The Role of Virtual Communication in Building an Intertwined Relation Between Business Resilience and Community Resilience during the COVID-19 Pandemic

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Abstract

The COVID-19 outbreak that emerged in December 2019 has had a dramatic impact on the global economy in which consumption, trade, and service activities have been greatly disrupted. Businesses across many sectors have experienced a severe decline in sales and jobs. But the magnitude and distribution of the pandemic greatly affected small firms, due to them being more financially constrained. This article provides a comprehensive assessment of the short-term impact of the COVID-19 pandemic on Algerian businesses. Based on a novel data set, the article shows how, beyond adjusting their labor costs and enforcing government-mandated lockdowns and social distancing, businesses could respond to the shock of COVID-19 thanks to the use of communication tools, such as the Internet and digital technologies, as well as the cooperation between companies. The article concludes that those firms that used Internet-based communication tools and those that built new ways of business cooperation and provided help to community during the lockdown showed higher survival rates after the lockdown.

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Introduction

The COVID-19 pandemic caused an unprecedented health and humanitarian crisis from the first outbreak in Wuhan, China, in December 2019, until July 2022. In that period, almost 582 million people were infected, and 6.41 million casualties were recorded globally (Johns Hopkins Coronavirus Resource Center, 2022). The World Health Organization (WHO, 2020) announcement on March 11, 2020 called for testing, severe social isolation, and the mobilization of resources as a matter of urgency for the advancement of science to prevent the transmission of the virus. The speedy and general spread of the virus compelled governments to force general but temporal lockdowns in March 2020, lasting for several months in most countries all over the world (Bernard et al., 2022). The temporary cease of all non-essential business activities created short-term worldwide disruptions but long-term changes in the chains of supply and demand. The confinement and social restrictions slammed the brakes on economic growth and crippled markets on an unprecedented scale, seriously affecting businesses that were flourishing and those that were not, hitting almost all industries. The 3.4% contraction in global GDP in 2020 is the deepest global recession recorded in eight decades (World Bank, 2022). Indeed, the drop in active small businesses and entrepreneurs was witnessed in nearly all industries. But, amid this widespread loss of businesses, above and beyond pre-pandemic rates, a global recovery quickly emerged to effectively respond to adversity, which has shown extraordinary business resilience. Thus, global growth has surged to an estimated 6.1% in 2021—the strongest pace since post-recession World War II (International Monetary Fund [IMF], 2022).

Resilient businesses respond innovatively and more efficiently when confronting unexpected uncertainties to bounce back from the untoward effects of the shock (Castellacci, 2015). Moreover, organizational resilience is the dynamic ability to reinvent business models and strategies in response to change (Hamel & Välikangas, 2003). Furthermore, in the context of the coronavirus pandemic, the brittleness of small- and medium-sized enterprises (SMEs) urged firms to quickly react to the full-blown crisis to survive (Zhu et al., 2020). To bolster resilience, the literature shows the need for resources that would enable organizations to anticipate, prepare for, withstand, and confront challenges and disruptions and even rekindle growth and reinvent their future for the better after the shock (Beninger & Francis, 2022; Hamel & Välikangas, 2003; Linnenluecke, 2017; F. Luthans & Youssef-Morgan, 2017; Seville et al., 2015). Flexibility, diversity, and held-in slack resources are helping resilient firms to cope with logistic disruptions and demand changes, by allowing them to divert resources swiftly from pre-pandemic products to a new portfolio adapted to "the new reality" during the pandemic (Beninger & Francis, 2022; Castellacci, 2015).

However, the capacity to cope with disruptions is uneven. First, rural economies with higher levels of self-employment and small and micro-enterprises with limited solvency and cash reserves are more likely to be less prepared to cope with disruptions caused by COVID-19 than urban economies (Cox & Hamlen, 2015; Phillipson et al., 2020). Second, small firms, compared to large firms, are highly vulnerable when coping with shocks. Despite the enormous capacity of SMEs—and not big firms—to create jobs and growth, generating 66.38% of the full-time global employment (Ayyagary et al., 2011), SMEs face many challenges to survive (Mead & Liedholm, 1998), as recorded by the high closure rates among newer firms (Haltiwanger et al., 2013). Indeed, the ability to support resilience by leveraging resources and to maintain slack in times of crisis is more limited in SMEs versus big firms (Linnenluecke, 2017). Third, unsurprisingly, there is a significant divergence between the economic recovery of small firms in advanced economies versus those from emerging markets amid the confinement during COVID-19. The former received fast and abundant liquidity support through grants and loans to avoid business failures, closures, worker lay-offs, and production losses, while small firms in emerging markets maintained positive adjustments to limit the extent of losses to absorb the shock without immediate financial aid to the private sector (IMF, 2022). In the context of emerging economies, a key question to investigate is how fragile enterprises within a fragile environment have built resilience to effectively respond to adversity. This research question is motivated by the lack of knowledge on how firms overcome sudden difficulties on the ground (Linnenluecke, 2017) and the need for more empirical studies in the field of business resilience in SMEs of developing countries (Castellacci, 2015).

Resilient businesses continuously adapt processes, test novel strategic options, anticipate changes in demand, forecast economic fluctuations in the industry, and shift resources to new initiatives that might yield even higher returns (Hamel & Välikangas, 2003). The environment of a poorly developed country, which suffers from lower health resources and tighter financial support, is a perfect scenario to study the proactive actions that small entrepreneurs have taken to revert to pre-crisis trends. This article is motivated by the research challenge of knowing the business resilience mechanisms and actions taken during a large-scale crisis with uncharted ripple effects in the presence of policy constraints. The study reveals that the isolation suffered by small- and medium-sized firms forced them to focus their resilience on virtual social interactions and communications, thus building philanthropic and cooperative relationships with stakeholders. That allowed for the survival of both, for the one who provides the help and for the one who receives it.

This article contributes to the literature in three aspects. First, it provides new evidence and quantitative analysis of the mechanisms SMEs use to build business resilience to absorb disruptions at the highest point of the shock. Second, our results support the thesis that business resilience is intertwined with wider community resilience (Adekola & Clelland, 2020; McKnight & Linnenluecke, 2016). This business networking and cooperative behavior, which happened during the lockdown, built an authentic business resilience with a wider community by activating resources, finding synergies, interchanging resources, reinventing business models previously

unexplored by the firms on their own during the pre-crisis, and donating resources. Third, the results are in line with the virtual social capital in the organizational resilience thesis, with virtual engagement with the community allowing to share tangible and intangible resources and redesign strategies adapted to virtual and socially distanced business models, thanks to the use of communication tools.

The remainder of the article is organized as follows. Section "Literature Review" points out the theoretical framework. Section "Data and Research Methodology" presents the data, research methodology and explores the relationship between the SME sector and the business environment at the peak of the pandemic shock, and the final section concludes the article.

Literature Review

The conceptualization of business resilience is in its infancy stage. The advancement of knowledge on resilience covers five disconnected streams with unclear boundaries, significant gaps, and findings with lack of consensus across disciplines (Linnenluecke, 2017; Saad et al., 2021).

Despite the complexity of framing resilience accurately, business resilience has become a paramount topic since the pandemic. The rapid spread of COVID-19 and the new variants of the same virus increased uncertainty about how quickly the pandemic could be overcome, as the recovery overlapped with the resurgence of the pandemic waves. In this scenario, policymakers were forced to confront multidimensional challenges beyond purely health threats: rising public debt, rising inflation, food insecurity, setbacks of human capital accumulation, job loss, and business closures, all of which especially hit developing countries.

The Eradication of Rigidities for Building Resilience

The first stream in the field of business resilience develops the threat-rigidity thesis by applying the Theory of Action, where the threat is an environmental event (such as a natural disaster, crisis, or shock) that has imminent negative or detrimental consequences for an entity and whose rigidities, both internal and external, requires multi-level action. In a first-order response, rigidities wear down the internal harmony between individuals, groups, and departments (Staw et al., 1981), limiting the proper absorption of impacts. In a second-order reaction, external rigidities limit the organizational readjustments toward a more decentralized structure and an adaptive ideology to turn the business around (Meyer, 1982).

The Control of the Shock Effects for Building Resilience

The second stream concerns industrial and manufacturing disasters, and it is based on two main theories: the Normal Accident Theory and the High Reliability Organizing Theory. The Normal Accident Theory states that industrial accidents and high-risk technological failures are inevitable (Perrow, 1984) and the source of systemic failures

is the unresolved contradiction between internal failures from humans, organizational procedures, or technology (named HOT factors) and external difficulties to prevent failures from regulatory, infrastructure, and community preparedness outside the plant (named RIP factors) (Shrivastava, 1994; Shrivastava et al., 1988). However, applying the latter theory (Rochlin, 1999; Sutcliffe, 2011; Weick et al., 1999), high reliability organizations rather than avoiding zero errors learn to control minor but critical failures. In fact, high reliable organizations address challenging conditions with awareness processes and minor adjustments designed to forestall the escalation of effects and turn potential catastrophes into business continuity and social security (Sitkin, 1992; Weick & Roberts, 1993; Weick & Sutcliffe, 2001).

The Role of Communication to Transform Individual into Community Resilience

The third stream shows theoretical progress by testing metrics for measuring the concept of resilience and providing solid evidence and conclusive findings for the advancement of the practical and theoretical knowledge on the mechanisms by which resilience improves personal outcomes, such as job satisfaction, job performance, and psychological well-being (Avey, Avolio, et al., 2011; Lee et al., 2017; Mishra et al., 2017). This stream defines resilience as a psychological capacity to bounce back from adversity and uncertainty (F. Luthans, 2002; B. C. Luthans et al., 2014) through positive adaptation (F. Luthans, Youssef, et al., 2007; Weick et al., 1999; Wildavsky, 1988). The literature starts to show that resilience is not just a defensively reactive capacity against threats with creative problem-solving (F. Luthans, Youssef, et al., 2007), but a transformative proactive capacity that enables individuals to thrive on positive adjustment to change and feel at ease outside the comfort zone (Masten & Reed, 2002).

In this stream, most of the literature integrates resilience into the multidimensional construct of psychological capital (PsyCap). PsyCap is defined as the individual's positive psychological state of development, which consists of the HERO dimensions: (1) perseverance in achieving goals, and, when necessary, redirect paths toward goals in order to succeed (Hope); (2) confidence to take on and exert the necessary effort to succeed in challenging tasks (Efficacy); (3) when beset by problems and adversity, sustain and bounce back, and go beyond, to achieve success (Resilience); and (4) positive attribution about success now and in the future (Optimism) (F. Luthans, Youssef, et al., 2007, p. 3).

The widespread use of the PsyCap dimensions has provided theoretical and practical advancements in resilience (Avey, Avolio, et al., 2011; Harms & Luthans, 2012; Hobfoll, 2002; Luthans, Avolio, et al., 2007). Resilient individuals learn to cope with mistakes, failures, and setbacks (Avey, 2014; B. C. Luthans et al., 2014; Sweetman et al., 2011). Then, business developmental interventions focused on training PsyCap are crucial since it has been tested that positive PsyCap generates sustainable performance, helping organizations to maintain competitive advantages (B. C. Luthans et al., 2014). Thus, the literature is starting to consider the role of multiple levels of

PsyCap in predicting performance from a personal psychological capacity perspective (Avey, Reichard, et al., 2011; F. Luthans, 2002) to a team-level (Dawkins et al., 2021; Rebelo et al., 2018; Rego et al., 2019; Walumbwa et al., 2011) and an organizational-level PsyCap skill (Clapp-Smith et al., 2009; Salanova et al., 2012). Although these avenues are being opened, the conceptualization of the PsyCap construct beyond the individual level presents challenges to be applied across the levels in which individuals are nested within an organization (F. Luthans & Youssef-Morgan, 2017). For example, the collective actions of the people in the organization that make up the system response are not just the sum of resilient individuals that work together (Hamel & Välikangas, 2003; Horne & Orr, 1998; F. Luthans & Youssef-Morgan, 2017; Youssef & Luthans, 2005). As the Social Learning Theory states, new behaviors can be acquired by observing and imitating others in a social context (Bandura, 1977). Thus, organizations are able to develop a culture of resilience throughout the institution, teams, units, and departments, building mechanisms and tools for coping with unexpected risks (Everly, 2011) while maintaining desirable functions and outcomes amid the shocks (Lengnick-Hall et al., 2011).

The collective concept of resilience describes the ability of the society to work together to survive and recover from catastrophic impacts (Aldrich & Meyer, 2015; Quarantelli & Dynes, 1977), which means a succinct contribution to the concepts of resilience (Hamel & Välikangas, 2003; Salanova et al., 2012) and business resilience (Pham et al., 2021). Indeed, resilience involves interactions with the community (Aldrich & Meyer, 2015; Longstaff et al., 2010; Nicholls, 2012; Pfefferbaum et al., 2015). Social networks, social capital, and business management play a decisive role in increasing the resilience of businesses (Beninger & Francis, 2022; Pham et al., 2021). The sociology of work, especially interactionism, offers a theoretical framework for studying the coordination process within and between groups in a dynamic way (Tillement et al., 2009).

In contexts such as humanitarian or natural catastrophes, community resilience is the ability of social units to mitigate hazards, contain the effects of disasters, and carry out recovery activities in ways to minimize social disruptions and mitigate the effects of future crises (Bruneau et al., 2003). Thus, resilient communities join efforts to foster recovery and more quickly regain a normal function, named "new normal," which could be above or below the ex-ante distribution, but always avoiding the deep and cascading consequences (White et al., 2015). More emphatically, a resilient community coordinates activities of groups that goes from multinational corporations, small entrepreneurs, government agencies, academic researchers, and community- and faith-based organizations with widely divergent interests (Tierney, 2015) that require communication, for example, between the scientific and policy domains (Cash et al., 2003). These studies support that the concept of resilience has evolved into a set of networked adaptive capacities that contribute to social capital, community competence, effective communication, and economic development (Norris et al., 2008).

Literature about the most recent disasters integrates communication and media (sources and processes) with the community (attributes and relationships) with the aim to develop a community resilience model (Houston et al., 2015). For example, natural

disasters affected corporate philanthropy (Tilcsik & Marquis, 2013) and firms around the globe provided donations during the public health crisis (Beninger & Francis, 2022). But the literature of pre-pandemic shocks did not identify any direct link between virtual communication and business resilience and community resilience yet (Reynolds, 2010). During COVID-19, technological platforms gave customers access to products bringing business resilience to Indonesian startups (Aldianto et al., 2021). Moreover, there is empirical evidence that business resilience and community resilience are mutually interlinked through virtual communication that create inter-firm relations for building resilience, for the community and for the firm (Zhang & Sung, 2021).

The Redesign of Operations and Functions to Build Resilience

The fourth research stream on business resilience is focused on the management of business functions and activities affected by unexpected shocks. Shocking turbulence could compromise the operational functions of an organization and could force it to redesign strategies and business models to fit the needs of the crisis. In this stream, the empirical studies are focused on building "organizational shock absorbers" over time, such as financial reserves, which allow reduced unit costs by redesigning more viable business models that minimize losses and reduce the extent of lay-offs (Gittell et al., 2006).

The Onset of the Supply Chain Resilience Stream

The fifth research stream on business resilience considers the business network with suppliers and providers (Linnenluecke, 2017). In this context, business resilience focuses on avoiding supply chain disruptions to prevent market collapse, securing the provision of goods and services (Ivanov & Dolgui, 2020), and recovering from unexpected events by maintaining continuity of operations at the desired level of connection and control over structure and function (Ponomarov & Holcomb, 2009). Besides the differentiation of short-but-frequent from long-but-rare disruptions (Ellis et al., 2011; Thomas & Tyworth, 2006), the complexity, density, and criticality of the nodes of each of the supply chain partners represent pressing concerns in the design of resilience in the entire supply chain network of firms involved in the production system (Craighead et al, 2007; Klibi et al., 2010; Martins, et al., 2019).

There is an extensive body of theoretical research on the conceptual framework of supply chain resilience which focuses on the factors to assess vulnerabilities and mitigate risks, such as integrative logistics management among partners and clients, diversification, good tandem robustness-efficiency, agility and/or flexibility (Christopher & Peck, 2004; Kleindorfer & Saad, 2005); visibility and collaboration (Jüttner & Maklan, 2011); capacity, adaptability, anticipation, recovery, dispersion, organization, market position, security, and financial strength (Pettit et al., 2013). However, empirical research on supply chain resilience is quite limited. Vanpoucke and Ellis (2018) tested that firms use two mitigation tactics (into buffer- and process-oriented) to build supply

chain resilience. Buffer tactics rely on excess or redundant resources, increasing product variety and decreasing product cycle time, while process tactics are supplier certifications and monitoring and auditing protocols to standardize, simplify, and harmonize quality. There is also empirical evidence at the firm level, without studying the entire supply chain, that the most hazardous industrial facilities are located in communities of lower socioeconomic status, which register higher accident and injury rates that affect the entire supply chain (Kleindorfer & Saad, 2005). Kleindorfer and Saad (2005) also tested different risk management programs (RMP), which are a set of protocols enacted in the 1990 USA Clean Air Act Amendment aimed at preventing and minimizing consequences associated with chemical manufacturing accidents, and fewer accidents are likely to occur if the RMP aims to improve the air quality versus the RMP that improves transparency to the general public about hazardous chemicals used in the facilities, and versus the RMP that manages processes of safety standards. In addition, it seems that the financial aspects of the firm are crucial in mitigating risks, as the higher the debt-equity ratio, the higher the number of disruptive accidents and injuries, while the higher the turnover, the lower the accident and injury rates (Kleindorfer & Saad, 2005).

The review of the resilience literature highlights that the theoretical advancement of knowledge in supply chain disruptions is starting to integrate multiple disciplines and merge the aforementioned streams to examine underexplored contexts. As an example, the facets of social capital that brings resilience in SMEs versus big corporations, include geographic proximity among decision-makers, low hierarchy, and close, committed, and respectful employee relationships (Polyviou et al., 2020).

The Virtual Communication to Build Business Resilience and Community Resilience

Overall, our article contributes to understanding the resilience response of small businesses in an emerging economy to the massive shock caused by the pandemic. The type of risks has huge implications for inferring the best kind of response for building business resilience after the COVID-19 catastrophe happened. Delving into statistical patterns, two main groups of risks could be observed: the "known–unknowns" and the "unknown–unknowns" (Vegh et al., 2018). The probability of the former, the known–unknown risks, is predictable because it follows a known stochastic distribution, and then, we can easily be insured against it (Knight, 1921). The known–unknown business risks are events in which extreme circumstances occur precisely and are symmetrically distributed outside any boundary around the mean, and could be explained either with the Normal Accident Theory (Perrow, 1984), such as engine failures or car accidents; by shaping a q-Gauss distribution, such as stock prices of commodities from 1928 to 2018 in emerging countries in Latin America (Vegh et al., 2018); or by following a power-law type distribution in which most of the observations are clustered in the early part of the distribution and the frequency quickly drops to display a very long tail with seemingly no mass below it, as observed with sudden reversals of

private capital inflows (Calvo, 1998; Edwards, 2004; Eichengreen & Gupta, 2016) and natural disasters, such as devastating earthquakes and hurricanes (Loayza et al., 2012). A key policy implication for the known–unknown business risks is that the fatter the distribution tails, the less market insurance is available, and thus the more important ex-ante proactive actions are to recover a dynamically stable state to meet the organization's goals in the market. In contrast, the unknown–unknown risks, named black swans in Taleb's terminology, are highly improbable events that provoke giant and unimaginable devastating shocks. In addition, black swans are threats, whose risks are very hard to detect and assess, and since there is not an ex-ante stochastic distribution, we cannot be insured against them (Taleb, 2007; Vegh et al., 2018). COVID-19 is the last black swan to be added to the list of eleven black swans previously registered in history (Vegh et al., 2018). But this pandemic has had an unprecedented magnitude of global effects (IMF, 2022) and is presenting cascading effects (Robinson et al., 2021). The public policy implications for black swans traditionally were limited to providing fast post-shock aid to minimize human and economic impacts. However, after the black swan of the 9/11 attack on the Twin Towers, protocols of benchmarking practices were newly recommended as an ex-ante aid to build resilience potential. Indeed, building a latent organizational response is emerging as a tool that strengthens engagement and cooperation between institutions, the private sector, and civil society (Burnard & Bhamra, 2011; Linnenluecke, 2017) along with building knowledge about the catastrophe.

As soon as COVID-19 forced a global lockdown, some developed countries provided fast financial aid, addressed mainly to small businesses, to help them cover operational costs while demand was frozen. Knowledge building is crucial in any black swan event, but clearly, in the case of COVID-19, science is saving lives with trend analysis of infections, and the discoveries of COVID-19 vaccines. In this context, business recovery started to be in the scope of the second line of priorities of actions to restore and build prosperity during the pandemic.

The aim of this work is precisely to shed light on understanding how virtual social capital has contributed to business resilience during the pandemic. More importantly, this article explores the connection between business resilience and community resilience. The empirical analysis of this article focuses on a large sample of SMEs in an emerging economy with scarce logistic infrastructure and in the process to activate mechanisms to facilitate an early financial response to the crisis during the lockdown. The social isolation derived from social distancing and quarantines changes the way business was conducted around the world. Non-frontline health aid businesses were forced to serve clients only virtually and suffered material shortages. In this scenario, inter-firm relations were nurtured thanks to telecommunications using virtual ways to work with employees, customers, suppliers, partners, organizations, and charitable institutions.

Data and Research Methodology

Our empirical analysis uses data collected between July and August 2020 in Algeria, using the COVID-19 Business Pulse Survey designed by the World Bank. The Business Pulse Survey is aimed at providing economic information about the effects of the pandemic on businesses. Our analysis provides a comprehensive assessment of the damage caused by the pandemic, the factors that affected normal operations during the pandemic, and the adjustments mechanisms that firms adapted to overcome the negative effects of the lockdown.

A good description of the firms surveyed in Algeria requires mentioning the size, the type of employees, and the activity carried out in those businesses. The sample includes 120 small firms (between 5 and 19 employees), 185 medium-sized firms (between 20 and 99 employees), and 114 large firms (with 100 or more employees). Among the 431 firms surveyed, only 22 (5.1%) firms are led by female entrepreneurs and 408 (94.9%) by male entrepreneurs. The sample also considers the nationality of the shareholders: 408 (97.37%) are domestic firms and 11 (2.63%) belong to international investors. As workers, women represented 19.34% of the full-time labor force and only 4.37% of the part-time jobs at the end of 2019. At the time the survey was conducted, 54 (12.74%) of the firms surveyed were young businesses, 149 (35.14%) were mature, and 221 (35.14%) were well-established Algerian businesses that operate in all sectors of the economy. The survey represents a good picture of the Algerian industry, which has been classified into construction and heavy industry (which account 29% of firms), manufacturing companies (47.56%), transportation and services (21%), and other industries (3%). Figure 2 presents some descriptive statistics for the firm-level indicators, detailed according to the status of operations at the time of the survey.

At the time of the survey, 19% of businesses were partially open and 5% were partially closed by mandate, whereas 9% of businesses were temporarily closed by choice, and 1% had closed permanently (accounting only for businesses that closed after January 15th, approximately 15 weeks or less at the time of the survey). Fortunately, most businesses (67%) remained open (Figure 1). Figure 1 suggests that at least 33% of businesses faced a high level of vulnerability. Workers in vulnerable businesses are those employed in firms that have temporally closed or are partially open, since these are the firms that are more likely to have liquidity problems and eventually close. The vulnerable workforce constitutes a large group of workers, mainly young entrepreneurs (44%) and mature entrepreneurs with a long experience in the market (32%), located in the Centre and West areas of Algeria (32%), medium and large firms (32%), businesses located in an industrialized area (36%), and foreign firms (45%) (Figure 2).

The impact on sales was large, widespread, and heterogeneous. Indeed, 79% of businesses experienced a decline in sales in June 2020 relative to the same month in 2019 (Figure 3), and the estimated average change in sales was −56%, while the median decline was 50% (Table 1). The decline in sales was widespread across size, top management's gender, sectors, regions, age, business location, and shareholders' foreignness, the drops of which were very heterogeneous, ranging from −100% (for
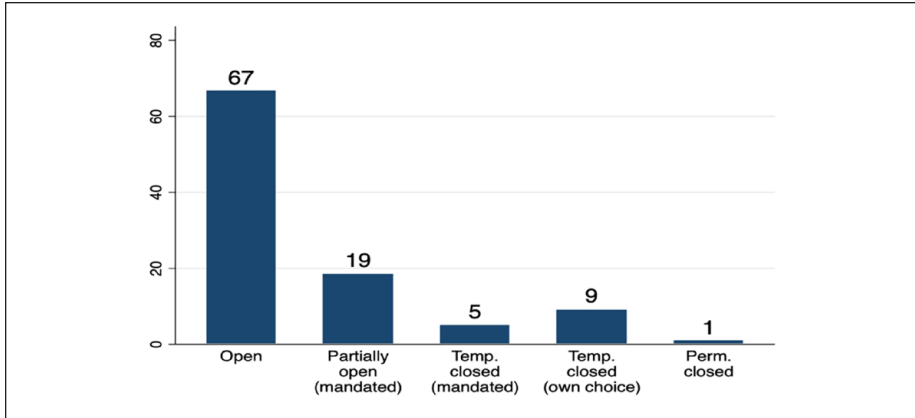
Figure 1. Percentage of firms across status of operations at the time of the survey.

the 10th percentile) to grow 10% (for the 90th percentile) for firms that operates in sectors other than construction, heavy industries, manufacture, and firm services (Table 1).

However, the business characteristics explain only a small fraction of the heterogeneity observed in the reduction in sales resulting from the COVID-19 shock, which implies that the shock affects similar firms differently. The survey suggests significant heterogeneity in the shock to firm sales. The interaction of size, formality status, sector, region, age, and export status only accounts for 29.8% of the deviations of sales reductions from the overall mean and cannot explain the remaining 70.1%. To obtain this estimate, the percentage change in sales is regressed on dummies for the interaction of size, formality status, sector, region, age, and export status, and calculate both the prediction from the regression (the explained component) and the residual (the unexplained component). For each observation, the deviation of the fall in sales from the overall mean is decomposed into unexplained deviations (deviations from the linear prediction) and deviations accounted for (deviations of the linear prediction from the overall mean):

$$y_i - \underline{y} = [y_i - \hat{y}_i] + [\hat{y}_i - \underline{y}],$$

where y_i corresponds to the change in sales for business i, $\hat{y}_i$ is the prediction from the linear regression, and $\underline{y}$ is the overall mean. The ratio of each component to the deviation from the overall mean is computed and averaged across all observations (using sampling weights). Thus, Kernel density estimates of the distribution of the change in sales, the change in sales predicted by a linear regression, and the residual of the regression (Figure 4).
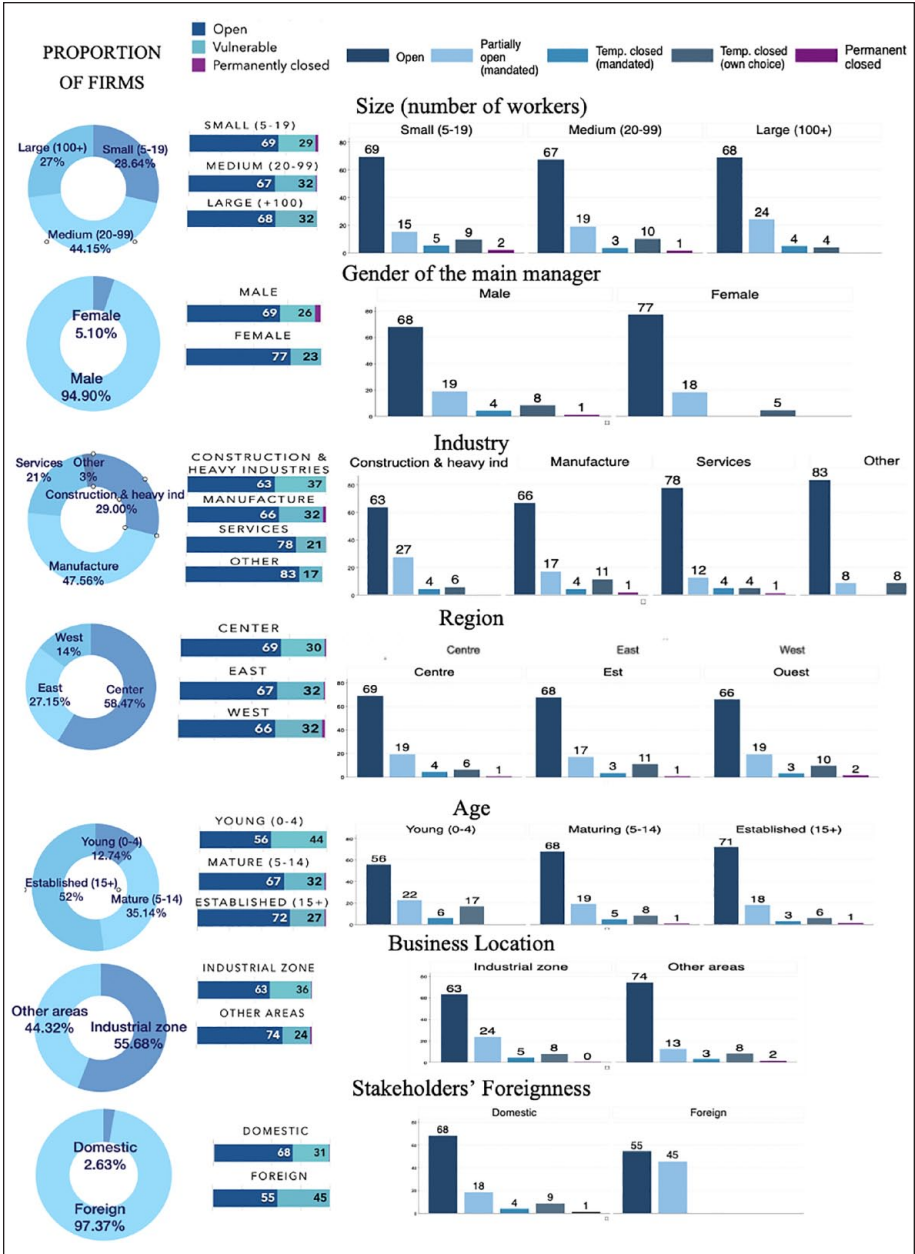
Figure 2. Heterogeneity in the proportion of jobs in businesses affected by the pandemic.
Note: The total number of paid jobs adds the number of full-time paid jobs and half the number of part-time jobs. The estimate of the number of jobs in permanently closed businesses only includes those that closed after January 15th (approximately 15 weeks or less at the time of the survey).
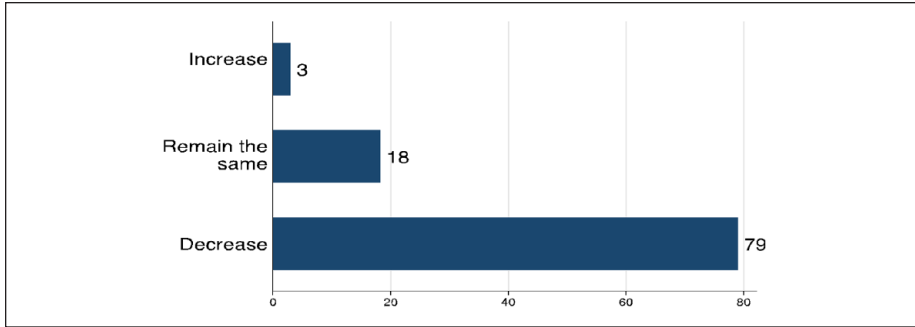
Figure 3. Fraction of businesses that experienced a change in sales during the 30 days before the survey relative to the same period in 2019.

Table 1. Change in Sales: Average and Percentiles from the Distributions Across Characteristics of the Business (%).

	Average growth (%)	10th percentile (%)	25th percentile (%)	Median growth (%)	75th percentile (%)	90th percentile (%)
Total	−56***	−90***	−80***	−50***	−40***	−20
Small (5–19)	−61*	−100	−80*	−60*	−40*	−30*
Medium (20–99)	−55	−90	−80	−50	−34	−20
Large (100+)	−49*	−80*	−70**	−50**	−30**	−20**
Male	−55	−90	−80	−50	−35	−20
Female	−61	−80	−80	−60	−50	−40
Construction and heavy industries	−59	−85	−80	−60	−40	−25
Manufacture	−54	−90	−80	−50	−30	−20
Services	−56	−90	−80	−50	−40*	−28
Other	−51	−100	−80	−55	−23	10***
Center	−55	−90	−80	−50	−35	−25
East	−55	−90	−80	−60	−38	−20
West	−59	−90	−80	−60	−50	−30
Young (0–4)	−54	−85	−75	−50	−35	−25
Mature (5, 14)	−60*	−95	−80*	−60*	−40*	−25*
Established (15+)	−53	−90	−80	−50	−30	−20
Industrial zone	−52*	−85	−80	−50*	−32*	−20*
Other zone	59*	−90	−80	−60*	−40*	−30*
Domestic	−56	−90*	−80	−52	−40	−20
Foreign	−48	−80*	−60	−45	−36	−20

Significance levels: *10%; **5%; ***1%

The employment response to the shock was dominated by a reduction in the number of working hours and, to a lesser extent, the granting of paid leave. During the pandemic, 40% of businesses reduced the hours worked of at least one employee
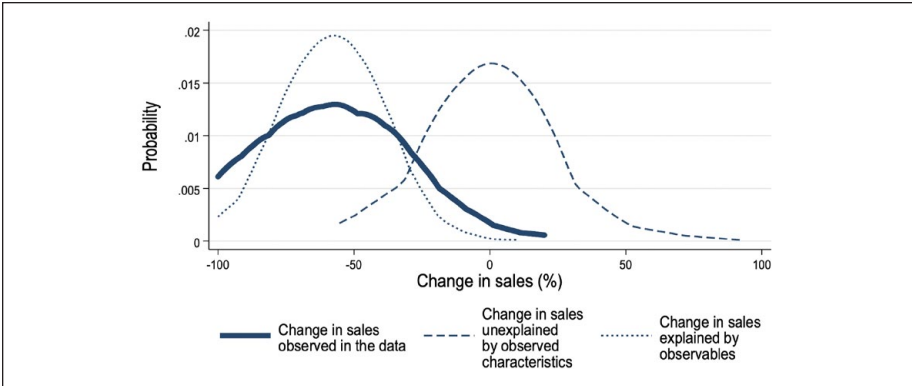
Figure 4. Estimated distribution of the change in sales during the 30 days before the survey relative to the same period in 2019.
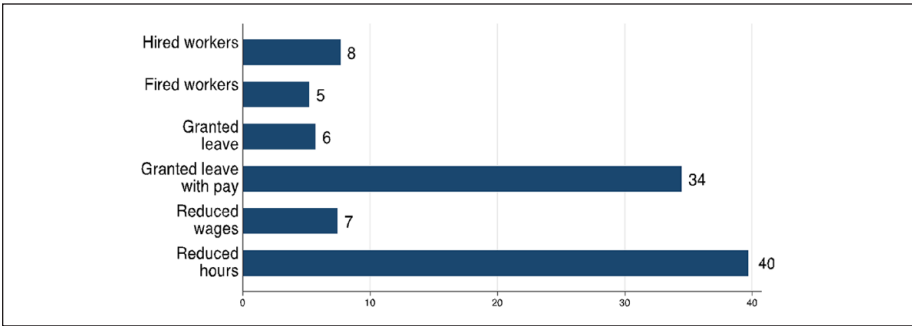

Figure 5. Percentage of businesses reporting at least one employee in each category (excluding permanently closed businesses).

(Figure 5), affecting 21% of the employment with working hours reduced (Figure 6), while 34% of businesses granted leave of absence with pay at least one employee (Figure 5) which affected 53% of the employment (Figure 6). Small- and medium-sized firms especially adjusted the hours of their employees, with 52% and 46% of their workers experiencing a reduction, respectively (Table 2). The second most frequent mechanism for firms labor adjustment was granting a leave of absence, which impacted 11% of its workers, 4% without pay. The third most frequently used adjustment mechanism was the reduction in wages used by 7% of the employers, which affected 12% of the employment covered by the survey. This adjustment suggests that the margin of response that firms adopt is constrained by labor regulations, with informal and agricultural firms adopting significantly different approaches regarding their employment responses. More importantly, job losses at the time of the survey were

Table 2. Estimated Fraction of Firms Affected by Margin of Labor Adjustment to the Shock (%).

Characteristics	Workers hired (%)	Workers laid-off (%)	Workers granted leave of absence (%)	Workers granted leave of absence with pay (%)	Workers with wages reduced (%)	Workers with hours reduced (%)	Workers in permanently closed businesses (%)
Total	2	1	4	7	12	37	0
Small (5–19)	0	3	8	33	11	40	0
Medium (20–99)	1	4	7	37	11	35	0
Large (100+)	0	1	8	31	5	41	0
Male	3	1	3	10	9	33	3
Female	1	2	7	7	18	51	3
Construction and heavy industries	0	1	1	2	14	20	1
Manufacture	1	2	5	6	11	41	2
Services	2	1	3	7	13	53	1
Other	4	2	6	14	16	45	5
Center	4	2	6	10	13	50	4
East	2	1	3	7	13	53	5
West	0	1	4	7	14	31	1
Young (0–4)	0	3	4	4	16	58	3
Mature (5, 14)	2	2	5	7	12	52	2
Established (15+)	2	1	5	9	14	36	3
Industrial zone	4	3	5	10	16	50	0
Other zone	2	2	5	8	13	40	3
Domestic	4	2	2	5	12	52	2
Foreign	2	1	8	31	5	41	3
Internet sale	3	1	5	11	2	29	NA
Non-Internet sales	2	1	4	15	4	21	NA
Internet delivery	0	1	3	5	1	3	NA
Non-Internet delivery	5	2	6	22	5	47	NA

Note. To estimate the fraction of workers affected, the total number of paid workers is computed adding the number of full-time paid workers and half the number of part-time workers.
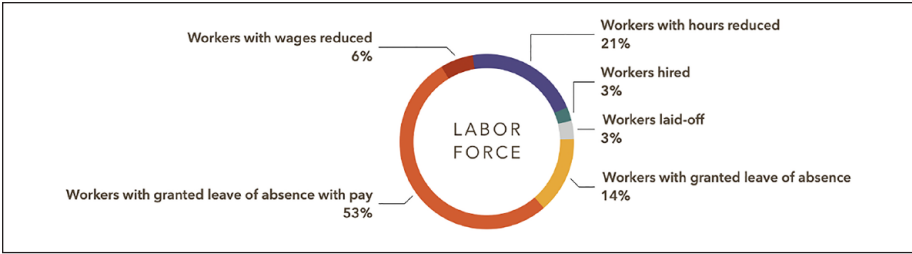
Figure 6. Share of workers affected by labor adjustments to the shock.
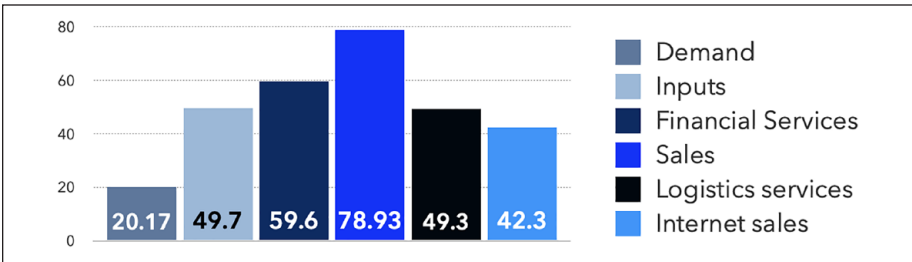

Figure 7. Proportion of firms affected by shocks (aggregate).

estimated at 5%, 1% in permanently closed firms, and 2% in firms still open or temporarily closed. Job losses in SMEs were higher than in larger businesses (Table 2).

COVID-19 caused disruptions in core business functions, but mainly in sales (79%) and financial services (60%) (Figure 7). However, communication through technologies seems to be the main tool not only to build business resilience, but also community resilience to the COVID-19 shock. Indeed, COVID-19 increased the use of the Internet in businesses (Tables 3 and 4 and Figures 8 and 9).

Table 5 reports the variables used in the probit analysis. Tables 6–8 report for each dependent variable, the maximum likelihood estimation of the coefficients of the probit regression model $Y^* = X\beta + \varepsilon$, $\varepsilon \sim N(0, \sigma^2)$, whereas $Y_i = \{0 \text{ if } y_i^* \leq 0, 1 \text{ if } y_i^* > 0\}$, in which we are testing the probability of the successful outcome that is i $Y_i = 1$ (Korn & Graubard, 1990). We compare three sets of models classified by the independent variables. Thus, the first set of models analyzes the influence of solidarity provided to other firms through intern-firm relations (models from 1 to 5), the second set of models analyzes the influence of solidarity received from other firms through intern-firm relations (models from 6 to 9), and the third set of models analyzes the influence of donations provided to other firms through intern-firm relations (models from 10 to 11).

More in detail, the first set of probit regression models measures the probability of the two shocks that firms suffered during the pandemic (sales and employment) and a

Table 3. Descriptive Statistics.

Variable	Mean	Std. Dev.	Min	Max	Obs
Dec_sales	0.7099768	0.4543001	0	I	431
Inc_leavw	0.5011601	0.5005797	0	I	431
Inc_leavwo	0.2412993	0.4283687	0	I	431
IntPayment	0.1034483	0.3052964	0	I	203
IntDelivery	0.1231527	0.3294248	0	I	203
Inc_SalaryRed	0.136891	0.3441316	0	I	431
ExtendPay	0.3426966	0.475279	0	I	356
ExceptDelProv	0.4456825	0.4977346	0	I	359
Disposalgss	0.7897727	0.40805	0	I	352
OthHelpProv	0.9651568	0.1837029	0	I	287
DeferPay	0.6639344	0.4730083	0	I	366
ExceptDelRec	0.6731302	0.4697203	0	I	361
Availabgss	0.902507	0.297042	0	I	359
OthHelpRecv	0.9830508	0.1293002	0	I	295
DonateProd	0.5994398	0.4906997	0	I	357
DonateMoney	0.6436782	0.4796015	0	0	348
ProdCost	0.8426966	0.364599	0	I	356
OthDonation	0.7403846	0.4391279	0	I	312

mechanism of resilience (the inter-firm relations with Internet use) conditional to the covariate of help provided to other firms (*ExtendPay*, *ExceptDelProv*, *Disposalgss*, and *OthHelpProv*). The second set of probit regression models measures the probability of the two shocks that firms suffered during the pandemic (sales and employment) and a mechanism of resilience (the inter-firm relations with Internet use) conditional to the covariate of help received from other firms (*DeferPay*, *ExceptDelRec*, *Availabgss*, and *OthHelpRecv*). And finally, the third set of probit regression models measures the probability of the two shocks that firms suffered during the pandemic (sales and employment) conditional to the covariate of donations provided to other firms (*DonateProd*, *DonateMoney*, *ProdCost*, and *OthDonation*).

Models 1 and 6 have the dummy variable *Dec_sales* as the dependent variable, which represents the decrease in sales. Models 2, 3, and 8 have as dependent variables three dummy variables that represent mechanisms of adjustments during the confinement, since the employers reorganized their human resources while businesses were frozen, forcing some employees to have paid leave of absence (*lnc_leavw*), and/or to keep redundant workers fully paid (*Redundantcov*) and/or to reduce salaries (*SalReduct*). Models 4, 5, and 10 have as dependent variables two dummy variables that represent the Internet as a business and community resilience tool for doing sales (*IntSales*) (Models 4 and 10) or other activities (*IntOth*) (Model 10).

When we shift the focus to the results of the probit model estimations, we present in Table 6 five versions of the baseline specifications of the inter-firm relations for

Table 4. Matrix of Correlations.

|	Dec_sales	Inc_leavw	Inc_leavwo	Int Payment	Int Delivery	Inc_ SalaryRed	Extend Pay	ExceptDel Prov	Disposalgss	OthHelp Prov	DeferPay	Except DelRec	Availabgss	OthHelp Recv	Donate Prod	Donate Money	Prod Cost	Oth Donation
Dec_sales	1																	
Inc_leavw	.122	1																
Inc_leavwo	.0863	.0773	1															
IntPayment	-.0861	-.0074	.1727	1														
IntDelivery	-.0747	.0472	-.0127	-.1229	1													
Inc_SalaryRed	.0765	.1604	.1452	-.0436	-.0121	1												
ExtendPay	-.0562	-.1582	-.0045	-.0846	.0535	-.0794	1											
ExceptDelProv	-.0222	-.107	-.1374	-.0931	-.0303	-.1047	.3951	1										
Disposalgss	-.1021	-.3898	-.0235	.0569	-.0958	-.2143	.1792	.1368	1									
OthHelpProv	-.074	-.0347	.0952	.0473	.0568	-.096	-.0206	.0117	.1544	1								
DeferPay	-.066	-.1268	.0585	-.0498	.0852	.07	.3187	.2751	.0579	-.0159	1							
ExceptDelRec	-.0509	-.1651	-.0418	-.0855	.1011	.041	.2443	.2158	.0336	-.0222	.4783	1						
Availabgss	-.0796	-.1574	.0713	.002	.0329	-.054	.1185	-.0502	.3468	.1401	.2594	.1903	1					
OthHelpRecv	.0493	-.1339	.0952	.0473	.0568	-.096	.0903	.0117	.1544	.6594	-.0159	-.0222	.1401	1				
DonateProd	.0884	-.114	.0169	-.0547	.0798	-.1607	.2446	.2647	.2064	.0879	.0471	.1625	.1552	.1896	1			
DonateMoney	.0216	.0029	.163	-.012	.0417	-.0648	.1885	.1199	.0969	-.0326	.1798	.227	-.0466	-.0326	.3714	1		
ProdCost	-.0181	-.0782	-.0435	-.0931	-.0827	-.04	.0948	.1135	.1651	-.0723	.0962	.1108	.1264	-.0723	.4396	.2202	1	
OthDonation	-.075	.0234	-.0016	-.0484	-.0313	-.0954	.1584	.1251	.2867	.0312	.0303	.0053	.268	.0312	.1074	.1322	.0187	1
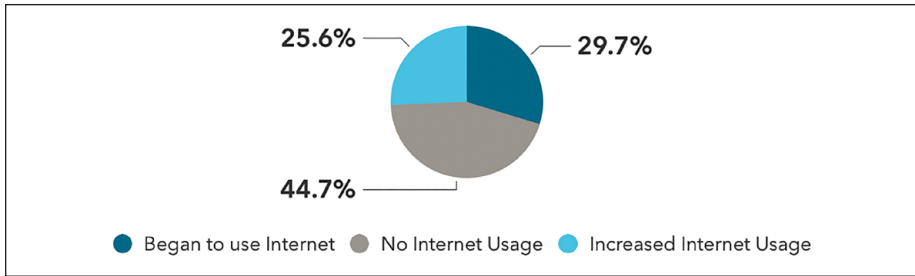
Figure 8. Proportion of firms that use the Internet.
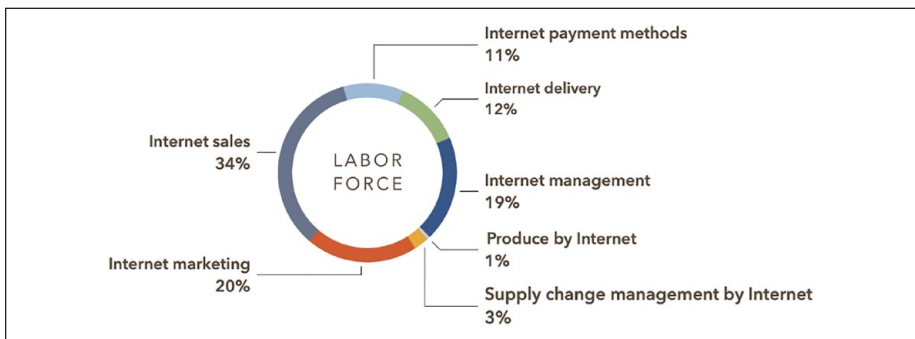

Figure 9. Proportion of firms that use the Internet.

providing help to other firms. In Model 1, there are two key firm-specific variables that matter to provide business resilience in terms of reducing the probability of sales decline. The *ExtendPay* and *Disposalgss* are significant and negatively related to the dummy variable decrease in sales (*Dec_sales*). The results suggest that firms are more likely to reduce the loss of sales the more they helped customers by voluntarily extending the payment period for purchased goods or services if the customer requested it. In particular, a 1% increase in the number of firms that provided an exceptional extension of payments during the pandemic (*ExtendPay*) reduced Pr(Y=1), the z-score of a number of firms whose sales decreased during the pandemic by .491 (*Dec_sales*). In addition, assisting other companies by making a firm's own resources available to other firms is an important factor in reducing the loss of revenue during the pandemic. Specifically, a 1% increase in the number of firms providing their own resources to other firms during the pandemic (*Disposalgss*) will reduce Pr(Y=1), the z-score of the number of firms whose sales decreased during the pandemic by .418 (*Dec_sales*).

Regarding paid absent employees (*Inc_leavw*), the results and conclusions for *ExtendPay* and *Disposalgss* are in line with those for decrease in sales. The ExtendPay and Disposalgss are significant and negatively related to the dummy variable paid

Table 5. List of Variables.

Variable		Description
1	*Dec_sales*	Dependent variable of Model 1 (Table 6) and Model 6 (Table 7) in the probit regression model. Dec_sales is a dummy variable that measures whether a firm has decreased sales by doing a comparison between the second quarter of 2020 and the second quarter of 2019. On average, 71% of firms in the sample reported decreases in sales during the pandemic.
2	*Inc_leavw*	Dependent variable in Model 2 (Table 6) and Model 7 (Table 7). Inc_leavw is a dummy variable that measures whether a firm has workers on leave of absence who received full pay during the pandemic at any time within the 15 weeks prior to the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). Half of the firms surveyed (50.11%) paid at least one employee on a leave of absence during the pandemic (50.12% of the respondents).
3	*Redundantcov*	Dependent variable in Model 3 (Table 6). Redundantcov is a dummy variable that measures whether a firm has any worker whose post, due to the pandemic, has become redundant to functions performed by other employees. These redundant and unnecessary workers were paid in full by the company for the entire period of time between the 15 weeks before the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). On average, 16.47% of the firms surveyed paid the full salary to at least one employee whose job became redundant during the pandemic (same percentage for respondents).
4	*SalReduct*	Dependent variable in Model 8 (Table 7). SalReduct is a dummy variable that measures whether a firm has reduced the salaries, wages, or benefits of any employee during the pandemic at any time between the 15 weeks prior to the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). The mean value of the number of firms reducing salaries, wages, or benefits of at least one employee was 16.47% among the surveyed (same percentage for respondents).
5	*IntMK*	Dependent variable in Model 9 (Table 7). IntMK is a dummy variable that measures whether a firm began using the Internet for Marketing activities during the pandemic, at any time between the weeks before the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). The average number of firms that became new Internet users during the pandemic and used it for doing Marketing campaigns was 49.26% of respondents (23.20% of surveyed).
6	*IntSales*	Dependent variable in Model 4 (Table 6). IntSales is a dummy variable that measures whether a firm started selling products and/or services over the Internet at any time between the 15 weeks prior to the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). The average number of firms that became new Internet users during the pandemic and used it for selling products and/or services was 44.33% among respondents (20.88% of surveyed).
7	*IntOth*	Dependent variable in Model 5 (Table 6). IntOth is a dummy variable that measures whether a firm started using the Internet for any other function other than marketing, sales, production, supply chain management, or providing online payment systems, at any time between the 15 weeks before the start date of the survey (July 1, 2020) and the date the survey was conducted (between July and August 2020). The average number of firms that became new Internet users during the pandemic and used it for other uses other than marketing, sales, production, supply chain, or payments was 9.85% among respondents (4.64% of the surveyed).

(Continued)

Table 5. (Continued)

Variable		Description
8	*ExtendPay*	Independent variable in Models 1–5 (Table 6). ExtendPay is a dummy variable that measures whether a firm helped customers, during the second quarter of 2020, by voluntarily extending the payment period of its goods or services if the customer requested it. This variable is a proxy for the financial solidarity provided in inter-firm relationships, as it requires the firm to absorb the costs and risks of providing this help and/or cooperate with partners to get this financial flexibility. The mean value of this variable was 34.27% among respondents (28.31% of the surveyed).
9	*ExceptDelProv*	Independent variable in Models 1–5 (Table 6). ExceptDelProv is a dummy variable that measures whether a firm helped customers, during the second quarter of 2020, by providing exceptional delivery services to customers due to a lack of transportation services. This variable is a proxy for logistic solidarity provided in inter-firm relationships, because it requires the firm to absorb the costs and secures the resources to provide exceptional logistics services itself or through the cooperation with partners to provide logistic services. The mean value of this variable was 44.57% among respondents (37.12% of the surveyed).
10	*Disposalgss*	Independent variable in Models 1–5 (Table 6). Disposalgss is a dummy variable that measures whether a firm helped other companies, during the second quarter of 2020, by putting its own resources (such as inputs, raw materials, utilities, distribution capacity, spare parts, human resources, and services) at their disposal. This variable is a proxy for the asset solidarity provided in inter-firm relationships as making assets available to other firms reduces the constraints of outputs based on the availability of factors of production. The mean value of this variable is 78.98% among respondents (64.50% of the surveyed).
11	*OthHelpProv*	Independent variable in Models 1–5 (Table 6). OthHelpProv is a dummy variable that measures whether a firm helped other companies, during the second quarter of 2020, with support other than financial, logistics, or asset assistance. This variable is a proxy for any type of solidarity provided in inter-firm relationships not captured with the variables ExtendPay, ExceptDelProv, and Disposalgss. The mean value of this variable is 96.52% among respondents (64.27% of the surveyed).
12	*DeferPay*	Independent variable in Models 6–9 (Table 7). DeferPay is a dummy variable that measures whether a firm during the second quarter of 2020benefited from voluntary deferral of payments to suppliers whenever requested. This variable is a proxy for financial solidarity received in inter-firm relationships, as it provides the firm with the capacity to absorb cash-flow fluctuations. The mean value of this variable was 66.39% among respondents (56.38% of the surveyed).
13	*ExceptDelRec*	Independent variable in Models 6–9 (Table 7). ExceptDelRec is a dummy variable that measures whether a firm received support, during the second quarter of 2020, from companies by receiving exceptional delivery services due to the firm's lack of means of transportation. This variable is a proxy for logistic solidarity received in inter-firm relationships, as partners absorb the costs and secure the resources to provide exceptional logistic services themselves or through cooperation with partners to provide logistic services to the client firm. The mean value of this variable was 67.31% among respondents (56.38% of the surveyed).

(Continued)

Table 5. (Continued)

Variable		Description
14	*Availabgss*	Independent variable in Models 6–9 (Table 7). Availabgss is a dummy variable that measures whether a firm received help, during the second quarter of 2020, from companies by making their resources available to the firm (such as inputs, raw materials, utilities, distribution capacity, spare parts, human resources, and services). This variable is a proxy for asset solidarity received in inter-firm relationships, by making assets available to the firm, which reduces output constraints based on the availability of factors of production. The mean value of this variable was 90.25% among respondents (75.17% of the surveyed).
15	*OthHelpRecv*	Independent variable in Models 6–9 (Table 7). OthHelpRecv is a dummy variable that measures whether a firm, during the second quarter of 2020, received help from other companies with support other than financial, logistic, or asset assistance. This variable is a proxy for any type of solidarity received in inter-firm relationships not captured by the variables DeferPay, ExceptDelRec, and Availabgss. The mean value of this variable is 98.31% among respondents (67.28% of the surveyed).
16	*DonateProd*	Independent variable in Models 10 and 11 (Table 8). DonateProd is a dummy variable that measures whether a firm donated, during the second quarter of 2020, the production of goods or services to institutions or associations. This variable is a proxy for asset solidarity provided in inter-firm relationships, as providing final products to other institutions or associations reduced the constraints of outputs based on the availability of assets. The mean value of this variable was 59.94% among respondents (49.65% of the surveyed).
17	*DonateMoney*	Independent variable in Models 10 and 11 (Table 8). DonateProd is a dummy variable that measures whether a firm donated production, during the second quarter of 2020, to institutions or associations at zero price. This variable is a proxy for financial solidarity provided in inter-firm relationships, as providing money to other institutions or associations reduced the constraints of outputs based on monetarysupport. The mean value of this variable was 64.37% among respondents (51.97% of the surveyed).
18	*ProdCost*	Independent variable in Models 10 and 11 (Table 8). ProdCost is a dummy variable that measures whether a firm produced products for the health crisis at cost price during the second quarter of 2020. This variable is a proxy for a mix of asset, financial and social solidarity provided in inter-firm relationships, as providing health products with zero profit to partners and other institutions or associations reduces the constraints asset-support-based productions, amplifies the purchase power of first-line aid products priced at reduced costs, and supports the recovery from the health catastrophe by adding capacity to produce emergency goods and services. The mean value of this variable was 84.27% among respondents (69.61% of the surveyed).
19	*OthDonation*	Independent variable in Models 10 and 11 (Table 8). OthDonation is a dummy variable that measures whether a firm either donated, during the second quarter of 2020, assets other than products and services at zero price, money, or health products at cost price. This variable is a proxy for any kind of solidarity received in inter-firm relationships not captured by the variables DonateProd, DonateMoney, and ProdCost. The mean value of this variable was 74.04% among respondents (53.60% of the surveyed).

Table 6. Estimated Correlation between Change in Sales, Absence (paid and unpaid) Workers, and Help Provided to the Community.

	(1)	(2)	(3)	(4)	(5)
	Probit	Probit	Probit	Probit	Probit
	Decrease in sales	Paid absence workers	Redundant workers	Internet sales	Other functions on the Internet
ExtendPay	−.491** (.199)	−.465** (.191)	−.103 (.227)	−.077 (.256)	.538 (.326)
ExceptDelProv	.098 (.194)	−.214 (.18)	−.16 (.209)	−.327 (.238)	.222 (.32)
Disposalgss	−.418* (.237)	−1.064*** (.237)	−.076 (.226)	−.677** (.269)	.084 (.404)
OthHelpProv	.232 (.442)	.678 (.432)	.311 (.545)	.797 (.822)	−1.942 (.837)
Constant	.922** (.46)	.593 (.444)	−1.132** (.558)	−.162 (.801)	.211 (.792)
Observations	276	276	276	153	153
R-squared	.0354	.1110	.008	.052	.112
Wald test	11.00***	42.14***	1.96***	11.02**	10.98***

Note. Standard errors are in parentheses.
Significance levels: *10%; ***1%.
The Wald test reports the Wald χ^2 of the test of the covariance matrix of the original model.

Table 7. Estimated Correlation between more Usage of Internet, Absence of Paid Workers and Salary Reductions, and Help Received from the Community.

	(6)	(7)	(8)	(9)
	Probit	Probit	Probit	Probit
	Decrease in sales	Paid absence workers	Salary reductions	Internet marketing
DeferPay	−.338* (.198)	−.355** (.180)	.282 (.235)	−.235 (.246)
ExceptDelRec	−.225 (.193)	−.316* (.177)	−.122 (.222)	−.590** (.238)
Availabgss	.031 (.301)	−.333 (.289)	−.334 (.320)	.307 (.366)
OthHelpRecv	.919 (.580)		−1.387** (.570)	−.563 (.779)
Constant	.053 (.620)	.822*** (.276)	.419 (.610)	.806 (.818)
Observations	290	285	290	164
R-squared	.0306	.0426	.0836	.0145
Wald test	10.40***	16.79***	0.0365*	12.41**

Note. Standard errors are in parentheses.
Significance levels: *10%; **5%; ***1%.
The Wald test reports the Wald χ^2 of the test of the covariance matrix of the original model.

absent workers (*Inc_leavw*) (Model 2). In particular, a 1% increase in the number of firms that provide an exceptional extension of payments during the pandemic (*ExtendPay*) will reduce Pr($Y=1$), the *z*-score of the number of firms with paid absent workers during the pandemic by .465 (*Inc_leavw*). Besides, a 1% increase in the

Table 8. Estimated Correlation between more Usage of Internet, the Reduction to the Workers of Salaries, Wages or Benefits, and Charity Activities Provided to the Community.

	(10)	(11)
	Probit	Probit
	Internet sales	Paid absence workers
DonateProd	−.221 (.232)	.308 (.333)
DonateMoney	−.381* (.216)	−.651* (.317)
ProdCost	−.425 (.285)	.021 (.416)
OthDonation	.041 (.231)	−.830*** (.305)
Constant	.600*** (.288)	−1.300*** (.406)
Observations	166	166
R−squared	.0492	.1022
Wald test	11.29***	12.07***

Note. Standard errors are in parentheses.
Significance levels: *10%; ***1%.
The Wald test reports the Wald χ^2 of the test of the covariance matrix of the original model.

number of firms placing their own resources at the disposal of other firms during the pandemic (*Disposalgss*) will reduce $\Pr(Y=1)$, the *z*-score of the number of firms with paid absent workers during the pandemic by 1.064 (*Inc_leavw*). These results show evidence that by providing community resilience (with the extension of payments and the provision of assets to other firms), firms generated their own business resilience (with the reduction of both sales decrease and paid employees on leave, respectively). The provision of exceptional delivery services (*ExceptDelProv*) and other types of help provided during the pandemic (*OthHelpProv*) are not significant in any of the regressions. Furthermore, Model 4 suggests that firms are more likely to start selling products and services if the number of firms making their own resources available to other firms decreases. Besides, a 1% increase in the number of firms that provide their own firm resources to other firms during the pandemic (*Disposalgss*) will reduce $\Pr(Y=1)$, the *z*-score of the number of firms that started to use the Internet during the pandemic by 0.677 (*Inc_leavw*). This result alone is more difficult to interpret, but by observing Models 1–5, this result should tell us that firms during the pandemic targeted inputs, raw materials, utilities, distribution capacity, spare parts, services, and the outsourcing of human resources, to customers through traditional business tools versus new Internet customers. Models 3 and 5 do not provide any additional conclusions on the mechanisms that increase the probability of firms having redundant workers and other functions provided by the Internet during the pandemic.

We now shift our focus to the support received from other firms. Table 7 presents four versions of the baseline specifications of the inter-firm relations that led to support from other firms during the pandemic. In Model 6, there is one key firm-specific

variable that matters in providing business resilience in terms of reducing the probability of a decrease in sales. The *ExtendPay* is significant and negatively related to the dummy variable decrease in sales (*Dec_sales*). The results suggest that firms are more likely to reduce the loss of sales the more support they received from partners who voluntarily extended the payment period for goods or services purchased by the firm when requested to do so. In particular, a 1% increase in the number of firms that received an exceptional extension of payments during the pandemic (*ExtendPay*) reduced Pr($Y=1$), the z-score of the number of firms that suffered a decrease in sales during the pandemic by .338 (*Dec_sales*). This result shows evidence that by receiving community resilience with the extension of payments, firms generated their own business resilience by reducing the decline in sales. In Model 7, there are two key firm-specific variables that matter to provide business resilience in terms of the reduction of the probability of firms with workers on leave of absence. *ExtendPay* and *ExceptDelRec* are significant and negatively related to the dummy variable paid absent workers (*Inc_leavw*). The results show that a 1% increase in the number of firms that received an exceptional extension of payments during the pandemic (*ExtendPay*) reduced Pr($Y=1$), the z-score of the number of firms with paid absent workers during the pandemic by .355 (*Inc_leavw*). In addition, a 1% increase in the number of firms that received an exceptional delivery service during the pandemic due to a lack of means of transport (*ExceptDelRec*) reduced Pr($Y=1$), the z-score of the number of firms with paid absent workers during the pandemic by .316 *(Inc_leavw)*. These results show evidence that by receiving community resilience with extended payments and exceptional delivery services from partners, firms generated their own business resilience less frequently than firms with paid absent workers. Regarding Internet marketing tasks as a new channel for inter-firm relations during the pandemic, *ExceptDelRec* is significant and negatively related to the dummy variable Internet Marketing (IntMK) in Model 9. The results show that increasing the number of firms that received exceptional delivery services during the pandemic by 1% due to the lack of transport facilities (*ExceptDelRec*) reduced Pr($Y=1$), the z-score of the number of firms that started to use the Internet during the pandemic for marketing by .590 (*IntMK*). These results show evidence that by receiving community resilience with exceptional delivery services from partners, firms generated their own business resilience by becoming new users of the Internet to advertise their business activities through websites, emails, etc. In addition, other help received was significant and negatively related to the dummy variable salary reductions (*SalReduct*) (Model 8). The results suggest that firms are more likely to reduce the salaries and benefits paid to workers when the number of firms that received other aid from partners is higher than the extension of payments, delivery services, or assets received. This result shows evidence that firms, less often than other mechanisms for adjusting resources to the pandemic were forced to reduce salaries or benefits, with the likelihood of the firm receiving help from others, such as price reductions or special offers, or any other help offered specifically during the pandemic and other than the extension of payments, delivery services, or assets received (*OthHelpRecv*). Specifically, a 1% increase in the number of firms that received other help during the pandemic (*OthHelpRecv*) reduced Pr($Y=1$), the z-score

of the number of firms that decreased their sales during the pandemic by 1.387 (*Dec_sales*).

Lastly, we focus on the donations made to other firms. Table 8 presents two versions of the baseline specifications of the inter-firm relations that led to charitable support to institutions or charities during the pandemic. In Model 10, there is one key firm-specific variable that matters for providing business resilience in terms of reducing the probability of sales decline: the donation of money to other institutions (*DonateMoney*). In particular, a 1% increase in the number of firms that provided help with monetary donations to institutions during the pandemic (*ExtendPay*) reduced Pr($Y=1$), the *z*-score of the number of firms whose sales decreased during the pandemic by .381 (Dec_sales). The results suggest that firms more likely to be aware of and support institutions providing social and health assistance during the pandemic were more likely to stem the decline in revenues. In terms of reducing the number of firms that were forced to have workers on paid absent leave during the pandemic, Model 11 shows that during the pandemic, the key variable that mattered was other donations, such as loans of the firm's own staff to cooperate at zero cost with the institution or charitable organizations, or any other assistance provided other than donated money, health products produced a cost price or donation of products to a non-governmental organization or charity(*OthDonation*). The results show that one unit change in the number of firms that made other donations (*OthDonation*) increases the Pr($Y=1$), the *z*-score of the number of firms that paid absent workers during the pandemic by .830 (*Inc_leavw*). The results suggest that firms with fully paid workers, but on leave, were more likely to make other donations, such as free institutional collaborations or social works using the firm's employees, or any other donations other than cash transfers or product donations to institutions. Moreover, these results show evidence that firms that made donations to other institutions that are close to the social needs that governments and firms do not efficiently reach, the firms generated their own business resilience (with paid absent workers and reductions in sales decline) while they generated community resilience (with the donations).

These results show evidence that by receiving community resilience (with the extension of payments and exceptional delivery services), firms generate their own business resilience (with the reduction of declining sales or with the reduction of sales and paid employees on leave, respectively).

Although other models were considered, they were not significant or conclusive. In summary, the evidence from the above models supports our thesis of business resilience, whereby firms benefited community members not only by receiving help from others, but also by providing help to others such as firms, charitable institutions, and other organizations.

Conclusions

This article has carried out an empirical analysis of business resilience in the context of lockdown during the pandemic in Algeria, a lower middle-income country (IMF, 2022). The COVID-19 shocks affected businesses through five distinct channels: (i)

Lockdown effects: measures and regulations to control the spread of a pandemic that affected a business' ability to operate and a consumer's to procure goods; (ii) Demand-side shocks: reduced demand due to lower consumer consumption, lower export demand, and lower demand for intermediate goods from other businesses; (iii) Supply-side shocks: reduced availability of labor and intermediate goods as value chains are disrupted; (iv) Financial shocks: deterioration of cash availability and credit conditions; and (v) Uncertainty shock: increased uncertainty leads to reduced appetite for investments and risks associated with innovation and entrepreneurship. The pandemic exposed the fragilities and vulnerabilities of most businesses when social distance was forced, although the unpredictable dramatic effects of COVID-19 affected businesses differently across sectors, sizes, regions, type of business location, gender of the entrepreneurs, age of the business, foreign shareholders, and Internet usage for sales and/or delivery services.

How businesses behave resiliently when risks occur remains largely untested, and this is elaborated upon in this article. To date, there is no empirical research that has investigated community resilience in a global disruption event to identify which cooperative actions can support the consequences of risk containment and build new market opportunities and how these actions enabled the mutual survival of businesses, both for the one who provides the help and for the one who receives it. Although the pandemic implies adverse circumstances, containment, and increased security regulations, companies chose to cooperate to reduce the effects of disruptions to their activities instead of competing head-on. The data show that some degree of cooperation between firms and institutions was in place at the time of the survey that built business resilience and community resilience. The mutual benefits of inter-firm relations shed light on the understanding of building business resilience and community resilience, in which virtual communications played a key role.

The first conclusion from the empirical analysis is about the relationship between community and business resilience. Thus, helping others by providing a voluntary extension of the payment period for the goods and services sold if customers requested it, provides more robust and stronger effects than benefitting from the payment extension received from others. The most important way for companies to cooperate was by voluntarily granting extended payment terms to suppliers of goods and services and to clients (56.38% and 28.31% of the firms, respectively). Business resilience can be observed in the number of businesses that decreased the reduction in sales and the number of firms that fully paid workers on leave of absence during the pandemic. Second, the provision of support by making resources available to others was significant in the inter-firm relationships during the pandemic for building one's own business resilience, because it helped firms to pivot resources and build new business opportunities while maintaining their functions and structures. More importantly, firms often provided support to local communities as part of their corporate social responsibility. At the time of the survey, the free provision of certain goods and services produced by the company (56.30% of firms of the sample) and financial contributions to relevant institutions and charities (51.98% of firms of the sample) were the two preferred means. The probit model provides evidence that firms capable of

providing such community support were more likely to perform well. These results also show the link between business resilience and community resilience through the cooperation with clients, providers, and charitable institutions.

This research has implications for the design of policies that could provide resilience for economic development, as results show businesses need to strengthen the cash flows of economic entities with indirect liquidity injections, such as tax deferrals, cost reductions or subsidized loans, and directly with cash transfers to firms. But more importantly, in the long run, SMEs should be targeted with investment support programs focused on promoting growth and productivity through telecommunication technologies. Indeed, as we have demonstrated in this case study for Algeria, both rural and remote areas, well-connected inter-firm businesses survived the pandemic better through business cooperation.

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