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How internet helped firms cope with COVID-19

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Since 2020, the stringent distancing measures put in place around the world in response to the spread of the COVID virus have highlighted the vital importance of digital technologies for maintaining economic exchanges and social interactions. As a result, increased digitalization[1] may have softened the deleterious impact of containment measures on economic activity and human capital in both developed and developing countries (Guillaumont, 2020; Ma et al, 2021, Chiou and Tucker, 2020). By reducing transaction costs and informational asymmetries (Aker, 2017; Goldfarb and Tucker, 2019), digital technologies are expected to boost firms' organizational and production capacities, to improve goods, services and financial markets functioning, to correct government failures, and therefore, to help them coping with the COVID crisis.

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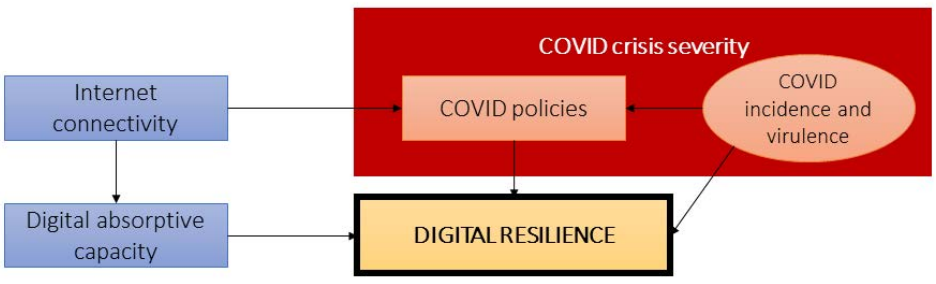
1. Defined in this paper as the increasing resort by the firm to internet-based technologies in the conduct of business.

... /... Many companies have responded to containment and distancing measures by adopting new organisational methods based on digital technologies (remote work, online sales, and home delivery). Several studies have shown that the use of digital tools has helped maintain economic activity during the crisis (e.g., Bloom et al., 2021; Fairlie & Fossen, 2021: Doerr et al., 2021). Nevertheless, these researches focus primarily on a few rich countries — mostly the U.S. — in which most businesses have access to fast Internet and make extensive use of these tools. In contrast, few studies have analysed the role of ICTs in business resilience from a more global perspective. Studies on large samples of countries, including developing countries (Apedo-Amah et al., 2021; Davies et al., 2021; Saka et al., 2021), have shown that the current crisis has encouraged the use of digital solutions, but without assessing their effect on business performance.

Using the World Bank *COVID-19 Impact Follow-up Surveys*, we investigate the role of digitalization in the capacity of firms to absorb the COVID crisis, based on a sample of 31,387 firms from 39 developing and developed economies. In particular, we question whether firms having access to and using the internet before the crisis were more resilient to the shock. Distinguishing between access to internet – proxied by 4G coverage in firm's location – and usage of internet services – proxied by website adoption by the firm – is key since the former is a necessary but insufficient condition for internet usage if the firm has not the capacity to absorb digital technologies (Paunov and Rollo, 2015, 2016). In addition, the implementation of, and compliance with, COVID policies the analysis may have been stronger in better connected places (Chiou and Tucker, 2020), which adds complexity and justifies analysing separately these two dimensions of the digitalization-COVID nexus.

Therefore, our analysis aims to better understand the channels through which digitalization prior to the crisis may have played a role in business performance during the crisis. On the one hand, better connected companies can more easily implement adaptation strategies that have required the use of digital tools such as online sales or remote work. On the other hand, in situations of movement restrictions, the digital link has facilitated access to additional resources, whether they be bank loans or public support (Saka et al., 2021). However, the relation may be tricky, considering that the crisis severity could be higher in digitalized places, where containment policies and behaviours are probably stricter and virus circulation more important. Our analysis therefore considers this dimension, too (Figure 1).

Figure 1: Digitalization, COVID-19 crisis severity, and digital resilience



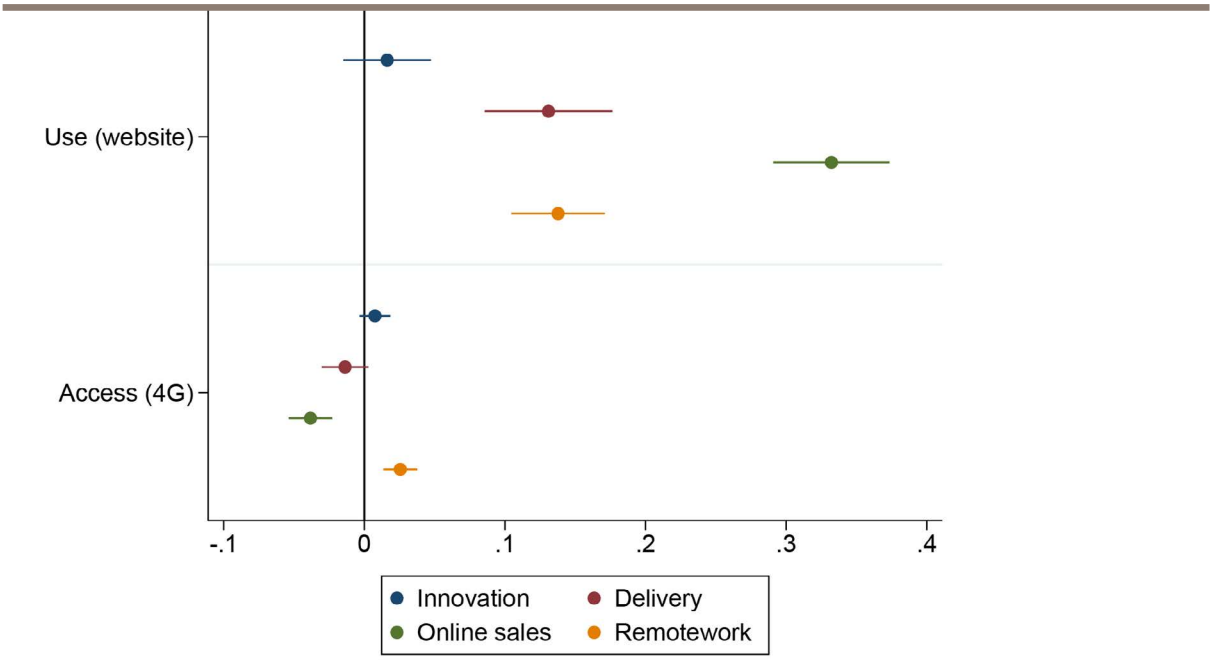
Source: Authors.

Main findings

First, our results stress that companies using website before the health crisis were more inclined than other firms to adopt digital coping strategies (Figure 2). The positive role of ICT use was emphasized through the adoption of the following coping strategies: (i) innovation, (ii) home-delivery services, (iii) online sales, and (iv) remote work. Results indicate that firm usage of website before the pandemic increases the likelihood to adopt three coping strategies out of four, directly relying on a digital link, namely home-delivery service, online sales and remote work. The effect of 4G coverage is less clear-cut and less marked. A better connectivity only improves the likelihood to adopt remote work but has a negative effect on online sales (and no effect on home-delivery and innovation).

Regressing indicators of firm performance during the crisis over digital coping strategies, while controlling for firm's access and usage of internet, a large set of controls and fixed effects (Table 1), we find that the adoption of home-delivery services and remote work has been efficient to limit degradation of firm performance during the COVID-19. Online sales have only allowed firms to maintain firm sales but have a limited effect on other outcomes. Finally, we stress that adoption of innovation does not play a role to limit the negative impact of the COVID-19 shock on business operations, possibly due to a time lag between the short-term consequences of the crisis and the medium-term benefits of innovation policy.

Figure 2: Internet and adoption of coping strategies, OLS estimates



The figure represents the marginal effect of the internet usage (website) and internet access (4G) on the adoption of new products or process (innovation), delivery, online sales or remote work. The estimated model (OLS) includes firm-, region-, and country-week-level control variables (including indexes of COVID policies' intensity from the Oxford COVID-19 Government Response Tracker), as well as country and week fixed effects. Bars display robust confidence intervals at 5%. We display results of models considering an increase of internet usage from 0 (no usage) to 1 (usage) and an increase of 10% of 4G connectivity, relative to average adoption of each strategy. Reading: Having a website increased adoption of delivery by 13%.

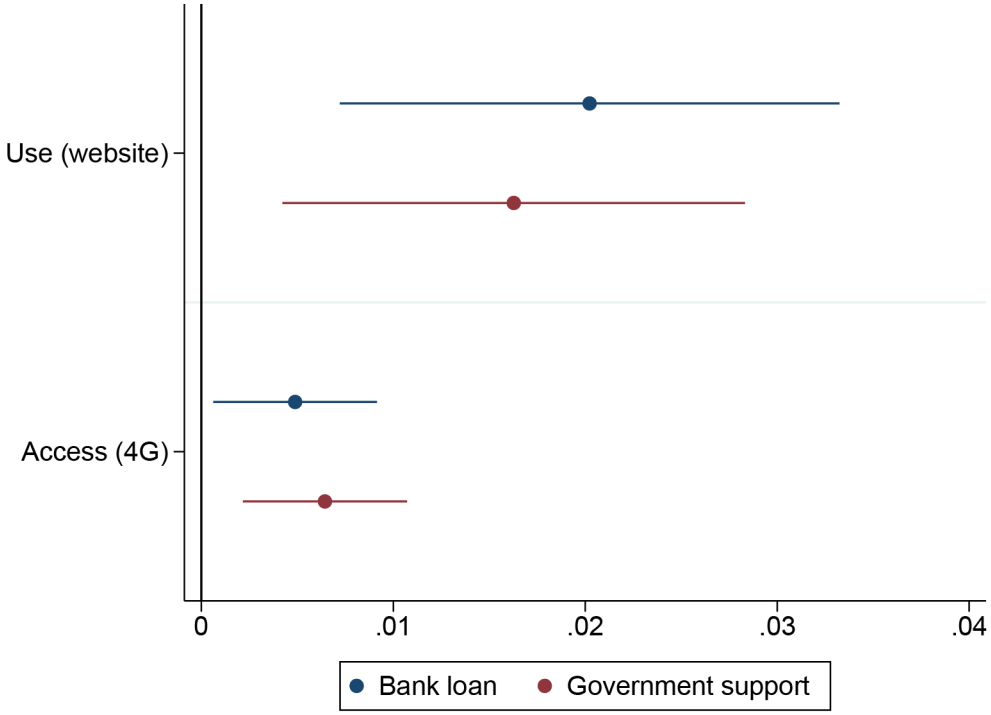
Table 1: Coping strategy, internet and firm performance, OLS estimations

	1	2	3	4	5	6	7	8
Dep. Var:	**Survival**		**Sales**		**Workers**		**Hours**	
Internet								
Use	0.415	0.291	1.180**	0.862	0.526	0.425	0.565	0.688
	(1.03)	(0.73)	(2.22)	(1.63)	(1.05)	(0.85)	(0.78)	(0.94)
Access	-5.482***	-5.456***	-8.692***	-8.649***	-1.528	-1.756	-8.620***	-8.277***
	(-3.94)	(-3.92)	(-5.09)	(-5.07)	(-1.01)	(-1.16)	(-3.48)	(-3.34)
Coping strategy								
Innovation		-0.411		-3.459***		-0.915**		-6.508***
		(-1.13)		(-7.24)		(-1.98)		(-9.92)
Delivery		1.437***		2.641***		0.392		-0.883
		(3.05)		(4.37)		(0.67)		(-1.09)
Online sales		0.512		1.384**		-0.357		0.109
		(1.16)		(2.38)		(-0.61)		(0.14)
Remote work		0.296		1.787***		2.335***		-0.874
		(0.85)		(3.68)		(5.02)		(-1.28)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country + week FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	26720	26720	26492	26492	26105	26105	26599	26599

The table presents the role of coping strategies and internet measures on performance of firms. Six indicators of performances are considered: the probability to remain open (columns 1 and 2), the sales evolution between the month before the survey and the same month in 2019 (columns 3 and 4), the evolution of permanent workers (columns 5 and 6) and the likelihood to maintain the same level of worked hours (columns 7 and 8). All indicators are built so that an increase indicates improved performance. The estimated model includes firm-, region-, and country-week-level control variables (including indexes of COVID policies' intensity from the Oxford COVID-19 Government Response Tracker), as well as country fixed and week effects. Standard errors are corrected for heteroscedasticity (robust t-test reported in parentheses). *, ** and *** signal significance at 10, 5, and 1%, respectively.

Second, our analysis suggests that firm's digital resilience is not explained by better access to external public (government support) or private (bank loan) financial resources through digital technologies. The chances of obtaining bank loans in times of social distancing can be increased if firms can maintain communication with their bank, even if the bank is not an online bank (Saka et al., 2021). Internet indeed allows information sharing, useful for the loan officer. Similarly, the digitization of public services may facilitate undertaking the steps required to obtain public aid, if the firm is familiar with e-government systems. Our analysis first points that internet access and usage has a positive effect on access to private and public resources during the COVID-19,(Figure 2) but this effect appears to be negligible.

Figure 3: Internet and adoption of coping strategies, OLS estimates



The figure represents the marginal effect of the internet usage (website) and internet access (4G) on the access to bank loan or government support. The estimated model includes firm-, region-, and country-week-level control variables (including indexes of COVID policies' intensity from the Oxford COVID-19 Government Response Tracker), as well as country and week fixed effects. Bars display robust confidence intervals at 5%. We display results of models considering an increase of internet usage from 0 (no usage) to 1 (usage) and an increase of 10% of 4G connectivity, relative to average adoption of each strategy. Reading: Having a website raised access to bank loan by 2%.

Regression analysis in Table 2 also indicates that access to private funds has a small impact on the likelihood to remain open and to limit layoffs. However, firms having access to private funds during the COVID-19 do not significantly perform better according to other metrics (business activity, reduction in the number of hours worked). Additionally, firms relying on public support tend to suffer more than their counterparts do. However, this finding is certainly due to reverse causation. Indeed, firms in dire straits are more likely to ask for public support. In line with previous results, we find that including the two measures of financial access do not change the coefficient associated with variables of ICT usage and internet access (both statistically and economically). To sum up, the analysis presented in the last sub-section points out that internet access and usage have increased the likelihood to get access to public and private funds. However, the contribution of internet is rather modest. In addition, having access to external funds does not help firms to perform better during the pandemic. As a consequence, we cannot give strong support for the second mechanism.

Last, an *a priori* surprising finding of this study is the negative effect of internet access on firm performances during the COVID-19, as indicated in Tables 1 and 2 above. Estimation conducted with indicates that the negative effect of 4G coverage on firm survival is explained by the role played by local connectivity in mediating the adverse effect of stringency and economic support policies on firm survival. The literature pinpoints the critical role of internet connectivity, in particular internet access, in conditioning

Table 2: Access to funds, internet and firm performance

	1	2	3	4	5	6	7	8
Dep. Var:	**Survival**		**Sales**		**Workers**		**Hours**	
Internet								
Use	1.209**	1.233**	1.353**	1.421**	0.309	0.251	0.998	1.195
	(2.11)	(2.16)	(2.13)	(2.24)	(0.47)	(0.38)	(1.09)	(1.31)
Access	-7.361***	-7.455***	-8.294***	-8.371***	-2.706	-2.800	-9.086***	-8.943***
	(-3.53)	(-3.57)	(-3.90)	(-3.95)	(-1.35)	(-1.40)	(-2.78)	(-2.73)
Access to private and public funds								
Bank loan (0/1)		1.095*		0.588		1.372**		-2.581**
		(1.74)		(0.82)		(2.06)		(-2.52)
Public support (0/1)		-1.694***		-2.979***		1.009		-5.579***
		(-3.10)		(-4.58)		(1.58)		(-5.79)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country + week FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	16,719	16,719	16,519	16,519	16,265	16,265	16,515	16,515

The table presents the role of coping strategies and internet measures on performance of firms. Six indicators of performances are considered: the probability to remain open (columns 1 and 2), the sales evolution between the month before the survey and the same month in 2019 (columns 3 and 4), the evolution of permanent workers (columns 5 and 6) and the likelihood to maintain the same level of worked hours (columns 7 and 8). All indicators are built so that an increase indicates improved performance. The estimated model includes firm-, region-, and country-week-level control variables (including indexes of COVID policies' intensity from the Oxford COVID-19 Government Response Tracker), as well as country and week fixed effects. Standard errors are corrected for heteroscedasticity (robust t-test reported in parentheses). *, ** and *** signal significance at 10, 5, and 1%, respectively.

households and firms' capacity to absorb the COVID-19 crisis and related movement restriction policies. However, other studies stress that internet connectivity, and its corollary, access to internet infrastructure, is a predictive factor of the ability of individuals to comply with COVID-19 restriction measures, and therefore of governments to implement strong and credible responses to the pandemic (Chiou and Tucker, 2020; Bai et al., 2020; Barrero et al, 202). Therefore, the possibility that the stringency of policy responses to COVID-19, in particular social-distancing measures, may vary according to internet accessibility should be considered. In a context a large digital divide and State fragility, the implementation of movement restrictions will be stricter in places where fast internet is accessible, and therefore, where people and firms can maintain communications using internet. In the same way, economic support and health policies provided to the population may be easier to deploy in such well-connected places, thereby facilitating the compliance and implementation of movement restriction policies. [1]

We study this hypothesis by examining whether local internet access conditions COVID-19 crisis severity, proxied by COVID-19 policy variables and mortality rates. We therefore investigate in Table 3 local heterogenous effects of COVID-19 policies on firm performance during the crisis, depending on 4G internet access. In a first step (column (1)), we add the interaction between the 4G coverage variable and the

1. Although there is so far, to our knowledge, no proper empirical analysis of the implementability of policy responses in a context of digital divide.

government stringency and economic support indexes. Because these policy variables may not fully capture the extent of governments' response to the crisis, by for instance omitting to consider self-inclination to isolate thanks to internet access, we also interact the mortality rate variable with the network coverage variable.[2] Estimations indicate that the negative effect of 4G coverage on firm performance is explained by the role played by local connectivity in mediating the adverse effect of stringency policy on firm survival, supporting that movement restriction policies have been harsher in well-connected places. Results also highlight the positive effect of economic support on firm survival in locations with greater internet coverage. However, further estimations also show that internet access mediates the adverse effect economic support policies on other performance outcomes. We indeed find that increased economic support has had a deterrent effect on sales evolution and workforce adjustments in better connected places. This relationship could however be explained by reverse causation since economic slow-down might be conditioned by receiving government support, which in turn may depend on access to internet communications.

2. Estimations are conducted replacing week dummies by month dummies, to ensure that our model is not saturated by the simultaneous inclusion of interaction policy variables week fixed-effects. Policy responses may indeed vary from week to another, and their implementation may progressively improve as governments and populations get more familiar with the pandemic.

Conclusion

The paper analyses the consequences of the digital divide on firms' capacity to cope with the COVID-19 pandemic. Using survey sample of 31,387 firms from 39 developing and transitions economies, we found that firms' prior use of website enabled them to soften the consequences of the health crisis on their business. We emphasized the role of both internet connectivity - measured in terms of 4G network coverage – and internet usage – measured by the adoption of the website technology, prior to the onset of the COVID-19 pandemic. We find strong evidence of a positive contribution of website adoption to the firm's resilience to the pandemic shock, but ambiguous evidence of mobile internet coverage. The positive role of ICT use was mainly through the adoption of coping strategies, in particular take-out, online sales and remote working. Moreover, the positive effect played by the use of digital tools is not explained by better access to external public (government support) or private (bank loan) financial resources. A negative effect of pre-pandemic internet access, net of internet usage, on firm performance is evidenced and explained by the role of connectivity in mediating the intensity of government responses to COVID-19. Therefore, policies aiming at reinforcing the private sector resilience to the current and future COVID-like health crises, should devote efforts on improving firm's capacity to integrate digital technologies in their production and communication processes.

Table 3: Government policies, internet access and firm outcomes during the pandemic

	1	2	3	4
Dep. Var:	**Survival**	**Sales**	**Workers**	**Hours**
Internet				
Webside use	3.256***	1.329**	0.965**	0.638
	(6.98)	(2.52)	(1.97)	(0.88)
Internet access (4G)	8.317	16.40*	2.155	-13.41
	(1.18)	(1.76)	(0.26)	(-1.00)
Covid-severity channel				
Internet access x stringency	-3.585***	-1.685	0.766	2.464
	(-3.00)	(-1.17)	(0.56)	(1.22)
Internet access x econ support	1.557***	-1.597**	-1.524***	-2.130**
	(2.58)	(-2.33)	(-2.61)	(-2.21)
Internet access x mortality	0.00282**	-0.00200	0.00206	0.00359*
	(2.23)	(-1.28)	(1.43)	(1.70)
Covid severity				
Stringency index	3.437***	-0.196	-2.110**	-8.402***
	(3.67)	(-0.17)	(-2.05)	(-5.38)
Econ. support index	-2.202***	0.474	0.474	3.046***
	(-4.11)	(0.86)	(0.88)	(3.74)
Mortality rate	-0.00155	-0.00257**	-0.00253**	-0.00004
	(-1.45)	(-2.04)	(-2.18)	(-0.02)
N	31,202	26,991	26,919	27,006
adj. R^2	0.135	0.211	0.057	0.201

The estimated model includes firm-, region-, and country-week-level control variables (including indexes of COVID policies' intensity from the Oxford COVID-19 Government Response Tracker), as well as country and month fixed effects. The table presents the factors affecting ex-post firm survival (probability to remain open), sales, worker number, hours worked. Remaining control variables and FEs, are not reported in the table. Standard errors are corrected for heteroscedasticity (robust t-test reported in parentheses) and estimations are weighted by the inverse of the number of firms per country. *, ** and *** signal significance at 10, 5, and 1%, respectively.

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