable, defined as the year of the survey minus the year in which the firm began operations. We also considered firm size by including the variable *full-time workers*, which measures the number of permanent full-time individuals working in the firm at the end of the last fiscal year. Smaller firms are less likely to adapt to a disruption, given their resource constraints, to articulate an effective response (Sullivan-Taylor and Branicki, 2011).

Our study also incorporates the variable *manager experience*, which counts the number of years of experience in the top managerial sector. Greater market knowledge may help managers implement efficient responses to reduce the detrimental effects of disruptions (Sayegh et al., 2004). To control for the effect of workers' education on organisational resilience (van der Vegt et al., 2015), we used a dummy variable, *skilled employees*, which equals 1 if the firm provided formal training programs for permanent, full-time employees and 0 otherwise (Tajeddin and Carney, 2019).

We also identified firms under state control. The main reason for this is that state-owned firms' objectives tend to differ from those of privately owned firms (i.e., socio-political vs. economic goals) (Boardman and Vining, 1989) and often affect their performance. We contend that this divergence of interest may be even more important when assessing firms' responses and resilience during a global crisis. Accordingly, we define the variable *state ownership*, which controls for the percentage of ownership in the hands of the government. Similarly, we control whether the firm is owned by foreign owners, as this could improve access to strategic resources beyond mere financial contributions (Choi et al., 2011). Therefore, we include *foreign ownership* to control for the percentage of firms owned by private foreign owners.

Furthermore, we incorporate the variable *export intensity* given its positive impact on sales growth (Filatotchev and Piesse, 2009). *Export intensity* is the percentage of a firm's sales exported in the previous fiscal year. Moreover, prior studies confirm higher performance growth rates when firms increase their exposure to online buyers through their web rather than having a web presence via portals or no presence at all (Scaglione et al., 2009). Accordingly, our study incorporated the variable *own website*. This dummy variable identifies firms confirmed to have their websites when responding to ES. To control for firms' financial situations prior to the crisis, we include the variable *internal funds*. *Internal funds* represent the proportion of a firm's working capital; that is, the funds available for day-to-day operations financed from internal funds or retained earnings in the previous year. Additionally, we control for the degree to which access to financing is viewed as an obstacle to a firm's operations. In this regard, the *obstacles to getting finance* are measured on a Likert scale ranging from 0 to 4. While a value of 0 indicates that access to financing is not an obstacle, *obstacles to getting finance* take a value of 4 when the firm considers it a very severe obstacle.

Lastly, we use information from the COVID-19 survey to define three additional control variables: *production adaptability*, which takes a value of 1 if the firm "adjusted or converted, partially or fully, its production or the services it offers" as a response to the COVID-19 pandemic, and 0 otherwise; *weeks temporarily closed* that counts the number of weeks each firm has been temporarily closed for a pandemic-related reason; and *government support* identifies those firms that have received any national or local government support in response to the crisis.

We include other firms, industries, countries, and time variables in all the estimations. Given that the data collection period of the COVID-19 survey varied among firms (see Table 1), we also included *month-fixed effects* for any time-specific influence in our estimations.

**Table 1**  
Descriptive statistics.

	Obs.	Mean	Std. Dev.	Min	Max	Source
Sales variation	11,148	-30.214	33.895	-100	300	Covid-19 Survey
Female manager	11,148	0.187	0.390	0	1	Enterprise Survey
Multi-unit business	11,148	0.158	0.365	0	1	Enterprise Survey
Telework	11,148	0.310	0.462	0	1	Covid-19 Survey
Omni-channel	11,148	0.238	0.426	0	1	Covid-19 Survey
Last mile delivery	11,148	0.225	0.418	0	1	Covid-19 Survey
Age	11,148	22.632	16.261	2	203	Enterprise Survey
Full-time workers	11,148	79.565	403.106	1	30,000	Enterprise Survey
Manager experience	11,148	20.900	11.695	1	70	Enterprise Survey
Skilled employees	11,148	0.354	0.478	0	1	Enterprise Survey
State ownership	11,148	1.026	9.149	0	99	Enterprise Survey
Foreign ownership	11,148	8.201	25.710	0	100	Enterprise Survey
Export intensity	11,148	15.506	29.515	0	100	Enterprise Survey
Own website	11,148	0.645	0.479	0	1	Enterprise Survey
Internal funds	11,148	74.831	30.950	0	100	Enterprise Survey
Obstacles to getting finance	11,148	1.210	1.251	0	4	Enterprise Survey
Production adaptability	11,148	0.357	0.479	0	1	Covid-19 Survey
Weeks temporarily closed	11,148	3.043	4.698	0	45	Covid-19 Survey
Government support	11,148	0.286	0.452	0	1	Covid-19 Survey

4.3. Descriptive statistics

Tables 1 and 2 present the descriptive statistics and correlations of the considered variables, respectively. Table 1 shows that, on average, firm sales decreased by 30.21 percent if compared with the same month in 2019. The description of the independent variables shows that, on average, the proportion of firms with female top managers is 18.66 %, whereas multi-unit businesses represent 15.78 percent. Regarding the changes in the business model in response to the crisis created by COVID-19, we can observe that, on average, 30.97 percent of firms implemented telework arrangements for their workforce, followed by those that introduced omnichannel (23.78 %) or last-mile delivery (22.51 %).

When the correlation matrix presented in Table 2 is analysed, we observe that all variables capturing changes in the business model are positively correlated with variations in firm sales. Female managers and multi-unit businesses also showed the expected relationship with the dependent variable. Overall, Table 2 shows that the variables considered presented a moderate correlation. To evaluate potential multicollinearity, variance inflation factors (VIFs) were computed for all variables. All VIFs were below the recommended threshold of 10 (Hair et al., 1995), with a mean VIF value of 1.12. This finding provides evidence of no multicollinearity concerns in our model specifications.

5. Results

Table 3 presents the results of the OLS linear regression with industry- and country-fixed effects. It is important to clarify that, given our dependent variable, a coefficient with a positive value implies an increase in the company’s sales and that, on the contrary, a negative value means that sales have decreased in 2020 compared to the same month in 2019.

The first column presents the baseline model results. Column 2 incorporates the variable female manager to analyse the effect of female-led firms on resilience when a disruption occurs (Hypothesis 1). Column 3 incorporates the multi-unit business dummy variable to test hypothesis 2. Columns 4–6 include the effects of each business model change (telework, omni-channel and last-mile delivery, respectively). Finally, Column 7 presents the full model specification considering all innovative responses implemented by firms to face the crisis (Hypothesis 3). As can be observed at the bottom of Table 3, the F-statistic values show that all the models are statistically significant.

Overall, the results presented in Table 3 remain quite stable and provide important insights into the role of firms’ resource endowments and changes in business models when facing the crisis generated by

COVID-19.

According to Hypothesis 1, we expect firms managed by females to be less resilient during pandemics than those managed by males. Accordingly, their performance should be better than that of male-led firms. As can be observed in Table 3 (Column 7), the coefficient of the variable female manager is negative and statistically significant ( $\beta = -1.139$ ;  $p < 0.10$ ), which means that the sales of firms managed by females decreased more than those run by males. This finding supports Hypothesis 1.

Regarding Hypothesis 2, the results in Column 7 show that the coefficient of the multi-unit business variable is positive and significant ( $\beta = 1.904$ ;  $p < 0.05$ ). This means that multi-unit businesses are more resilient than single-unit businesses and therefore supports Hypothesis 2.

Finally, Hypothesis 3 states that firms which adapted their business models will be more resilient than those that have not. Overall, results in Table 3 show that two of the business model changes considered, telework ( $\beta = 2.193$ ;  $p < 0.01$ ) and last-mile delivery ( $\beta = 4.564$ ;  $p < 0.01$ ), have a positive and significant effect on the sales of the companies considered. Though the positive coefficient of the omni-channel seems to be in line with our expectations, its effect is non-significant ( $\beta = 0.872$ ;  $p > 0.10$ ), at least when the full model specification is considered. These results partially support Hypothesis 3.

In addition to studying our main variables, we can draw important insights from the control variables included in our estimations. A few coefficients at the firm level are statistically significant and remain stable in all models. For instance, the empirical evidence confirms that the sales of larger firms have suffered less ( $\beta = 0.00164$ ;  $p < 0.05$ ) than the ones of smaller organisations, a finding which is in line with prior literature (Sullivan-Taylor and Branicki, 2011). Also, in those firms that provide formal training programs for their permanent, full-time employees cope better with the crisis generated by COVID-19 ( $\beta = 1.594$ ;  $p < 0.01$ ). In the case of firm ownership, both state ownership ( $\beta = 0.122$ ;  $p < 0.01$ ) and foreign ownership ( $\beta = 0.0280$ ;  $p < 0.05$ ) have positive and significant coefficients, which could be indicative of their relevance in accessing strategic resources to navigate pandemics. Similarly, the results confirm the importance of financial resources to cope with disruption, as the variable obstacles to getting finance have a negative impact on sales variation ( $\beta = -0.805$ ;  $p < 0.01$ ). In this regard, firms facing greater obstacles to accessing finance show a worse ability to recover from shocks than firms that perceive financial resource access as a minor obstacle. In the case of government support, the variable shows a negative and statistically significant coefficient ( $\beta = -3.183$ ;  $p < 0.01$ ), which is in line with our expectations. Companies that receive government support show worse performance and a lower ability to navigate crises. Finally, it is important to note the harmful effects of the

**Table 2**  
Correlation matrix (1,148 obs.).

Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	
[1] Sales variation	1,00																			
[2] Female manager	-0,00	1,00																		
[3] Multi-unit business	0,01	-0,02	1,00																	
[4] Telework	0,06	-0,03	0,07	1,00																
[5] Omni-channel	0,01	0,02	0,04	0,29	1,00															
[6] Last mile delivery	0,03	0,04	0,04	0,19	0,45	1,00														
[7] Age	0,03	-0,06	0,12	0,07	-0,03	-0,04	1,00													
[8] Full-time workers	0,04	-0,03	0,09	0,09	0,02	0,01	0,09	1,00												
[9] Manager experience	0,05	-0,09	0,03	0,01	-0,08	-0,06	0,38	0,03	1,00											
[10] Skilled employees	0,04	-0,02	0,11	0,12	0,03	0,02	0,10	0,07	0,07	1,00										
[11] State ownership	0,07	0,02	0,04	-0,01	-0,01	-0,02	0,14	0,07	-0,04	-0,01	1,00									
[12] Foreign ownership	0,03	-0,02	0,15	0,13	0,00	-0,02	-0,01	0,09	-0,06	0,13	-0,03	1,00								
[13] Export intensity	0,05	-0,04	0,03	0,09	-0,05	-0,11	0,08	0,11	0,08	0,12	0,00	0,29	1,00							
[14] Own website	0,12	-0,05	0,10	0,15	0,08	0,00	0,13	0,07	0,11	0,15	0,03	0,07	0,13	1,00						
[15] Internal funds	0,01	0,05	-0,01	-0,07	-0,03	-0,02	-0,05	-0,01	-0,02	-0,08	0,02	0,03	-0,02	-0,05	1,00					
[16] Obstacles to getting finance	-0,14	-0,01	0,01	-0,01	0,01	0,03	-0,01	-0,02	-0,06	-0,02	-0,02	-0,05	-0,07	-0,07	-0,18	1,00				
[17] Production adaptability	-0,02	0,02	0,05	0,10	0,18	0,21	-0,05	0,02	-0,07	0,03	-0,02	0,01	0,00	0,01	0,03	0,05	1,00			
[18] Weeks temporarily closed	-0,50	0,02	-0,01	-0,02	0,03	0,01	-0,06	-0,03	-0,08	-0,02	-0,05	-0,02	-0,07	-0,11	-0,02	0,11	0,00	1,00		
[19] Government support	0,02	0,00	-0,02	0,03	-0,03	-0,04	0,03	-0,01	0,08	0,03	-0,05	0,00	0,09	0,11	-0,00	-0,05	0,04	0,03	1,00	

temporary closure of business activities on firm performance during this crisis. As expected, the variable *weeks temporarily closed* reveals that the number of weeks the firm has been (required or voluntary) closed has a detrimental impact on sales variation ( $\beta = -2.555$ ;  $p < 0.01$ ).

5.1. Robustness tests

To ensure that the results from prior evidence were robust, we performed several additional analyses. First, a potential concern is that there might be a sample selection bias. As indicated in the description of the data set, our sample includes firms that have remained open since the outbreak of the COVID-19 crisis or have closed temporarily for some weeks due to the COVID-19 crisis. However, our sample does not include firms that reported being permanently closed when responding to the COVID-19 survey; therefore, we do not have responses related to their behaviour after the onset of the COVID-19 crisis. Accordingly, one assumption is that companies that have closed permanently could be those characterised by a worse initial position (i.e., a worse resource endowment) to face the crisis. To address this concern, we conducted the first analysis that allows us to evaluate whether firm-level factors determine the likelihood of going out of business after the COVID-19 outbreak. To this end, we define a dummy variable *permanently closed*, which equals 1 if the firm confirms to be permanently closed at the time of responding to the COVID-19 questionnaire and 0 if the firm is open or temporarily closed. The results of the logistic regression analysis are presented in Table A3 (OSA).

Overall, an important finding extracted from Table A3 is that business closures are exogenous and do not depend on a firm's capacity to access resources. As can be observed, neither the variable *female manager* ( $\beta = 0.0649$ ;  $p > 0.10$ ) nor the fact of being a *multi-unit business* ( $\beta = -0.274$ ;  $p > 0.10$ ) has a significant effect on firm survival. However, the fact of having your strategic resources seem to be more relevant as revealed by some variables related to, for instance, the number of years of *managerial experience* ( $\beta = -0.00922$ ;  $p < 0.10$ ) or the formal training of the firm permanent workers ( $\beta = -0.436$ ;  $p < 0.01$ ). Furthermore, the liability of newness is shown to be a significant determinant of why organisations fail ( $\beta = -0.00899$ ;  $p < 0.05$ ). Although an organisation's age does not exert a significant effect on its performance (Table 3), it is an important predictor of survival (Kalleberg and Leich, 1991). The liability of smallness has also been shown to be detrimental to business survival ( $\beta = -0.00141$ ;  $p < 0.05$ ).

Second, another potential concern is that our variables of interest related to access to resources (i.e., *female manager* and *multi-unit business*) might also have an impact on pre-pandemic revenue fluctuations. To test this, we used two questions included in the ES questionnaire that allowed us to calculate the percentage change in companies' sales before the pandemic. In particular, the ES reports the final complete fiscal year firms' total sales and the firm's total sales three fiscal years ago. Based on these two questions, we generated the variable *pre-pandemic sales variation* that measures the percent change in establishment sales and used it as the dependent variable in the estimations shown in Table A4 (OSA). The results in Column 2 confirm that neither the *female manager* ( $\beta = -0.00431$ ;  $p > 0.10$ ) nor the *multi-unit business* ( $\beta = -0.0237$ ;  $p > 0.10$ ) variables had an impact on firms' sales variation before the COVID-19 outbreak. Accordingly, the results of this second analysis reinforce the idea of the key role played by the firm traits considered in our study on firms' resilience in the context of a pandemic.

Finally, we define new measures for the variables used to test our hypotheses as an additional robustness analysis. On the one hand, for female-led firms, we created the variable *female ownership* that measures the percentage of the firm ownership that females hold. According to our proposition, we would expect higher values of female ownership to negatively affect firm resilience. On the other hand, we capture whether the organization modifies its business model to cope with the pandemic through two new variables: *business model innovation* and *intensity of the business model innovation*. The former is a dummy variable that takes the

**Table 3**  
Regression with industry and country fixed effects for sales variation.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female manager		-1.213* (-1.76)	-1.189* (-1.73)	-1.138* (-1.65)	-1.206* (-1.75)	-1.192* (-1.73)	-1.139* (-1.66)
Multi-unit business			2.127*** (2.79)	2.003*** (2.63)	2.002*** (2.62)	1.975*** (2.60)	1.904** (2.50)
Telework				3.037*** (5.06)			2.193*** (3.56)
Omni-channel					3.093*** (4.76)		0.872 (1.22)
Last mile delivery						5.230*** (7.93)	4.564*** (6.36)
Age	-0.00169 (-0.09)	-0.00166 (-0.09)	-0.00414 (-0.22)	-0.00975 (-0.53)	-0.00474 (-0.26)	-0.00636 (-0.34)	-0.0103 (-0.56)
Full-time workers	0.00196*** (3.04)	0.00194*** (3.01)	0.00181*** (2.80)	0.00162** (2.50)	0.00180*** (2.79)	0.00178*** (2.75)	0.00164** (2.53)
Manager experience	-0.0380 (-1.49)	-0.0413 (-1.62)	-0.0392 (-1.54)	-0.0358 (-1.40)	-0.0365 (-1.43)	-0.0374 (-1.47)	-0.0355 (-1.39)
Skilled employees	1.984*** (3.44)	1.976*** (3.43)	1.878*** (3.25)	1.660*** (2.87)	1.802*** (3.12)	1.786*** (3.10)	1.594*** (2.76)
State ownership	0.121*** (3.90)	0.121*** (3.90)	0.118*** (3.80)	0.122*** (3.92)	0.120*** (3.87)	0.120*** (3.86)	0.122*** (3.94)
Foreign ownership	0.0357*** (3.30)	0.0357*** (3.30)	0.0322*** (2.96)	0.0276** (2.53)	0.0317*** (2.90)	0.0319*** (2.93)	0.0280** (2.56)
Export intensity	-0.0102 (-0.96)	-0.0106 (-1.00)	-0.0106 (-1.01)	-0.0118 (-1.11)	-0.0103 (-0.97)	-0.00658 (-0.62)	-0.00778 (-0.74)
Own website	1.024* (1.73)	1.002* (1.69)	0.861 (1.45)	0.687 (1.15)	0.663 (1.11)	0.692 (1.16)	0.572 (0.96)
Internal funds	-0.00926 (-1.05)	-0.00903 (-1.02)	-0.00944 (-1.07)	-0.00809 (-0.92)	-0.00882 (-1.00)	-0.00834 (-0.95)	-0.00747 (-0.85)
Obstacles to getting finance	-0.850*** (-3.82)	-0.845*** (-3.80)	-0.835*** (-3.76)	-0.830*** (-3.73)	-0.827*** (-3.71)	-0.812*** (-3.66)	-0.805*** (-3.62)
Production adaptability	-0.437 (-0.76)	-0.429 (-0.74)	-0.476 (-0.82)	-0.841 (-1.44)	-0.933 (-1.59)	-1.252** (-2.14)	-1.555*** (-2.63)
Weeks temporarily closed	-2.574*** (-39.88)	-2.570*** (-39.81)	-2.563*** (-39.67)	-2.563*** (-39.63)	-2.559*** (-39.51)	-2.558*** (-39.62)	-2.555*** (-39.51)
Government support	-3.027*** (-4.60)	-3.033*** (-4.61)	-3.060*** (-4.65)	-3.165*** (-4.81)	-3.138*** (-4.76)	-3.087*** (-4.70)	-3.183*** (-4.84)
Industry fixed effects	Yes						
Country fixed effects	Yes						
Month fixed effects	Yes						
Constant	-45.16*** (-9.92)	-44.63*** (-9.79)	-45.03*** (-9.88)	-45.91*** (-10.07)	-45.73*** (-10.02)	-46.94*** (-10.28)	-47.59*** (-10.41)
N	11,218	11,213	11,204	11,177	11,174	11,175	11,148
F-statistic	30.03***	29.92***	29.75***	29.70***	29.64***	29.93***	29.73***

Notes: t statistics in parentheses, \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.

value of one when the firm declares implementing any of the three changes considered. This broader measure captures firms' business model innovation without differentiating between the specific types of innovative responses implemented. The variable *intensity of the business model innovation* counts the number of changes each firm implemented in response to the COVID-19 outbreak. Accordingly, the *intensity of the business model innovation* variable ranges from 0 to 3.

Table A5 presents the results of linear regression with the new independent variables. While Columns 1 and 2 incorporate the effect of *Female ownership*, Columns 3 and 4 introduce new variables capturing the innovative behaviour of firms facing crises (*business model innovation* and *intensity of the business model innovation*, respectively). As can be observed in Column 1, the variable *Female ownership* presents the expected coefficient as it is negative and significantly different from zero ( $\beta = -0.0199$ ;  $p < 0.05$ ), confirming our hypothesis 1. This result remains the same when including in the model specification the variable *female manager*, as can be seen in Column 2 ( $\beta = -0.0177$ ;  $p < 0.10$ ). Nonetheless, in this latter model, our main variable, the *female manager*, becomes non-significant ( $\beta = -0.345$ ;  $p > 0.10$ ). Regarding the impact of business model innovation on firm resilience, the results in Table A5 aligned with our expectations. Column 3 confirms that those firms that have implemented a change in their business model to face the crisis generated by COVID-19 have had a better performance than firms adopting a passive stance ( $\beta = 4.433$ ;  $p < 0.01$ ). Similarly, Column 4

reveals that the greater the firm's innovative effort, the higher the firm's sales increase ( $\beta = 2.501$ ;  $p < 0.01$ ). These results support our 3rd hypothesis.

## 6. Conclusions and discussion

Since its outbreak in January 2020, COVID-19 has affected millions of people worldwide. The direct effects on citizens' health are dramatic, with the number of deaths surpassing four million in July 2021 (World Health Organization, 2021). The economic consequences of the pandemic have become major concerns for governments, firms, and households worldwide. In this context, a deeper knowledge of how businesses face external shocks, such as the COVID-19 crisis, is a topic of interest to both academics and practitioners. Our study addressed these concerns by evaluating how the endowment of firm resources and innovation in a business model can help firms maintain their resilience in a non-ergodic world. The empirical results offered interesting insights that can be summarised into three main conclusions.

First, manager gender is a significant determinant of firm resilience when a disruption occurs. Our findings show that in crisis scenarios, firms managed by females are less resilient than those managed by males in a crisis scenario. Second, multi-unit firms are more resilient than their single-unit counterparts. Finally, innovation in the business model was shown to increase resilience compared to the adoption of a passive

stance. The implementation of certain organisational responses related to business process innovation (*telework and last-mile delivery*) has had a positive and significant effect on firms' resilience.

Our findings also reveal the importance of other firm-level factors (which we do not theoretically address in this study due to inherent constraints) in mitigating the consequences of the crisis. As discussed above, other factors that account for resource availability are especially relevant in handling complex situations when a disaster occurs. For instance, the resource constraints of smaller firms to articulate an effective response have been revealed as an obstacle and have been shown to condition firm resilience (Sullivan-Taylor and Branicki, 2011). Similarly, obstacles to accessing financial resources seem to be relevant when facing disruptions such as the COVID-19 outbreak. This result is in line with prior studies that stand up for the importance of being able to access new external resources to effectively respond to and recover from a disaster (Battisti and Deakins, 2015).

Our findings have important academic, managerial, and policy implications. From an academic perspective, our study contributes to the management literature by providing a deeper understanding of why certain types of organisations can better withstand external shocks than others (van der Vegt et al., 2015). We develop a theoretical framework that explains firm resilience as a function of key firm resources (manager gender and multi-unit structure) and strategic responses through business model innovation. In doing so, we address recent calls in the literature that emphasise the importance of assessing the role of firm-specific capabilities (Behl et al., 2022; Krammer, 2022a) and post-crisis business model adjustments (Galkina et al., 2023) in overcoming difficult times.

Moreover, we provide robust empirical evidence in a generalisable context for several thousand firms across multiple countries and sectors. In particular, the study shows that firm behaviour is not homogeneous and that heterogeneity in firm responses and differences in resource availability influence firm resilience. Novel insights into the benefits of a diversified (multi-unit) structure and strong business model innovation capabilities are imperative for dealing with the challenges of a pandemic. These findings also respond to scholars' calls for a better understanding of business responses to various types of disasters (Oh and Oetzel, 2011). Our findings also warn of the potential pitfalls that female managers suffer when faced with major shocks (Knight and Cavusgil, 2022), thus advancing the literature on leadership and organisational behaviour that focuses on the penalties and pitfalls suffered by females in the aftermath of crises (Ryan et al., 2016; Mukherjee & Krammer, 2022).

Finally, these findings complement recent studies on the value of flexibility in times of uncertainty (Dickler et al., 2022) and contribute to the advancement of the recent literature on the 'new normal' (Krammer, 2022a) or 'wicked world' (Rašković, 2022) that characterises the global economic environment that all firms need to understand and adapt to. In addition, we illustrate both sides of the coin in terms of resilience (i.e., enabling factors and some hindering issues that can reduce organisational resilience) in response to recent calls in the literature for a more balanced approach (Hoegl and Hartmann, 2021).

While these insights provide significant advancements in our knowledge of how organisations cope and develop resilience, they are still subject to some limitations and caution in terms of interpretation. For instance, our working assumption is that once the COVID-19 vaccines have been deployed and the reopening of economies has occurred worldwide (except China, maybe), we will be able to capture resilience by examining post-COVID-19 reactions in the 2020–2021 period. Some may not agree with this assessment and can argue that COVID-19 is still ongoing, but just at lower levels or more "under the radar" than before.

In addition, there are some data-related limitations which are unfortunately beyond the scope of our study, as the data were collected and administered by the World Bank rather than the authors of this study. Specifically, we employed cross-sectional data collected between May and December 2020. This implies that our study comprises information

gathered during the initial stages of the pandemic in most of the countries considered. Future availability of panel data or more recent surveys might allow researchers to replicate our estimations in more advanced stages of the pandemic and examine the long-term effects of the COVID-19 crisis on businesses and the effectiveness of an innovative business model. Furthermore, it is also necessary to recognise that our dependent variable has certain limitations and that we would be interested in having information on the creation of value or measures closer to the profitability of the company.

Lastly, in terms of caveats, the nature of the Enterprise Surveys (ES) design (e.g., many binary questions, lack of dimensionality for panel data, and irregular coverage of countries over time) has been discussed in prior studies in this vein (Krammer, 2019). These limitations also bound us, and we would like to see more in terms of the coverage and types of questions and variables developed by the World Bank to improve our understanding of firm strategies and resilience in the rich setting provided by ES coverage.

Our results have important practical implications for managers. The main reason for this is that the selected strategy is important when natural disasters occur. Firms engaging in the strategic renewal of their business models in response to the COVID-19 crisis have suffered less than those adopting passive stances. Accordingly, managers should be more willing to implement an innovative business model to handle a crisis, such as the one generated by COVID-19, given that it mitigates the negative impacts on firm performance and survival. This would lead us to agree with authors who have proposed innovation as a fundamental way out of the crisis (Flammer & Ioannou, 2021; Krammer, 2022a; Roper & Turner, 2020; Spescha & Woerter, 2019) and even those who face this situation as an opportunity for companies (Watkins and Yaziji, 2020). Although this may not be surprising, the ability of a company to access external resources has also been highlighted as a determining aspect in facing a crisis of this type (Ciravegna et al., 2023).

Regarding policy ramifications, obtaining a deeper understanding of business resilience to disruptions is crucial if we consider that the number of high-risk events worldwide has steadily increased in recent decades (van der Vegt et al., 2015). The formulation of adequate public policies requires accumulating knowledge of the characteristics of the companies most affected by the pandemic and the attributes of resilient firms. In this sense, our results suggest that small and medium-sized companies were more affected by the crisis, while the increase in business digitisation seems to have mitigated its consequences. Similarly, the results also show the convenience of creating programs to reduce female-led barriers to financing and, more generally, to increase access to external resources of female-led firms. For example, this could be achieved by reducing the digital gap between females and males<sup>5</sup>, which would improve access to external financing through digitisation.

#### Endnotes

1. For example, the number of reported natural disasters has increased from 77 in 1970 to 361 in 2019 (EMDAT, 2020).
2. In the case of the COVID-19 pandemic, depressed demand is the most frequent concern (Balleer et al., 2020).
3. The final sample consists of the following countries: Albania, Belarus, Bulgaria, Chad, Croatia, Cyprus, Czech Republic, El Salvador, Estonia, Georgia, Greece, Guatemala, Guinea, Honduras, Hungary, Italy, Jordan, Latvia, Lithuania, Moldova, Mongolia, Morocco, Mozambique, Nicaragua, Niger, North Macedonia, Poland, Portugal, Romania, Russian Federation, Slovenia, Togo, Zambia, and Zimbabwe.
4. Note that a larger firm is understood as a firm that includes several distinct locations or establishments, including branch offices or production, distribution, or sales sites.
5. According to Rowntree (2019), females are 10 % less likely to own than males to own a mobile. The report also shows that 313 million fewer women than men use mobile internet.

## CRedit authorship contribution statement

**Jaime Gómez:** Writing – original draft, Conceptualization. **Sorin M. S. Krammer:** Writing – review & editing, Conceptualization. **Beatriz Pérez-Aradros:** Writing – original draft, Methodology, Formal analysis, Data curation. **Idana Salazar:** Writing – original draft.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jbusres.2023.114428>.

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