

Corporate resilience in the face of COVID-19: A proposal measurement index

La résilience des entreprises face au COVID-19 : proposition d'un indice de mesure

La resiliencia de las empresas frente al COVID-19: propuesta de un índice de medición

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Article abstract

The paper aims to revisit the business resilience concept in the specific case of the COVID-19 pandemic. We examine firm resilience factors in ten European and Mediterranean countries. Through a cross-sectional study of a sample of 3,722 firms in all industries, we analyze how firms have survived the crisis. By constructing a multidimensional index identifying resilient companies, the paper contributes to the theoretical and empirical literature and defines a methodology that assesses a firm's resilience to promote a business strategy that encourages the growth process and develops new aptitudes to cope with future crises.

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ABSTRACT

The paper aims to revisit the business resilience concept in the specific case of the COVID-19 pandemic. We examine firm resilience factors in ten European and Mediterranean countries. Through a cross-sectional study of a sample of 3,722 firms in all industries, we analyze how firms have survived the crisis. By constructing a multidimensional index identifying resilient companies, the paper contributes to the theoretical and empirical literature and defines a methodology that assesses a firm's resilience to promote a business strategy that encourages the growth process and develops new aptitudes to cope with future crises.

Keywords: Business resilience, Coping strategies, COVID-19 pandemic, International investigation, Resilience factors

Résumé

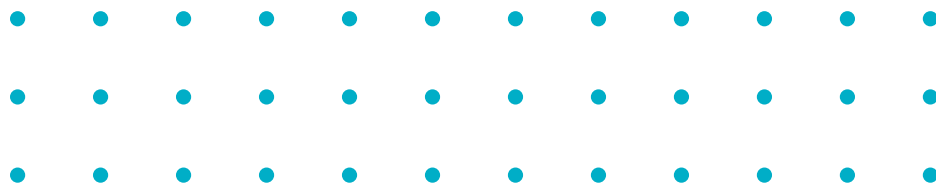
Cet article vise à revisiter le concept de la résilience des entreprises pendant la pandémie du COVID-19. Nous examinons les facteurs de résilience des entreprises dans dix pays européens et méditerranéens. À travers une étude transversale d'un échantillon de 3,722 entreprises de tous les secteurs d'activité, nous analysons comment les entreprises ont survécu à la crise. En construisant un indice multidimensionnel identifiant les entreprises résilientes, l'article contribue à la littérature théorique et empirique de la résilience des entreprises afin de promouvoir une stratégie qui encourage le processus de croissance et le développement de nouvelles capacités pour faire face aux crises futures.

Mots-Clés : Résilience des entreprises, Stratégies d'adaptation, Pandémie de COVID-19, Enquête internationale, Facteurs de résilience

Resumen

Este artículo tiene como objetivo revisar el concepto de la resiliencia de las empresas en la pandemia de COVID-19. Examinamos los factores de resiliencia de empresas en diez países europeos y mediterráneos. A través del estudio transversal de una muestra de 3,722 empresas de todos los sectores de actividad, analizamos cómo las empresas han sobrevivido a la crisis. Al construir un índice multidimensional que identifica a las "empresas resilientes", el artículo contribuye a la literatura teórica y empírica. Define una metodología que evalúa la resiliencia de una empresa para promover una estrategia empresarial que fomente el proceso de crecimiento y desarrolle nuevas aptitudes para hacer frente a futuras crisis.

Palabras clave: Resiliencia de las empresas, Estrategias de adaptación, Pandemia de COVID-19, Encuesta internacional, Factores de resiliencia



For years, crises have been hitting humanity in different regions (e.g., Hurricane Katrina in 2005) over more extended periods and with large-scale effects (e.g., the financial crisis of 2008). The COVID-19 pandemic spread globally and rapidly. It required decisive action and emergency policies. Nevertheless, some measures have been detrimental to business and financial performance.

Before the COVID-19 sanitary crisis, resilience was a new public and private policy (OECD, 2013, 2019, 2020a, 2020b). The resilience of policies is identified through four characteristics: (1) emphasizing the importance of recovery and adaptation following disruptions; (2) recognizing that massive disruptions such as climate change or pandemics will occur in the future; (3) ensuring the fundamental capacity of recovery and adaptation systems; (4) taking advantage of new opportunities that emerge with new crises to implement broader systemic changes in the system (OECD, 2020a). However, in the face of the COVID-19 pandemic, both the nature and contributions of resilient policies have fundamentally changed (OECD, 2020a). Resilience in the post-COVID-19 phase is not the resilience known in the literature, i.e., the ability to resist downturns and return to the status quo. The new approach to policy resilience emphasizes a system's ability to anticipate, absorb, recover, and adapt to new systemic and interdependent threats. Today, the long-term resilience of economies and societies is the objective of new policies (OECD, 2020b). The speed and depth of the COVID-19 crisis have revealed that prioritizing economic efficiency over long-term resilience can have substantial societal costs. Therefore, from a macroeconomic perspective, one of the most critical challenges is determining how and at what cost new policies can achieve more resilient and agile economic situations that can withstand rare but potentially catastrophic events (Jenny, 2020).

As a microeconomic issue, resilience is one of the most analyzed themes in the context of the COVID-19 pandemic. Accordingly, several studies have focused on firms' resilience in the face of the pandemic in various aspects: management processes, organizational methods, corporate culture, marketing, supply chains, and strategy (e.g., Alonso *et al.*, 2020; Greene *et al.*, 2020; Supardi and Hadi, 2020; Cheema-Fox *et al.*, 2020). Through this study, we analyze the resilience of firms in the face of the COVID-19 pandemic, i.e., their ability to emerge from the crisis with the lowest economic and social costs, but also their aptitude to better cope with future crises (e.g., infectious diseases, financial shocks, mental changes, digital disturbances, political instability and social tensions).

A World Bank survey conducted between May and October 2020 examines business resilience factors in ten European and Mediterranean countries. Both macro-economic and firm-level considerations are analyzed to identify the factors impacting a business resilience to the COVID-19 crisis. The paper aims to revisit business resilience concept in the specific case of the COVID-19 pandemic and define a methodology that assesses a firm's resilience to promote a business strategy that encourages growth process and develops new aptitudes to cope with future crises. After defining resilient firms, we identify resilience factors by analyzing data collected by the World Bank from 3,722 firms located in ten different countries.

The rest of the article is organized as follows: In section II, we introduce a literature review related to the concept of resilience in the face of crises. In section III, the principal factors of business resilience are presented. Section IV provides an overview of the main resilience indexes identified in the literature. Our methodology and the main results are explained and discussed in section V. The last section is dedicated to the conclusion and managerial implications.

Literature review

Resilience in theory

Theoretical literature widely discusses the concept of resilience, and there are many definitions of resilience. Indeed, resilience is the ability to adapt successfully to adversity, stress, or disruption (Alonso *et al.*, 2020). It is also a process that links a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disruption (Norris *et al.*, 2008). Finally, resilience indicates predisposition and ability to cope with a crisis (Herbane, 2019). The OECD describes resilience as "the capacity of households, communities and nations to absorb and recover from a shocks while adapting and positively transforming their structures and livelihoods in the face of stress, change and uncertainty to long term".

In 2012, a report by the National Academy of Sciences (NAS) characterized resilience as the ability and capacity of a system to perform four functions in the face of adverse events: (1) planning and preparedness, (2) absorption, (3) recovery, and (4) adaptation.

While resilience is one of the most analyzed research topics in the context of the COVID-19 pandemic, the concept is not new. Resilience has been used for decades in fields as varied as military operations, psychology, civil engineering, and the environment (OECD, 2019).

Resilience has often been redefined and extended by heuristic, symbolic, or normative dimensions (Brand and Jax, 2007). Thus, ecological science uses resilience to "measure the persistence of systems and their capacity to absorb change and disturbance while maintaining the same relationships between populations or state variables" (Holling, 1973). Resilience is also used in psychology. Some studies (e.g., Norris *et al.*, 2008; Treglown *et al.*, 2016; Chamorro-Premuzic and Lusk, 2017) have explored the individual's resilience to stressful situations. According to Chamorro-Premuzic and Lusk (2017), resilience refers to the psychological capacity to cope with stressful circumstances and recover from adverse events. For their part, Treglown *et al.* (2016) described resilience as a "dynamic process, in which interaction with the environment takes place through negotiation and management of resources in response to stressors. Thus, resilience should flow from ordinary processes that protect the effectiveness of the resource allocation system.

Similarly, resilience is used across scientific disciplines as a multidisciplinary approach to analyze system responses to the events highlighted. Within sustainability research, there are many definitions of resilience. However, resilience's conceptual clarity and practical relevance are under serious threat (Brand and Jax, 2007). Indeed, there is

always interference between the original concept of resilience developed by the ecological sciences and the malleable concept of resilience used as an object of approach by different scientific disciplines (Sabatino, 2016).

“The ability of the adaptive resilience system to withstand market or environmental shocks without compromising the ability to allocate resources efficiently” (Perrings, 2006). According to the dynamic approach, two paths characterize firm resilience, one absorptive and the other adaptive, which effectively allow for positive adjustment after a shock but differ according to the capabilities developed in each temporal phase (Conz and Magnani, 2020). Therefore, adaptive resilience can be defined as the ability to recover from a shock and resume growth (Hill *et al.*, 2008).

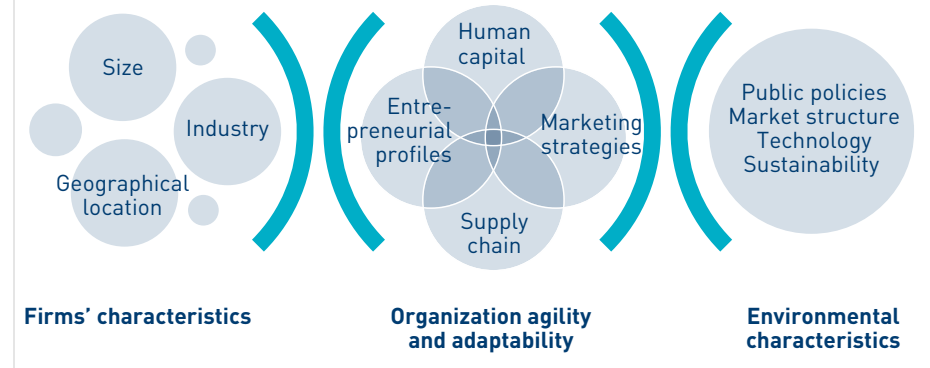
Brand and Jax (2007) determined that (1) the sense of resilience has been diluted and remains increasingly blurred due to the concept’s usage for different purposes and a vast extension; as a result, resilience remains relatively vague, imprecise, and unspecified; (2) resilience is considered a hybrid concept containing a mixture of descriptive and normative aspects; (3) the term resilience is used ambiguously for divergent intentions; there are at least ten different approaches to resilience, and each approach focuses on different aspects of resilience relevant to the specific interest; the ecological aspect is emphasized by ecologists, while sociologists emphasize the political and institutional aspects, etc.; (4) last research studies increasingly analyze the social, political, and institutional dimensions of resilience; (5) resilience is increasingly conceived as a perspective, a way of thinking, an approach to address social processes rather than a clear and well-defined concept; moreover, the increased malleability of resilience can be helpful because it is used across disciplines and between science and practice.

Despite this growth in published work related to resilience in the management and business sciences, the term’s conceptualization and definition remain fragmented. A few studies [Baggio *et al.*, 2015; Conz *et al.*, 2016; Gilly *et al.*, 2014; Limnios *et al.*, 2014] sought to identify the diverse interpretations of resilience in different research areas, but a systematization of definitions of resilience in the management and business literature is still lacking. In addition, most studies have focused on system resilience (Norris *et al.*, 2008) and supply chain resilience (Ambulkar *et al.*, 2015; Brandon-Jones *et al.*, 2014; Pettit *et al.*, 2010; Sheffi and Rice, 2005; Sharma *et al.*, 2020), while business resilience is still under-researched.

Business resilience literature before the COVID-19 pandemic

The literature related to the resilience of companies is not specific to the context of the COVID-19 pandemic. Indeed, the earlier studies focused on firms’ resilience in the face of disruption even before the COVID-19 pandemic. Parker and Ameen (2018) suggested specific capabilities as factors that could influence firms’ resilience. They explain how proactive risk management could reduce the impact of disruption orientation and investment in risky infrastructure on business resilience. The results also revealed that a company could become more resilient based on reconfiguring its resources. While Sabatino (2016) suggested a model assessing entrepreneurs’ resiliency to exogenous economic shocks using qualitative analysis, firms’ resilience builds on adaptability, flexibility, and innovation. Interested only in manufacturing enterprises, Sabatino (2016) proposed seven determinants to identify a resilient firm: (1) product focalization; (2) geographic focalization; (3) quickness in decision-making; (4) organizing structure based on the clan model; (5) business culture of national imprinting and value system; (6) “customer-centricity;” and (7) an efficient system of incentives for strategic aims.

FIGURE 1
Business Resilience Dynamic



Torres and Augusto (2019) analyzed brand resilience in the face of negative information in a digital environment. The study suggested that when a brand succeeds in developing and maintaining an attractive brand personality, consumers will positively affect it and positively discuss it on social media networks. Consequently, this consumer behavior will lead to higher resilience to negative information and increased purchase intentions. The study concluded that brand personality influences consumer behavior more than online brand experience.

Why is the COVID-19 so different from other crises?

The COVID-19 crisis has substantially negatively impacted developed and developing economies alike. Compared to previous major crises—such as the 2008 subprime crisis, the 1987 stock market crash, or the 1929 depression—the world economy experienced an unexpected exogenous shock during the pandemic. The COVID-19 crisis seems to be shallower than the Great Depression of 1929, but still deeper than the financial crisis of 2008. Indeed, the current recession is adversely affecting economic activity and GDP growth. According to the IMF’s published estimates for 2020, a sharp contraction in global GDP of 3% has been recorded. Nevertheless, the crisis’s negative effect was more pronounced in advanced countries (-6.1%) than in emerging and developing countries (-1%).

During the Great Depression of 1929, a significant contraction in GDP was experienced. Between 1929 and 1932, the Euro-area recorded three successive years of GDP decline: -3.9%, -6.2%, and -4.2% (Bergeaud *et al.* 2020).

The magnitude of the current GDP contraction appears to be much larger than the 2008 subprime crisis. Nevertheless, an important difference should be noted. The 2008 financial crisis had long-lasting effects on GDP (Reinhard and Rogoff, 2009) and was followed by a catch-up process that persisted for several years (Gordon, 2000). Also, the 2008 subprime crisis provides interesting insights into the investment and diversification opportunities still possible in some emerging countries (Hemche *et al.*, 2016).

To prevent the global spread of COVID-19, the World Health Organization (WHO) announced the beginning of a pandemic in March 2020. With contact between people limited and significant restrictions imposed on many economic sectors, the pandemic led to an unprecedented global economic crisis.

Unlike the previous crises, COVID-19 has had an unparalleled impact on labor, product, and financial markets. Moreover, contrasting with former economic and financial crises originating in the economic sphere, the COVID-19 pandemic is atypical. While typical crises usually end through policies and measures taken by governments, resolving the COVID-19 crisis depends on continuing medical advances to defeat the spread of the coronavirus.

Consequently, the accumulated knowledge of economic and financial crises may be irrelevant or have limited use in the case of COVID-19. The anti-crisis measurements and tools used by governments and enterprises during previous economic crises will not be operational in the face of the COVID-19 crisis. Their impact will be limited to moderating the social impacts on citizens and firms forced to suspend their activities due to COVID-19. Furthermore, the pandemic is a worldwide phenomenon, and the solutions suggested at the macro and micro levels must be global and suitable for all economies and firms.

In this atypical crisis, identifying firms' resilience factors—especially during the first wave of COVID-19 when the effects of the crisis were most severe—could prepare them for other exogenous crises, whatever their health, natural or cyber origins. Moreover, the analysis of endogenous and exogenous factors that have enabled firms to cope with the COVID-19 crisis and limit its socio-economic impact could pave the way for new research adapted to an uncertain and unpredictable world.

Business resilience factors during the COVID-19 pandemic

The empirical literature on resilience before the COVID-19 pandemic is fundamentally different from that developed during the pandemic. However, the COVID-19 pandemic has dramatically changed how firms and consumers behave (Donthu and Gustafsson, 2020). The pandemic revealed that local supply chains could improve resilience and reduce environmental impacts by enhancing economic circularity and improving resource allocation, following the experience of containment measures during the COVID-19 pandemic and its direct impact on current complex global value chains (OECD, 2020c). The OECD report (2020b) recommended improving supply chains' resilience, including increased adherence to circular economy principles.

As a micro-economic issue, resilience to the COVID-19 pandemic has been the subject of several studies. The COVID-19 crisis forces management researchers to incorporate complexity and explore new theories, methodologies, and methods (Bansal, Grewatsch, and Sharma, 2021). This line of thought seeks to identify corporate resilience factors by analyzing these companies' different responses and policies during the crisis.

Firms' characteristics: size, activity, and geographical location

The literature on business resilience to the COVID-19 pandemic revealed that firms' characteristics, such as size, industry, and location, are crucial (e.g., Gu *et al.*, 2020; HSBC 2020b; Carletti *et al.*, 2020). Indeed, the COVID-19 crisis has affected all companies, regardless of their sector of activity, size, or geographical location. Nevertheless, several studies have revealed a differentiated impact based on several factors, including size and industry (HSBC, 2020b; Xiong *et al.*, 2020; Shen *et al.*, 2020).

The manufacturing industry recorded the most significant negative impact (Gu *et al.*, 2020). On the other hand, the pandemic positively affected the construction, information exchange, computer services software, health care, and social work sectors.

Gu *et al.* (2020) highlighted two significant facts: (1) the negative impact of COVID-19 was more pronounced in private companies than in public and foreign companies, and (2) small companies were affected by the crisis more than large companies. In the Italian context, the study of Carletti *et al.* (2020) revealed that COVID-19 had a more pronounced negative effect on small and medium-sized companies, companies belonging to the industrial and wholesale trade sectors, and companies with high pre-COVID-19 leveraged assets. However, listed companies were less affected by the crisis. De Massis and Rondi (2020) argue that COVID-19 is triggering challenges for Family Business (FB) and requires rethinking current FB research's underlying assumptions. The crisis had amplified pre-pandemic weaknesses and vulnerabilities. Before the crisis began, relatively fragile firms were the most affected (Buchheim *et al.*, 2020).

Organizational characteristics: agility and adaptability

A firm's resilience during the COVID-19 pandemic depends on the agility and adaptability of its organization. Many studies revealed that all companies had developed proactive policies and strategies to respond to activity breakdowns. Businesses focused on market opportunities are more resilient in crisis times than those that become more focused on necessity. Opportunity-based management is associated with entrepreneurial orientation, which includes the dimensions of innovation, proactivity, and, therefore, willingness to take risks (Covin and Lumpkin, 2011). Thus, firms with a higher entrepreneurial orientation have a higher chance of survival during and after a crisis (Soininen *et al.*, 2012; Eggers, 2020).

The empirical literature revealed that companies' most significant concerns during the crisis were financial impact, uncertainty, loss of customers, unknown duration of the crisis, and socio-economic effects on employees and their livelihoods (Alonso *et al.*, 2020). The four main aspects of resilience are: (1) financial fragility during the pandemic; (2) decisions to preserve jobs and the extent to which they were forced to temporarily close or lay off employees; (3) the impact of uncertainties about the duration of the crisis on business decisions; and (4) the use of financing through public policy by these businesses and how this influenced their pandemic management process (Bartik *et al.*, 2020). With limited access to cash, some companies have been forced to reduce expenses, increase debt, and in some cases, even declare bankruptcy. Moreover, expectations regarding the likely duration of the disruptions related to COVID-19 vary considerably from one industry to another. For example, in the tourism and hospitality sector, Alonso *et al.* (2020) noted that the reactions to the crisis during the COVID-19 pandemic are mainly manifested in two different ways: first, how activities, tasks, or daily routines are undertaken; second, increased awareness of health and safety compliance issues and attention to new health and safety protocols.

Human capital and employees' resilience were among the organizational components of companies' resilience strategies during the crisis. Indeed, the COVID-19 crisis has profoundly affected the supply and demand sides of the labor market. The industries with a higher fraction of the workforce not working remotely were more vulnerable to

the pandemic. Indeed, companies with employment problems experienced a decline in their stock market performance and a higher probability of anticipated default on obligations (Papanikolaou and Schmidt, 2020).

Individuals and contextual factors impact career resilience (Hite and McDonald's, 2020). Low-paid workers, mainly women with young children, have been much more affected by the pandemic's disruptions (Papanikolaou and Schmidt, 2020; Arbolino and DiCaro, 2020).

The pandemic will impact the international business strategies of large multi-national enterprises MNEs (Verbeke and Yuan, 2021). Several studies have focused on the marketing strategies implemented during the COVID-19 pandemic (Wang *et al.*, 2020). In response to the COVID-19 crisis, firms innovated their marketing strategies using two dimensions, the motivation for innovations and the level of collaborative innovation considering the environmental mutations (Cohendet *et al.*, 2010). In addition, the impact of internal benefits (dynamic capabilities) and the external environment's impact (dependence on resources) influenced resilient marketing strategies.

Supply chain resilience

Resilience allows supply chains to reduce their disruptive tendencies and recover more quickly. The use of digital technology facilitates existing strategies for building supply chain resilience. Innovative technologies in supply chain management enable transparent, secure, and fast data exchange and automation through intelligent contracting. Theoretical analysis reveals the promotion of supply chain resilience strategies, mainly using intelligent contracts for risk collaboration (Lohmer *et al.*, 2020).

Firms must reorganize their supply chains to prioritize integration and localness (Crane and Matten, 2021). During the COVID-19 pandemic, companies faced challenges matching demand with supply, managing technology, and developing a resilient supply chain. However, supply chains were reshaped rather than restructured during the pandemic. As a result, 80% of the companies surveyed by the HSBC Bank (HSBC, 2020a) reported being closer to their strategic partners and supply chain during the pandemic. Simultaneously, more than 90% of the sample companies said that they supported the companies in their network.

Beyond profitability, firms struggle to build a sustainable supply chain (Sharma *et al.*, 2020). Therefore, leadership responsibility is critical in managing overall supply chain resilience capabilities (Shin and Park, 2021).

According to Sharma *et al.* (2020), to increase supply chain resilience, companies must commit to six strategic recommendations: (1) focusing on a sustainable supply chain; (2) requiring dynamic responses when facing disruption; (3) deriving value from technology deployment; (4) developing a culture of collaboration; (5) diversifying the supply chain; and (6) synchronizing strategic processes.

Cultural factors and entrepreneurial profiles

Culture is a cornerstone of business resilience challenge and change. Indeed, culture can create a sustainable advantage and enable companies to seize long-term opportunities generated by innovation, technology, and sustainability (HSBC, 2020a).

In addition to cultural factors, entrepreneurial profiles can influence companies' resilience (Ahlstrom and Wang, 2021). For example, during the COVID-19 pandemic,

Alonso *et al.* (2020) identified three different profiles of business owners and managers: (1) active managers, who were able to adapt to the crisis by improvising their service and product offerings or by exploiting their innovation capabilities and locational advantages; (2) inactive managers, who chose to remain vigilant in the face of the pandemic, while undertaking preparations for a new post-pandemic operation; and finally, (3) inactive managers, forced to interrupt their activities or be ready for new protocols that would allow the company to reopen.

The literature recognizes entrepreneurial expertise as a potentially critical factor in overcoming crises and disasters (Eggers, 2020). The perceived entrepreneurs' resilience is positively correlated with their perception of success. Moreover, the relationship is more pronounced when the entrepreneur has a vast network of stakeholders (Santoro *et al.*, 2020).

Public policies and measures

Most policy initiatives taken to protect and reduce the impact of the COVID-19 crisis tend to target established businesses, existing industry sectors and economies. These initiatives focus on employment to ensure the continuity of economic activity. The current focus is on preserving the present, while the future and activity of the economy receive less attention (Kuckertz *et al.*, 2020). Indeed, some governments have responded through wage subsidies and SME support programs. The objective has been to limit the risks of massive unemployment and the liquidation of the most vulnerable businesses (Philippon, 2020).

In this context, Philippon (2020) analyzed the approaches used by different governments to mitigate the economic and financial costs of the COVID-19 pandemic. The optimal choice is to offer a continuation bonus to effectively induce a restructuring, liquidation, or continuity of activity. Thus, it would be economically inefficient to prevent all bankruptcies because some businesses are unviable and must be closed. While acknowledging that during the COVID-19 crisis, governments had little information on the quality of individual firms, the study suggests that governments should rely on the behavior of private creditors to decide which firm to save effectively and which firm to liquidate.

Technology, sustainability, and market structure

Technology is critical to business continuity and sustainability for three reasons: (1) it improves business agility and flexibility; (2) it increases productivity; and (3) it improves workforce capabilities. Moreover, sustainable enterprises were better prepared for the COVID-19 crisis. Indeed, sustainable firms could take advantage of the crisis because consumers and investors favor firms with strong environmental, social, and governance performance. (HSBC, 2020a).

The COVID-19 crisis has impacted the market structure in terms of both supply and demand. Lockdowns and social distancing disrupted the typical consumer buying habits and encouraged consumers to improvise (Sheth, 2020). Competitors must be engaged in resilience work characterized by meshing, pooling, and deploying practices to improve their market resilience. Competitors contributed to market resilience by shaping their market from competitive to collaborative when faced with disturbances and disruptions (Beninger and Francis, 2021).

TABLE 1
Overview of the main resilience factors identified in the literature

Resilience Factors	Definitions	References
Firms' characteristics		
Size of firms	The COVID-19 crisis had a more pronounced negative effect on small and medium-sized companies.	Amann and Jaussaud (2012); Gu <i>et al.</i> (2020); HSBC (2020b); Carletti <i>et al.</i> (2020); De Massis and Rondi (2020); Verbeke and Yuan, (2021)
Sector of activity	The manufacturing industry recorded the most significant negative impact. On the other hand, the pandemic positively affected the construction, information exchange, computer services, software, healthcare, and social work sectors.	Buchheim <i>et al.</i> (2020); Xiong <i>et al.</i> (2020)
Geographic location	The crisis's negative impact depends on two dimensions: the sector of activity and the region.	Shen <i>et al.</i> (2020); Stanickova and Melecký (2018)
Organizational characteristics: agility and adaptability		
Activity resilience	Many companies developed proactive policies and strategies to respond to activity breakdowns. Businesses that focus on market opportunities are more resilient in crisis times than those that become focused by necessity. Creativity and anticipating organizational and strategic changes increase organizations' resilience during crises.	Covin and Lumpkin, (2011); Soininen <i>et al.</i> , 2012; Eggers (2020); Marwa and Milner (2013); Bartik <i>et al.</i> (2020); Hillmann (2020)
Marketing strategies	Firms innovated their marketing strategies using two dimensions: the motivation for innovations and the level of collaborative innovations considering environmental mutations.	Wang <i>et al.</i> (2020); Cohendet <i>et al.</i> , (2015). Faeni (2016)
Human capital and employees' resilience	The COVID-19 crisis has profoundly affected the supply and demand sides of the labour market. Low-paid workers, mainly women with young children, have been disproportionately affected by the pandemic.	Papanikolaou and Schmidt (2020); Hite and McDonald (2020)
Supply chain resilience	Companies faced challenges matching demand with supply, managing technology, and developing a resilient supply chain. Resilience allows supply chains to reduce their disruptive tendency and recover more quickly.	Soni <i>et al.</i> (2014); Liu <i>et al.</i> (2018); Lopez and Ishizaka (2019); Lohmer <i>et al.</i> (2020); Sharma <i>et al.</i> (2020); Crane and Matten (2021); Shin and Park (2021)
Cultural factors and entrepreneurial profiles		
Culture	Culture can create a sustainable advantage and enable companies to seize long-term opportunities generated by innovation, technology, and sustainability.	Alonso <i>et al.</i> (2020); Ahlstrom and Wang (2021)
Entrepreneurs' attitudes	Entrepreneur resilience is positively correlated with their perception of success.	Marwa and Milner (2013); Cepel <i>et al.</i> (2020); Eggers (2020); Santoro <i>et al.</i> (2020); Ahlstrom and Wang (2021)
Environmental characteristics		
Public policies and measures	The majority of policy initiatives taken to protect and reduce the impact of the COVID-19 crisis have tended to target established businesses, existing industry sectors, and economies.	Walsh and Cunningham, (2016); Kuckertz <i>et al.</i> , (2020)
Technology	Technology is critical to business continuity and sustainability.	HSBC (2020a); Lohmer <i>et al.</i> (2020)
Sustainability	Sustainable firms could take advantage of the crisis because consumers and investors favor companies with robust environmental and social policies and good governance.	Lamprinakos (2019); HSBC (2020a); Balugani, <i>et al.</i> (2020)
Market structure	The study concludes that new practices will emerge after the pandemic, supported by technological advances, changing demographics, and innovative ways for consumers to cope with the new frontiers of work, leisure, and education.	Sheth (2020); Beninger and Francis (2021)

Resilience indexes in literature

Research on resilience to extreme the events or natural catastrophes has traditionally focused on defining the concept and studying specific cases. More recently, interest has shifted to identifying and assessing factors that make an entity more resilient. By defining individual or composite resilience indicators, the literature measures and evaluates resilience and tracks progress toward building it.

Rose and Krausmann (2013) analyzed the existing resilience indexes. They concluded that many of the previous resilience indicators are not relevant for various reasons, primarily (1) the studies' vulnerability, (2) the absence of conceptual frameworks, (3) the lack of studies focused on businesses, and (4) the bias of indicators easily calculated by using publicly available data.

In reviewing the resilience index developed to date, we concur with Rose and Krausmann (2013) that there is no business-specific resilience index. Until now, the conceptual framework for the specification of economic resilience has been based on three approaches: the microeconomic approach, focusing on individual resilience based on household behavior; the mesoeconomic approach, analyzing individual industries or markets; and the macroeconomic approach, studying resilience by considering the interaction between economic entities.

Moreover, unlike Uddin *et al.* (2021), who used the resilience index as an explanatory variable for the impact of the COVID-19 crisis on market volatility, our study proposes the definition of a new resilience indicator at the company level.

Table 2 presents an overview of the literature the main resilience indexes. This table includes the approach adopted (macro, regional, community, and individual), the context in which the index was employed, and the resilience factors identified. The last column highlights the shortcomings of the proposed indexes in the specific case of business resilience.

The main shortcoming of the reviewed indexes arises from the fact that explanatory factors relate to general economic characteristics rather than specific factors of corporate resilience. Many of the studies in Table 2 define the resilience index as a multidimensional indicator combining economic, social, and institutional factors.

Furthermore, most studies focus on the resilience of communities, regions, or economies. The resilience of companies as independent entities that could face extreme events and exogenous shocks is largely ignored in these studies. When microeconomic resilience is analyzed (i.e., at the level of individual companies and organizations), corporate resilience is often limited to resilience options for customers and suppliers.

Rose and Krausmann (2013) asserted that most economic resilience indexes were of limited use for gauging the recovery of businesses after a disaster. Paradoxically, business behavior is the key to economic recovery in the aftermath of a disaster, mainly in the short run. Another shortcoming of the existing resilience index noted by Rose and Krausmann (2013) is long-term orientation and limited short-term use.

In contrast to the existing literature, our study attempts to identify business resilience factors by integrating strategic, cultural, financial, and operational components of firms' resilience. Unlike previous studies, we do not analyze business resilience as a factor of community or macroeconomic resilience in the face of disasters. Instead, corporate business resilience is a multidimensional concept that depends on internal and external factors impacting a company's performance. The aim is to assess and quantify business resilience by proposing a composite index. Using the corporate index, the decision-makers could improve their resilience and prepare for future crises.

TABLE 2
Overview of the main resilience indexes identified in the literature

Study	Resilience Indexes	Approach	Related Context	Resilience Factors	Relevance
Ainuddin and Routray (2012)	Community resilience index (CRI)	Macroeconomic	Earthquake-prone area in Baluchistan	<ul style="list-style-type: none"> - Social: age, education, health, social capital - Economic: housing capital, employment, income, sources of income - Institutional: mitigation, municipal services, awareness building - Physical: shelter capacity, house age, location 	Not relevant
Briguglio <i>et al.</i> (2009)	Composite index of economic resilience	Macroeconomic	86 countries	<ul style="list-style-type: none"> - Macroeconomic stability: the fiscal deficit-to-GDP ratio; the sum of the unemployment and inflation rates; the external debt-to-GDP ratio - Microeconomic market efficiency: the banking industry is dominated by private firms; foreign banks are permitted to compete in the market; credit is supplied to the private sector; controls on interest rates interfere with the credit market - Good governance: the economic freedom of the world index - Social development: UNDP Human Development Index (HDI) 	Partially relevant
Cohen <i>et al.</i> (2013)	Conjoint community resilience assessment measure (CCRAM)	Community resilience	Nine small to medium-sized towns (Israel)	<ul style="list-style-type: none"> - Leadership - Collective efficacy - Preparedness - Place attachment - Social trust - Social relationship 	Not relevant
Courtney <i>et al.</i> (2008)	Coastal community resilience (CCR)	Community resilience	Indian Ocean region	<ul style="list-style-type: none"> - Governance: society and economy - Coastal resource management - Land use and structural design - Risk knowledge - Warning and evacuation - Emergency response disaster recovery 	Not relevant
Cutter <i>et al.</i> (2010)	Baseline resilience indicators for communities (BRIC)	Macroeconomic/ Adapted vulnerability index	FEMA Region IV - USA	<ul style="list-style-type: none"> - Social: education, health, transport, communication, - Economic: employment, housing capital, business size, income, equality - Institutional: mitigation, political fragmentation, social connectivity - Infrastructure: housing type, housing age - Community capital: place engagement, Innovation, social capital 	Not relevant
Hughes & Bushell (2013)	Base resilience index (BRI)	Regional resilience	Ethiopia's Somali region	<ul style="list-style-type: none"> - Livelihood viability - Innovation potential - Access to contingency resources and support - Integrity of the natural and built environment - Social and institutional capability 	Not relevant
Lockwood <i>et al.</i> (2015)	Individual dimensions of adaptive capacity	Individual resilience	Rural landholders in South-Eastern Australia	<ul style="list-style-type: none"> - Social capital: local networks, trust reciprocity - Human, financial, and physical capital: knowledge and information, labor and time, finance and infrastructure - Management approach: innovation, adaptive management, risk behavior - Governance: legitimacy, accountability, inclusion and fairness, leadership coordination and collaboration 	Relevant
Mayunga (2007)	Community disaster resilience index (CDRi)	Community resilience	Conceptual framework	<ul style="list-style-type: none"> - Social capital: trust, norms and networks - Economic capital: income, savings and investment - Human Capital: education, health, skills, knowledge and information - Physical capital: housing, public facilities, business and industry - Natural capital: resources stocks, land and water, ecosystem 	Partially relevant

TABLE 2
Overview of the main resilience indexes identified in the literature

Study	Resilience Indexes	Approach	Related Context	Resilience Factors	Relevance
Nguyen and James (2013)	Household resilience to floods (HRF)	Household resilience	Flood of Vietnamese Mekong river delta (MRD)	<ul style="list-style-type: none"> - Households' confidence in securing food, income, health, and evacuation during floods and recovery after floods - Households' confidence in securing their homes so they are not affected by large flood events such as the 2000 flood - Households' interest in learning and practicing new flood-based farming practices that are fully adapted to floods for improving household income during the flood season 	Not relevant
Orencio and Fujii (2013)	Integrated community-based risk reduction (ICBRR)	Community resilience	Disaster-resilient coastal community local level in the Philippines	<ul style="list-style-type: none"> - Environmental and natural resource management (ENRM) - Sustainable livelihoods (SL) - Social protection (SP) - Planning regime (PR) 	Not relevant
Prashar <i>et al.</i> (2012)	Climate disaster resilience index (CDRI)	Community Resilience	Nine revenue districts of Delhi	<ul style="list-style-type: none"> - Five dimensions: physical, social, economic, institutional, natural 	Partially relevant
Sherrieb <i>et al.</i> (2010)	Community resilience index (CRI)	Community resilience	Mississippi counties	<ul style="list-style-type: none"> - Economic development - Social capital, information, and communication - Community competence 	Partially relevant
Stanickova and Melecký (2018)	Composite weighted index of regional resilience (CWIRR)	Regional resilience	European Union (28)	<ul style="list-style-type: none"> - Community links (CL) - Human capital and sociodemographic structure (HC-SDS) - Labor market (LM) - Economic performance (EP) - Innovation, science, and research (ISR) 	Partially relevant
Uddin <i>et al.</i> (2021)	Overall resilience score	Macroeconomic score	34 developed and developing countries	<ul style="list-style-type: none"> - Economic factors: productivity, political risk, oil intensity, urbanization rate - Risk quality factors: natural hazard, risk quality, fire risk quality, cyber risk - Supply chain factors: control of corruption, infrastructure quality, corporate governance, supply chain visibility 	Relevant
Vaitla <i>et al.</i> (2012)	Livelihood change over time (LCOT)	Household resilience	Ethiopia, Tigray	<ul style="list-style-type: none"> - Household food insecurity and access scale (HFIAS), - Coping strategies index (CSI), - Food consumption score (FCS), - Illness score - Value of productive assets: land, livestock, and tools - Net debt - Income (with per capita daily expenditure as the best measurable proxy for income) 	Not relevant
Yoon <i>et al.</i> (2015)	Community disaster resilience index (CDRI)	Community resilience	229 local municipalities in Korea	<ul style="list-style-type: none"> - Human, social, economic, institutional, physical, and environmental aspects 	Partially relevant

* Relevant = the factors identified by the considered index are entirely relevant for firms

Not relevant = the factors identified by the index are not relevant for firms

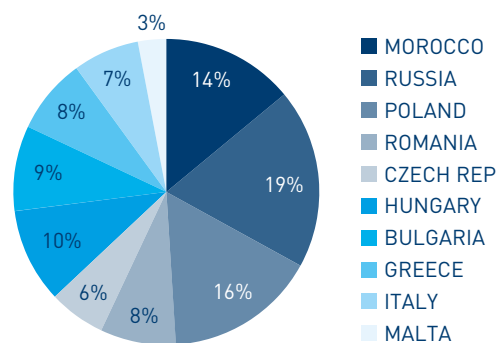
Partially relevant = some of the factors identified by the index can be integrated into the resilience index of firms

Data, Methodology and Results

To analyze the impact of the, COVID-19 pandemic on business resilience, we used data from a survey carried out by the World Bank between May and October 2020. The choice of the first wave is motivated by the big lockdown. Moreover, this period experienced the strongest crisis effects, considering its magnitude and unpredictable and exogenous nature.

Our sample comprises 3,722 companies from ten European and Mediterranean countries (Bulgaria, the Czech Republic, Greece, Hungary, Italy, Malta, Morocco, Poland, Romania, and Russia). Figure 2 synthesizes the distribution of the sampled companies by country. However, to supplement the World Bank survey data, we used other data-bases to obtain the number of infections and deaths linked to COVID-19.

FIGURE 2
Distribution of the sampled companies by country



Questionnaire and data

The World Bank questionnaire is organized to obtain information relating to the (1) profile of the company: its size, sector of activity, geographic location, and market (local or international); (2) the impact of the pandemic on its level of activity, its sales, the organization of its production chain, its distribution networks, its suppliers; (3) the policies and measures put in place internally to respond to the pandemic: remote sales, remote work; (4) the effects of the pandemic on the level of employment (job retention, partial unemployment, dismissal); (5) the effects of the crisis on access to short and medium term financing (cash flow, customer deadlines, supplier deadlines, debt, etc.) and on risks (operating, liquidity, solvency, bankruptcy, etc.); (6) the aid and support mechanisms put in place by the public authorities during the crisis (government or local aid, tax exemptions or reductions, subsidies); and (7) expectations regarding the evolution of the pandemic and the level of confidence in a possible resumption of activity in the short and medium term.

Descriptive statistics

The sample studied includes 3,722 companies from ten European and Mediterranean countries: 59.8% are manufacturing companies, 15.8% are retail firms, and 24.3% are service companies. In addition, 61.5% of the sample companies are male-run. Moreover, the participant companies reported an average closure term of 9 weeks (with a minimum of 0 and a maximum of 52 weeks).

A descriptive statistics analysis reveals that 66% of the sampled companies have experienced a decline in their activity, and 66% reported that their liquidity has decreased. A cross-analysis of the activity variable with the sector shows that the services sector was most affected by the crisis. Of 1,458 companies, 1,036 report declining business (more than 70% of service companies). However, 509 companies reported that their activity increased by 21% on average (with a maximum of 300%).

Moreover, 17% of the companies benefitted from government or local aid schemes. However, public aid depends on the country (from 2 to 42%, depending on the country). For the same period, 23.6% of businesses reported that their credit sales declined, 65% remained the same, and 9% increased their credit sales. Regarding credit sales, 21.4% of businesses experienced a decline in their credit sales, 66.38% experienced no change, and 9.84% experienced an increase in this business practice. Regarding the primary sources used to deal with cash shortages, 28.4% of companies revealed that they have benefitted from additional supplier delays, 12.9% from owners, and 12.2% from tax authorities. Table 3 summarizes the descriptive statistics for our sample.

TABLE 3
Descriptive Statistics

Variables	Mean	SD	min	max
WTEMPEmployees	0.774	0.419	0	1
WPERMEmployees	0.206	0.405	0	1
WSALES	0.325	0.469	0	1
WHoursWeek	0.545	0.498	0	1
WDEMAND	0.115	0.319	0	1
WSupplyChain	0.443	0.497	0	1
WLIQUIDITY	0.0974	0.297	0	1
WOnlineActivity	0.956	0.206	0	1
BRI_Index	2,700	1,700	0	8
INFECTIONS	419,086	1.05E+06	8295	4.19E+06
DEATH RATE	0.0418	0.0293	0.0042	0.119
MED	0.322	0.467	0	1
LNRNB	38.31	2,830	23.60	40.45
MOROCCO	0.137	0.344	0	1
RUSSIA	0.187	0.390	0	1
POLAND	0.158	0.364	0	1
ROMANIA	0.0834	0.277	0	1
CZECH REP	0.0635	0.244	0	1
HUNGARY	0.0988	0.298	0	1
BULGARIA	0.0877	0.283	0	1
GREECE	0.0834	0.277	0	1
ITALY	0.0710	0.257	0	1
MALTA	0.0307	0.173	0	1
MAY	0.0149	0.121	0	1
JUNE	0.326	0.469	0	1
JULY	0.118	0.322	0	1
AUGUST	0.305	0.461	0	1
SEPTEMBER	0.199	0.400	0	1
OCTOBER	0.0370	0.189	0	1

Business Resilience Index (BRI)

To measure the sample companies' resilience during the COVID-19 pandemic, we built a Business Resilience Index (BRI). The index is constructed binary based on eight criteria: (1) the number of temporary employees; (2) the number of permanent employees; (3) sales levels; (4) the total hours worked per week during the pandemic; (5) the demand for the company's products and services; (6) the supply chain; (7) liquidity or cash flow; and (8) online business activity. For each criterion, the value equals 1 when the variable increased or was static during the pandemic and 0 if it decreased. Consequently, the values in our BRI vary from zero to eight. The closer the BRI is to eight, the more resilient the company is in that it satisfies many of the eight resilience criteria. The BRI is a proxy for business resilience, i.e., the ability of a company to cope with any adverse situation and reduce economic and social costs.

The eight criteria are business resilience drivers. They may be classified into five resilience factors, all of which were deduced from the empirical literature review: (1) employment resilience (Papanikolaou and Schmidt, 2020; Hite and McDonald, 2020); (2) activity resilience (Zou *et al.*, 2020); (3) supply chain resilience (Sharma *et al.*, 2020; Lohmer *et al.*, 2020; Shin and Park, 2021); (4) finance policy resilience (Bartik *et al.*, 2020; HSBC, 2020a); and (5) response to COVID-19 (Alonso *et al.*, 2020; Wang *et al.*, 2020). Table 4 summarizes the eight criteria used to build the Business Resilience Index.

TABLE 4
Business Resilience Index (BRI)

Variables	Resilience drivers	Resilience factors
WTEMPEmployees	Number of temporary employees	Employment resilience
WPERMEmployees	Number of permanent employees	
WSALES	Sales are maintained or increased	Activity resilience
WHoursWeek	Total hours worked per week during the pandemic	
WDEMAND	Demand for the company's products and services	
WSupplyChain	Supply chain	Supply chain resilience
WLIQUIDITY	Liquidity or cash flow	Finance policy resilience
WOnlineActivity	Online business activity	Response to COVID-19

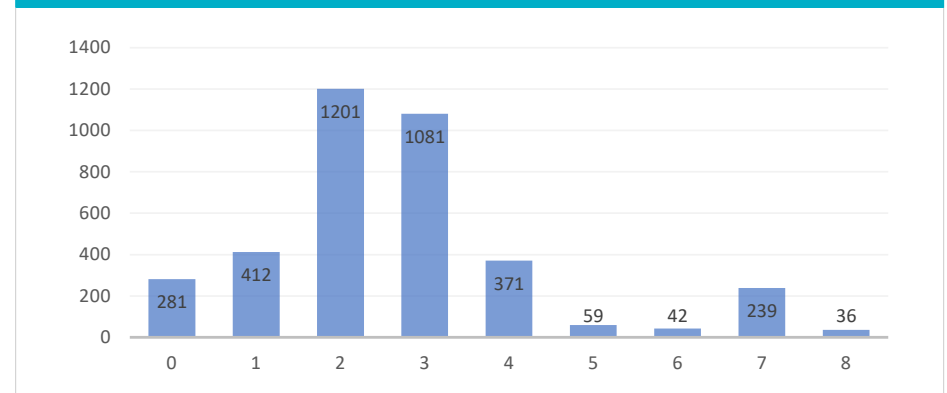
While Uddin *et al.* (2021) used an overall resilience score to measure economic resilience, we are interested in assessing business resilience at a corporate level. The score proposed by Uddin *et al.* (2021) is an equally weighted composite measure of three factors. Each factor is a similarly weighted average of four factors within each group. Thus, the score measures the strength and vulnerability of a country's resilience across the 12 drivers. The factors included in the score are (Uddin *et al.*, 2021): (1) within the economic drivers-productivity, political risk, oil intensity, and urbanization rate; (2) within the risk quality drivers-exposure to natural hazards, natural hazard risk quality, fire risk quality, and inherent cyber risk; and (3) within the supply chain drivers-control of corruption, infrastructure quality, corporate governance, and supply chain visibility.

Business Resilience Index Results

Figure 3 determines the distribution of the sampled companies based on their BRI. In response to the COVID-19 crisis, the companies' resilience was relatively low. Of the 3,722 companies, 1,201 have a resilience index equal to 2 and 1,081 equal to 3, 32%, and 29% of the sample, respectively. Moreover, the sampled companies' average resilience index equals 2.7 with a minimum of 0 and a maximum of 8 (see Table 3).

FIGURE 3

Cumulative distribution of the sampled companies by resilience level



Utilizing a cumulative distribution of the sampled companies according to their resilience level (Figure 4), more than 80% have a BRI equal to 2. Consequently, these companies satisfy only two of the eight criteria of business resilience. The most resilient companies, i.e., those with a resilience level equal to 8, represent only 1% of the sample. Furthermore, only 20% of the sampled companies have a median resilience level of 4 (Figure 4).

To better understand firms' reactions and adaptability to the global health crisis, we looked at firms' distribution according to their country's resilience levels (BRI).

As shown in Figure 5, Mediterranean companies, in general, are less resilient than Eastern European ones. For example, 14% of firms in Morocco are not resilient (BRI=0), followed by Italy with 13.5%. This observation can be explained by the seriousness of the health situation in Italy, especially in the northern region. Addressing this problematic situation necessitated a prolonged lockdown and the closing of borders. As mentioned above, geographical location and business sector are critical factors for business resilience (Zou *et al.*, 2020; Gu *et al.*, 2020; Carletti *et al.*, 2020). Milan and Lombardy in northern Italy drive the country's economy with 10% and 22% of the national GDP. The economies of both countries (Morocco and Italy) rely heavily on the tourism sector. In Italy, tourism employs 4.2 million people generating 13% of the GDP.

FIGURE 4
Cumulative distribution of the sampled companies by resilience level

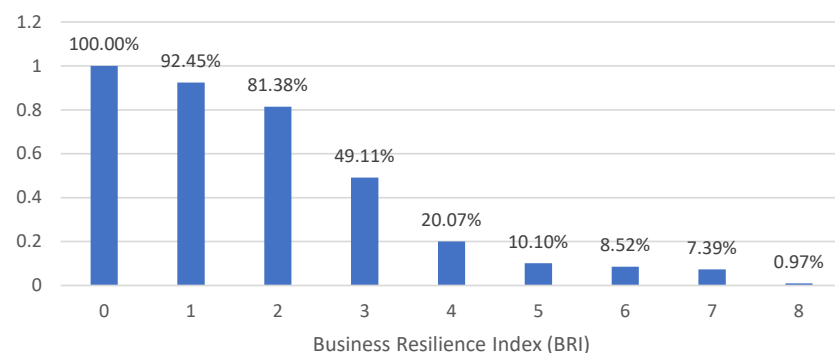
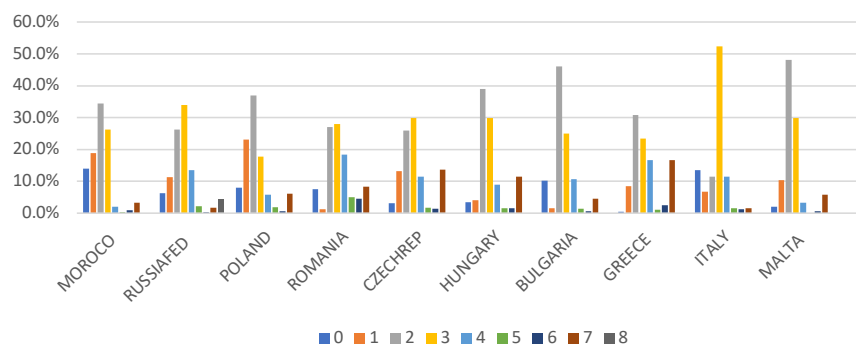


FIGURE 5
Distribution of firms by country and by the BRI level



According to our index, less than 1% of the sampled firms are 100% resilient (meeting 8 out of 8 resilience factors). They are all Russian firms, representing 4% of the Russian sample.

Figure 6 illustrates the distribution of the most resilient firms by country. We consider a firm to have high resilience if it obtains more than 4 out of 8 factors in our BRI.

According to this distribution, Greek and Romanian firms are the most resilient (36.7% and 36.3%, respectively), while Morocco and Malta have the lowest percentage of highly resilient firms (6.5% and 9.7%, respectively).

FIGURE 6
Distribution of Highly Resilient Firms by Country

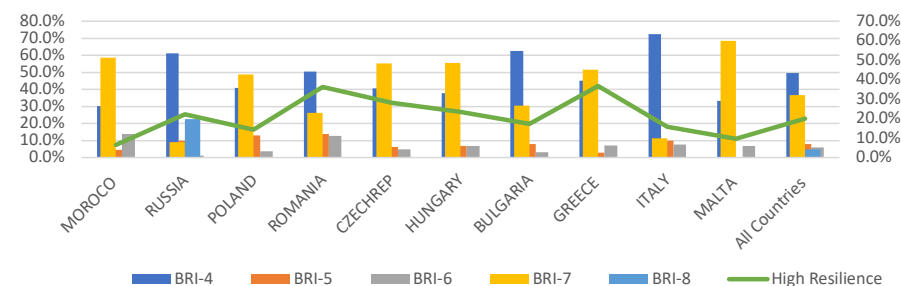


FIGURE 7
Distribution of firms by country and by 3 levels of BRI

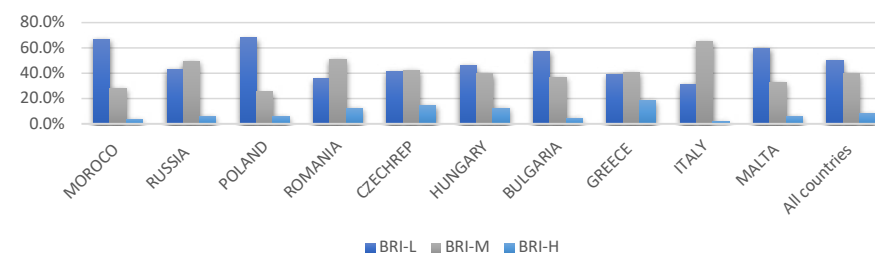
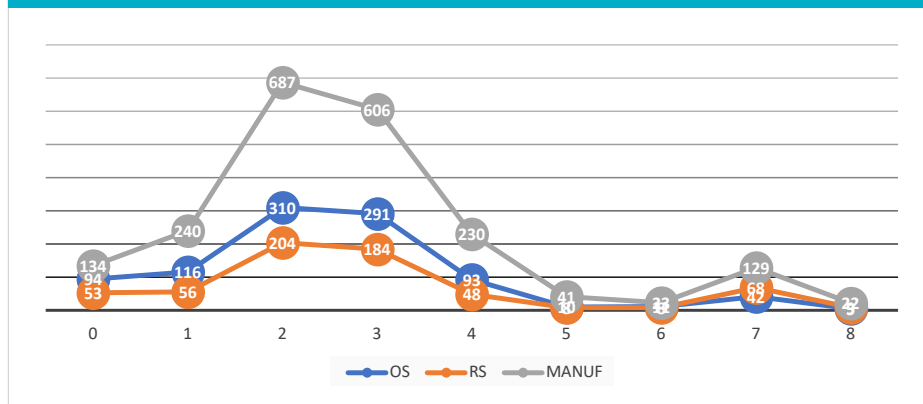


Figure 7 represents the sampled firms' distribution by country and resilience levels: highly resilient firms are marginal in all countries. However, medium resilient firms dominate five countries: the Czech Republic, Greece, Italy, Romania, and Russia. In contrast, the less resilient companies dominate the remainder of the sample countries, i.e., Bulgaria, Hungary, Malta, Morocco, and Poland.

Figure 8 shows a distribution of BRI scores across the dominant industries. More than half of the sample is from manufacturing (MANUF with 57%), followed by other services (OS with 26%) and retail (RS with 17%). As shown in Figure 8, the companies in the sample follow the same distribution per industry sector. One-third of the companies in each industry sector met three of our resilience (BRI) factors, while only 1% of firms in all sectors have strong resilience, with eight out of eight factors.

FIGURE 8
Distribution of firms by industry and BRI score



Results of average comparison tests

To analyze the impact of the various variables on business resilience, we performed comparison tests of averages. The results reveal that most of the discriminating variables selected had a substantial impact on business resilience. We present the methodology for the first variable and the difference between the averages and the value of the test's details P-value for the other variables. According to these test results, the Mediterranean basin companies (MED) were less resilient than their Eastern European comparators, with an average of 3.47 versus 3.71. This difference is statistically significant at the 1% threshold. Companies that reported using the devices for credit purchases and sales (SALCRED, PURSCRED) during the COVID-19 period have a lower BRI than those that did not use these devices by an average of one point (-1.05 and -0.99), and this difference is statistically significant. For companies that have requested additional time to pay taxes, owners, and suppliers (PAYDELTA, PAYDELANLORD, PAYDELSUPP), these companies have been less resilient than those that have not used these practices.

Regarding month-on-month resilience trends, the firms surveyed in June were more resilient than those observed in July and August because they recorded average differences of -0.42 and -0.54. This difference became positive and significant again in September, decreasing as the COVID-19 crisis reached a new phase. Regarding sector-specific resilience, the manufacturing and retail sectors were more resilient than the services sector, which recorded a negative difference of -0.29. To consider the geographical dimension of the pandemic's impact on companies' resilience, we conducted these tests by discriminating according to the countries. The results reveal that Moroccan, Polish, Bulgarian, Greek, Italian, and Maltese companies are less resilient than others in the sample.

Results discussion

As a multidisciplinary concept applied in various fields of study, the resilience theory has gradually become an established tool in business management. With the COVID-19 crisis, interest in this analytic perspective has increased. Resilience will undoubtedly prevail as one of the central topics of economic and managerial theory in the medium and long term. With increasing risks and uncertainties, the business environment has become less predictable, and businesses must become more resilient to adversity. Therefore, by

identifying resilience factors and proposing a business resilience index, our study enriches the theoretical and empirical literature that lacks of similar analyses.

This study focuses on the business resilience of 3,722 companies in ten countries during the COVID-19 pandemic. Constructing a multidimensional index identifying firms resilient to the COVID-19 pandemic is intended to contribute to the existing theoretical and empirical literature on to resilience during extreme events. Furthermore, the COVID-19 crisis will catalyze several long- and short-term policy changes and require scholarly attention to conduct theoretical and empirical research (Verma and Gustafsson, 2020). The study has managerial and policy implications. The study enlightens managers facing uncertainty and global crises such as pandemics or natural disasters by analyzing internal factors. While introducing macroeconomic considerations, mainly public measures and policies, the study helps governments implement more effective policies in response to the crisis.

Compared to the existing literature, this paper is the first to investigate resilience factors internationally. For instance, Buchheim *et al.* (2020) analyzed the determinants of companies' business prospects and strategies to mitigate the effects of the COVID-19 crisis by studying a representative panel of German companies. Bartik *et al.* (2020) investigated the reaction to the COVID-19 situation of small American companies. Carletti *et al.* (2020) explored the effects of COVID-19 on profits and equity losses in a representative sample of Italian companies. At the same time, many studies have focused on China (Shen *et al.*, 2020; Qin *et al.*, 2020; Xiong *et al.*, 2020; Wang *et al.*, 2020; Zou *et al.*, 2020; Gu *et al.*, 2020).

Moreover, this study analyzed firms' resilience as a multidimensional phenomenon. We constructed a resilience index based on eight items deduced from the theoretical literature, managerial practices, and the World Bank's qualitative questionnaire data. This approach follows the bibliometric study of COVID-19 literature conducted by Verma and Gustafsson (2020). The study identified four main research themes, which are COVID-19's impact on (1) business, (2) technology, (3) supply chain management, and (4) the service industry.

The study highlighted companies' low resilience in ten European and Mediterranean countries regarding managerial practices on the empirical side. Faced with the COVID-19 pandemic, most companies were ill-prepared for the crisis. More than 80% of the sample companies are resilient at a level of 2 on a scale of 0–8. However, only 1% of companies are resilient at a level of 8. The study also found that, on average, companies in Eastern European countries were more resilient than Mediterranean companies during the pandemic. In this context, we highlight the crucial rule of the manager, as far as different orientations have been taken by organizations based on the cognitive diversity of their top managers (Mazouz, 2003).

Conclusion and Managerial implications

During the COVID-19 crisis, firms faced their most significant challenge. Although short-term challenges dominated firms' responses, the crisis catalyzed long-term changes. Our business resilience index suggests that firms' resilience must be built on short—and long-term solutions. The five resilience factors identified when building our business resilience index were: employment resilience; activity resilience (Amin, A., & Cohendet, P. 2003); supply chain resilience; finance resilience; and response to the crisis.

Consequently, the most resilient firms were those closer to their employees, customers, and suppliers. Indeed, high employee qualifications and technological mastery increase firms' resilience in a crisis. The most resilient firms were those able to switch to teleworking during the pandemic. At the same time, the consumers' proximity and loyalty and the control of the supply chain improved companies' shock absorption capacity. The more integrated the company's environment, the higher its capacity to cope with shocks, notably due to the solidarity of suppliers and the loyalty of customers.

Our business resilience index also suggests that a company's financial strength before the onset of the crisis and its ability to mobilize sources of financing quickly and efficiently for its working capital requirements are fundamental components of a firm's resilience.

The COVID-19 crisis has enabled firms to become more agile and responsive to change. Companies' agility and adaptability positively correlate with resilience. Moreover, the imposed social distancing accelerated companies' digital transformation through online sales and teleworking. Consumers and employees reinforced their self-resilience and adaptability to digital transformation.

The crisis also accelerated deep structural trends such as technological change and sustainability. Resilience must be integrated into firms' DNA to cope with future crises, such as infectious diseases, climate change, financial crashes, or socio-political instability.

Our business resilience index has enabled us to draw the profile of a resilient firm. To be resilient in the face of extreme events, a firm must: (1) rely on qualified and resilient employees; (2) adapt quickly to external events and shocks; (3) be close to suppliers and attentive to customers; (4) have a strong balance sheet and sufficient cash flow; and (5) master technological changes and act sustainably.

To improve their firm's resilience, managers must take the following actions in the next years: (1) Rely on cultural change to create a sustainable advantage by improving employee well-being through innovation, inclusion, lifelong learning and training, remote working, and reimagining workplaces; (2) Invest in technology to ensure business continuity by improving agility and productivity and upskilling the workforce; (3) Build resilience in environmental sustainability to reduce exposure to existing, and emergent risks; (4) Consider resilience as a key concern given the external environment uncertainty in decision-makers thinking and for investors escaping vulnerable business models.

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