HOW COULD ECUADORIAN FIRMS SURVIVE TO THE PANDEMIC? INNNOVATING

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Abstract. The pandemic of Covid-19 has caused the biggest shock in the economy since the Second World War. In this paper, we studied we study what conditioned the capability of the companies in Quito, Ecuador, to continuous operating in the new Covid-19 reality. The hypothesis remains that innovative firms have a greater capacity to adapt to the pandemic. We apply a probabilistic and ordinary least squares model. We use the data of a survey built to 1,730 SMEs in Quito between April and May of 202. We confirm that the probability to continuous operating number of the companies in Quito was related to the innovations developed after the pandemic started. We also explore the role of innovation is contrasted, both by diversity and typology. This paper contributes to the idea that innovation is fundamental to the future of the firms also in a little innovative country.
Keywords: Pandemic, economic shock, innovation, , Ecuador
JEL Classification: M41, C83, L20

1. Introduction

The Covid-19 crisis has highlighted the weaknesses of many economies in the world. In the case of Latin America, it has shown that in addition to the high percentage of informal enterprises that are more vulnerable to changes in the environment, there is also a more precarious job with lower wages and worse working conditions (Cajner et al., 2020). Despite these difficulties, there are small and medium-sized enterprises that make a great effort in relative terms to adapt, innovate and evolve. One of the best changes in the pandemic, is the best adaptation to the new reality of the firms and this adopt a flexible character, leading to a more dynamic and innovative business fabric (BID, 2020).

In this line, the present article contrasts the hypothesis of whether Ecuadorian companies that do more innovation had more prob been able to continue their business (H1) and if the innovations could contribute to the firm's activity level (H2).

We use the data resulting of the survey built to 1730 companies of the city of Quito, Ecuador elaborate by the University of the Americas and the Chamber of Commerce from Quito. The survey asked companies whether they had to close down completely and at what operational level they were working at one month after the state of alarm was declared. These are our two dependent variables, to respond to the two hypotheses that are proposed.

With this information, the role of innovation is contrasted, both in diversity and by typology, to verify their influence on the adaptability and thus on the survival of enterprises in a complex economic context through probabilistic and ordinary least squares models.

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We can conclude that the number of innovations in the firm in the pandemic is positively related to the probability to continue operating. Attending to the different innovations, result significative (marginal effects in parentheses) teleworking (11.4%), marketing innovation (10%), digitalization (5.8%) and market innovation (4.7%).
The operation level is affected for the same variables of the open/close models and with the same direction, but it this case, product and process innovations are also significative and the market innovation has the bigger marginal effect (5%).
In the case of the digitalized companies, the marketing innovation was the most important innovation variable.
The remainder of this paper is organized as follows. In Section 2, we carry out a theoretical framework on innovation and the pandemic, and we present some basic related facts about the context. In Section 3, we present the data source that is used, and the methodology that we will follow. Results are presented in Section 4. Finally, we end the paper in Section 5 with the conclusions and Section 6, with recommendations.

2. Theoretical Framework

From an evolutionist point of view, the economy is dynamic, and cannot have a balance, but constantly changes through a process of business growth and adaptation. This process of adaptation will be stronger in times of crisis, like in the current pandemic by Covid-19 so that firms that are not able to adapt to the new normality in their production process, distribution, etc... will tend to disappear.
The problem lies in a region like Latin America, where the industrial revolution did not take place with the strength and depth of other regions, whose production depends mainly on the primary sector and raw materials, where the generation of innovation is less, and lack a strong and competitive technology-based industry. It creates a greater vulnerability of firms to the lack of access and development of technology, lower value-added, and therefore a worse adaptation to their environment (Sagasti, 2001; Escandón et al., 2013).
In the modern organization theory, the investigation is included in the dynamic capability theory, developed by Teece & Pisano (1994) and Teece et al. (1997). This theory, based on the resources-based vision (RBV) (Penrose, 1959; Newbert, 2005; and Ambrosini & Bowman, 2009), raises the speed and the grade which are configurated to satisfy the need and the opportunity that offer the environment to generate bigger and sustainable returns (Teece, 2012). It is important to sign the heterogeneity of the capabilities and sources in the relation firm-environment, especially in the innovation process.
In the generation of added value, innovation plays a leading role, since it allows to improve the efficiency and productivity levels of the company through the increase of the profit margin and/or market share. Dynamic skills, especially in the areas of management and leadership of the company, becomes fundamental in heterogeneous and highly changing and volatile environments (Krzakiewicz & Cyfert, 2014; Lin et al., 2016; Zapata & Mirabal, 2018; Camiña et al., 2020).
Under this theory, is developed an econometric model that measures the innovation capability and his influence in the probability to the firm to continue open, showing the capability to adapt to the Ecuadorian small and medium firms. The probability of

continuing to operate during the pandemic is checked, as well as the level of functioning and whether there are synergies between digitalization and other types of innovation.

The economic crisis that some countries were already experiencing even before the Covid-19 pandemic has undoubtedly deepened because of this global public health problem. In this context, economic and business research has focused on understanding the fundamentals and repercussions of the pandemic (Baldwin & Di Mauro, 2020). The pandemic has represented an external economic shock to economies where confinement measures, including mobility restrictions, negative effects on public health and health systems, and a crisis of confidence on the part of economic agents have had a negative impact on economic activity worldwide. While much of the recent research has focused on the impact in the United States, the findings of these studies show that one-third of the jobs lost during the pandemic will not be recovered (Barrero et al., 2020). This problem is compounded by the recognition that the effects of the pandemic have been heterogeneous across countries, territories, companies, and individuals.

In the case of companies, it has become evident that there is an allocation crisis in terms of employment and resources, especially in the weakest points of the business and occupational structure, where SMEs, microenterprises, and less qualified workers, or those with less labor protection, stand out (Alekseev et al., 2020; Cajner et al., 2020). Moreover, it has been found that these negative impacts tend to be greater in companies led by women or by managers with a background in human and social sciences, and in small, non-digitalized companies (Bloom et al., 2021). It should also be noted that existing credit constraints make it even more difficult for these types of companies to recover (Gourinchas et al., 2021). Therefore, the context of globalization, digitalization and automation, and crisis due to the global health emergency in which we currently find ourselves, poses significant challenges in the markets, especially in the labor market, which has witnessed a significant and accelerated deterioration (Coibion et al., 2020). Experts point out that the way out of this crisis will depend on global value chains and the capacity of countries to protect the aforementioned points, which represent the weakest part of their economic structure (Groshen, 2020).

The results also reveal that the sectors or types of employment that have been less affected by the Covid-19 pandemic are those that had greater flexibility for the establishment of remote work, production, and demand-driven practices (Brynjolfsson et al., 2020). This implies that, those sectors such as tourism, commerce, transportation, and production, which are highly dependent on face-to-face activities, have been the sectors that have been most affected by the pandemic (He et al., 2020). In this sense, the digital maturity of companies begins to take a relevant role, considering that the available evidence indicates that companies with better digital maturity indexes tend to react better to the negative effects generated by the pandemic in their activity (Rapaccini et al., 2020). However, this relationship is neither homogeneous nor linear, as it has been observed that only in those economies with greater digital readiness, digitalization could act as a complementary booster of industrial GDP. This invites us to think of digital transformation as a lever of industrial prosperity for this new post- Covid-19 economic cycle.

In this sense, and given the importance of structural reforms in companies for the correct adoption of this type of technologies, dynamic capabilities have become relevant

(Ballestar et al., 2020). These capabilities reflect the readiness of companies to achieve competitive advantages, as they allow them to detect, take advantage of and transform economic activity, in addition to creating, reconfiguring, and leveraging the resources and capabilities of organizations (Teece, 2014, 2016; Teece et al., 1997). This industrial reorganization that companies must undertake to perceive the benefits of digitalization can be of two types. First, there are the restructurings, the same that involve changes in the fundamental principles of organizational design, this type of reorganization is widespread, but is performed less frequently. On the other hand, there are reconfigurations, which refer to changes in the units while maintaining the existing organizational principles; this type of reorganization is of a continuous type, although with a smaller scope (Girod & Whittington, 2017).

Though there is no generalized recommendation as to what type of reorganization companies should carry out, given the context of Spanish companies, the recommendation is a complete restructuring to obtain the complete benefits of digitalization. This restructuring should include the adaptation of principles, strategies, cultures, and norms with respect to digital transformation, as well as an emphasis on the training of workers, where not only digital skills should be developed, but also complemented with hard and soft skills, and a reorganization of the ways of working and production. Thus, the post- Covid-19 industrial context would be marked by the establishment of a new window of opportunity for disruption that would be based on: 1) the acceptance of an international context where there are changes in the globalization phase, 2) the acceleration of the transition to the fourth industrial revolution; and 3) the absolute need to develop and significantly expand the capabilities of employees (Deloitte, 2021; Livesey, 2018; PWC, 2020).

For analyzed the effect of the pandemic about the innovation, must be considered the economic structure of the countries observed. Studies like Albert (1994) and Buesa and Molero (1996), show the relationship between bigger firms and innovation level. To illustrate this situation, the Figure 1 shows that, for the year 2016, based on the countries considered, the United States is the one with the highest business density, with around 101 companies per thousand inhabitants, followed by Spain with 57. Among the Latin American countries considered, Ecuador stands out with approximately 51 companies per thousand inhabitants, followed by Mexico with 36 and Colombia with 31. Germany is below Colombia, with 28 companies per thousand inhabitants.

On the other hand, the business structure made up of microenterprises varied in the order of between 88% and 97%, without considering Argentina with a value of 70%. The United States is the country with the largest number of microenterprises, 96.5%, followed by Mexico (95.4%) and Spain (94.6%). Ecuador is in fifth place, with 90.5%. In terms of small businesses, Argentina is the largest with 22.9%, followed by Brazil with 10.7%. Small businesses in Ecuador represented 7.5% of its business network. In relation to medium-sized companies, Argentina was first with 5.6%, followed by Germany (2.7%) and Ecuador (1.5%). Other of principal question to analyze the innovative production, is the situation of labour market, especially in Latin America, where the underemployment is busy by a big part of population.

Figure 2 shows the structure of the Ecuadorian labor force by income decile. It can be seen that there is an inverse relationship between income deciles and underemployment,

being 50%, 66% and 74% for deciles 1, 2 and 3 and 39%, 29% and 14% for deciles 8, 9 and 10, respectively. This is similar, although to a lesser extent, for unpaid employment, with 34% of the workforce in decile 1 and 2.5% in decile 10.

There is a direct relationship between income deciles and appropriate employment. The share of appropriate employment in the labor force structure of deciles 1 and 2 is practically zero. Appropriate employment is increasing from decile 3, being 3.8% to 82.5% in decile 10. In general terms, unemployment, both hidden and open, has a small share in the workforce structure of the different deciles. However, in addition to appropriate employment behavior, it can be seen that the Ecuadorian labor market has high rates of informality, especially for the low and middle-income deciles. is in first place, with 678,197; in relation to Germany with 183,640. Spain follows with 100,364. In the Latin American region, Brazil leads with 84,887; while Ecuador has 4,786.

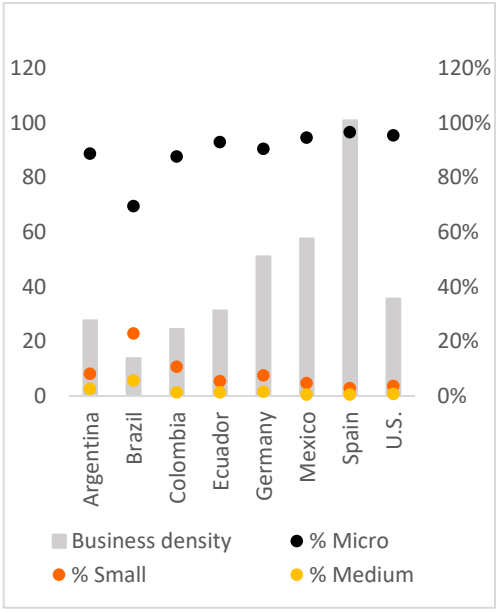

Figure 1. Business density and business composition, by country (2016)

Adopted from SME Finance Forum (2019), World Bank (2020) and National Survey of Employment and Unemployment (ENEMDU), INEC (2020)

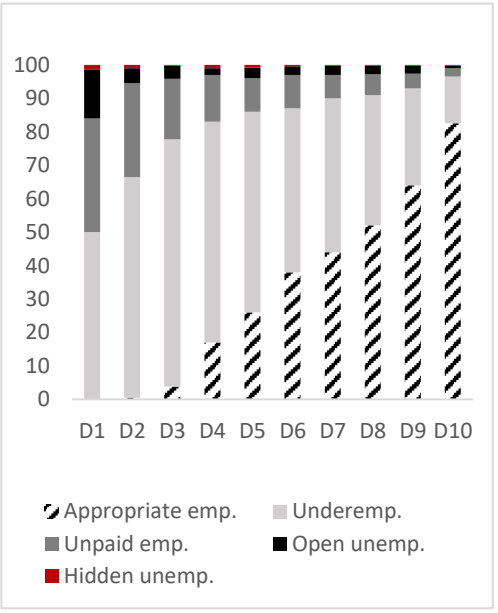

Figure 2. Structure of the Ecuadorian labour force by income decile

Adopted from SME Finance Forum (2019), World Bank (2020) and National Survey of Employment and Unemployment (ENEMDU), INEC (2020).

Note: Due to the availability of data, the year 2017 is used for Colombia and 2013 for Mexico

Figure 4 presents indicators relating to countries' productivity and connectivity in terms of the digital economy. Productivity and the Global Connectivity Index (GCI) have a correlation of 0.98. The U.S. has the highest productivity and the highest GCI score, followed by Germany and Spain. In the Latin American region, Argentina has the highest

productivity, followed by Brazil and Colombia. However, Brazil ranks first in the CGI, followed by Argentina and Colombia. Ecuador is the country with the lowest productivity and GCI. project "The impact of the Covid-19 in the city of Quito", which has been developed a survey in the city of Quito, Ecuador between April 15th and May 7th of 2020, about the impact of Covid-19 in 1730 firms. Annex 1 expands on the details of the methodology followed, including the applied survey.

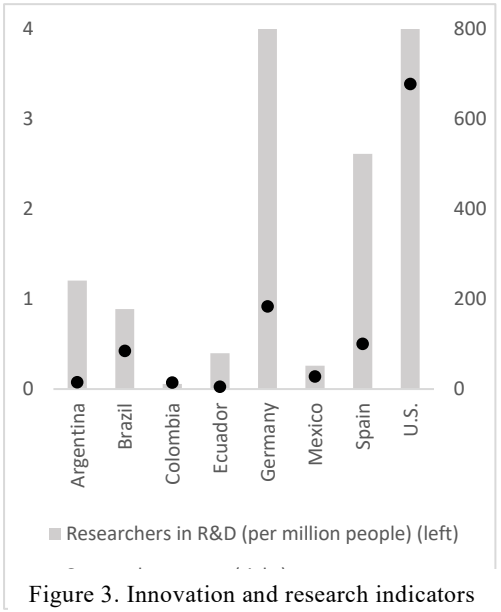

Figure 3. Innovation and research indicators

Source: World Bank (2020), SCImago (2020), ILOSTAT (2020), Huawai Technologies Co., Ltd. (2020) and KOF Swiss Economic Institute (2020). Note: The indicator of researchers in R&D (per million people) correspond to the year 2014.

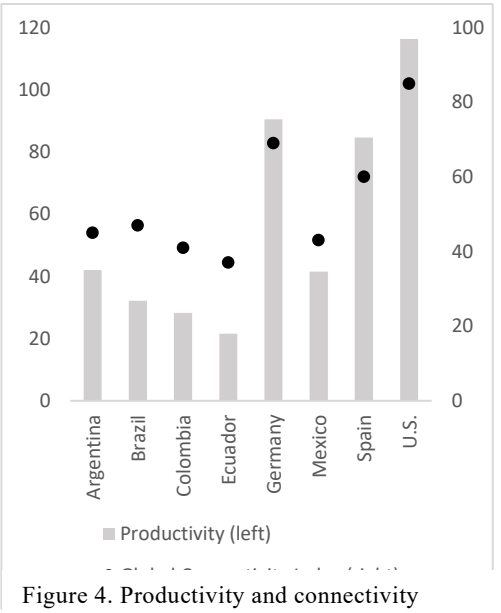

Figure 4. Productivity and connectivity indicators (2019)

Source: World Bank (2020), SCImago (2020), ILOSTAT (2020), Huawai Technologies Co., Ltd. (2020) and KOF Swiss Economic Institute (2020).

Note: Productivity is measured by output

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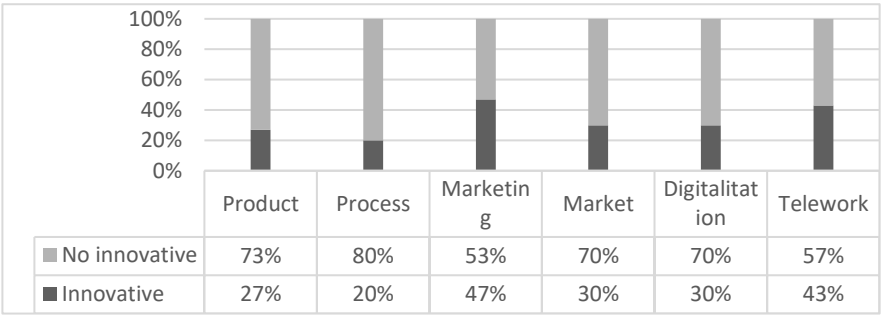
In December 2019, the Social Security Ecuadorian Institute (IESS) and Internal Income Services (SRI), register 899.208 firms in Ecuador, which 98% are small or micro firms and Quito registered the 19% of all, that is to say, 167,433 firms.

For sample purposes, it will be considered exclusively formal companies, since in the region the informal economy represents at least half of the business fabric.

The survey contents information about the identification of the firm (name, ID, sector, number of workers, sales and data about the entrepreneur -sex, age-) and questions about the effect of the Covid-19 in his normal operation (operation level, change of raw material prices, changes in the number of workers, knowledge about the new protocols, time to recover -expectative-, and changes in the firm -innovations-).

Figure 5 shows the firms of the data base make or not innovation since the beginning of the Covid-19 pandemic. The innovations more adopted are marketing (47%) and telework (43%) and the less adopted are process (20%) and product innovation (27%). However, it's important to establish if any innovation generates more effect in the probability of survival.



	Product	Process	Marketing	Market	Digitalitation	Telework
No innovative	73%	80%	53%	70%	70%	57%
Innovative	27%	20%	47%	30%	30%	43%

Figure 5. Distribution (%) of firms that has innovated since the pandemic began. Source: Survey "The impact of Covid-19 in micro and small firms in Quito".

The hypothesis remains that innovative companies have a greater capacity to adapt themselves to new environments and realities such as COVID. To test this, we analyze the number of innovations and the type of innovation how it affects the likelihood of staying open during the pandemic. In addition, it analyzes the case of digitized companies, and the role of innovation in them.

For this model, we have used the question about "the firm continues operating", to develop a probit model where the answer is a dummy: no -0- or yes -1-, and contrast if the number of innovations develop for the firm in the last weeks or days is related to probability to continuous operating.

Subsequently, in the model 2, we change the number of innovations for dummies about each type of innovation (product, process, marketing, market, teleworking or digitalization). We include others control variables: age and sex of the entrepreneur, dummies of size by sales and number of workers, change in the workers -working hour, dismissed…-, and any dummies about the sector farming, industry and any sector of services that is significantly more or less affected that the average of services (like transport, tourist, or entertainment).

3. Results

Two models are presented below, in model 1 an approximation is made through the effect of innovation on the probability of continuing to operate: in model 1 observing the effect of the number of innovations, in model 2 each type of innovation.

Table 1.1. The Firm Continues Operating: Models 1 and 2

Variables		Model 1		Model 2	
		Probit	Marginal effect (dy/dx)	Probit	Marginal effect (dy/dx)
Innovations	Innovations (number)	0.1815*** (0.03)	0.0564*** (0.01)	-	-
	Product Innovation	-	-	0.0314 (0.08)	0.0098 (0.02)
	Process Innovation	-	-	0.0273 (0.08)	0.0085 (0.03)
	Marketing Innovation	-	-	0.3459*** (0.07)	0.1080*** (0.02)
	Market Innovation	-	-	0.1493** (0.08)	0.0466* (0.02)
	Teleworking	-	-	0.3641*** (0.07)	0.1136*** (0.02)
	Digitalitation	-	-	0.1871*** (0.08)	0.0584** (0.02)
Number of workers	Small (10-49)	0.1071 (0.09)	0.3325 (0.03)	0.0715 (0.09)	0.0223 (0.03)
	Medium (50-199)	0.0895 (0.17)	0.0278 (0.05)	0.0535 (0.16)	0.0167 (0.05)
	Big (>200)	0.2958 (0.30)	0.0918 (0.09)	0.2248 (0.29)	0.0702 (0.09)
Sales	Small (100,000-1M)	0.2287*** (0.09)	0.0710*** (0.03)	0.2452*** (0.09)	0.0765*** (0.03)
	Medium(1-2M)	0.4137*** (0.14)	0.1285*** (0.05)	0.4144*** (0.15)	0.1293*** (0.05)
	Big (2-5M)	0.4916** (0.22)	0.1527** (0.07)	0.4433** (0.23)	0.1383** (0.07)
	Very Big (>5M)	0.4154* (0.26)	0.1290* (0.08)	0.4006* (0.25)	0.1250* (0.08)
Age		0.0301 (0.10)	0.0093 (0.01)	0.0227 (0.03)	0.0071 (0.01)
Sex		0.0958 (0.07)	0.0298 (0.02)	0.0903 (0.07)	0.0282 (0.02)
Labour	Change in Labour Journey	1.1768*** (0.07)	0.3654*** (0.02)	1.0788*** (0.07)	0.3367*** (0.02)
	Reduction of Number of Workers	-0.0411 (0.12)	-0.0128 (0.04)	-0.1240 (0.12)	-0.0387 (0.02)
Sectors	Farming Sector	0.3992** (0.07)	0.1239** (0.05)	0.4617*** (0.17)	0.1441*** (0.05)
	Industrial Sector	-0.1789* (0.10)	-0.0556* (0.03)	-0.1787* (0.10)	-0.0558* (0.03)
	Tourist Sector	-0.3377*** (0.13)	-0.1048*** (0.04)	-0.2083* (0.13)	-0.0650* (0.04)
	Recreational Sector	0.3864** (0.20)	-0.1200** (0.07)	-0.3882* (0.21)	-0.1211* (0.07)
	Transport Sector	0.3727** (0.16)	0.1157** (0.05)	0.3720** (0.17)	0.1161** (0.05)
	Constant	-0.9743*** (0.11)	-	-0.9483*** (0.11)	-

Note: Dependent variable: the firm continues operating = 1

Table 1.2. Observations, Roc Curve and Condusion matrix in Models 1 and 2

	Model 1	Model2
Observations	1730	1730
Roc curve	78.96%	79.65%
Confusion matrix	73.88%	73.71%

Analyzing the marginal effects, we can observe in the model 1, that each type of innovation additional generated in the pandemic, increase a 5.64% the probability to continue operating. Also, we can observe that the firms that changes the journey of their workers instead of dismisses them, increase a 36.54% the probability to open. Moreover, the size -observed in the level of sales- reduce the probability to close in 5.03% for level.

It is congruent with the theory because it has more sources and permit to the firm to adapt better. In the sectors, is included farming and transport that increase the probability to continuous open in 12.39% and 11.57%, respectively, versus industry, tourist and recreational firms, which increase a 5.56%, 10.48% and 12% additional of probability to close respectively.

Characteristics of the entrepreneur such as age or sex, as well as the number of workers are not revealed to be significant. The latter case draws particular attention to the usual presence of this variable in the economic literature, although it may be that the level of turnover reflects the size of the company from a more pragmatic perspective.

In this sense, the probability as the turnover volume increases from $100,000 to $1 million increases the probability in 7.10%, in 12.85% when invoiced between $1 and $2 million, 15.27% if the turnover is between $2 and $5 million, and in 12.90% if it is more than $5 million. Linearity is observed between the level of turnover and the probability of operating in pandemic, although in the latter case the probability slightly decreases.

In the model 2, we can see any type of innovation and the marginal effect. The product and process innovation result no significance values, versus other innovation that increase the probability to continuous with the normal activity of the firm: marketing (10.80%), market (4.66%), teleworking (11.36%) and digitalization (5.84%). The control variables show similar values, so they are not commented again, so the models are robust.

An additional model has been developed by checking the level of operation of the firms, continuing with the logic of the previously proposed models. In this case, the depend variable is level of operation, that is measured as discrete variable the percentage (0, 10, 20… 100%). Again, two models are made, the model 3 analyzing the impact of the number of innovations made, and the model 5 that includes a dummies variable for each type of innovation.

In the model 4 and 6 we have segregated the firms that have adopting the digitalization technology and it is analyzed the potential effect of number of innovations and the effect of each one of other innovations.

Table 2. Operation Level

Variables		Model 3	Model 4	Model 5	Model 6
Innovations	Innovations (number)	0.0392*** (0.01)	0.0377*** (0.01)	-	-
	Product Innovation	-	-	0.0353*** (0.01)	0.0410 (0.03)
	Process Innovation	-	-	0.0379*** (0.02)	0.0280 (0.03)
	Marketing Innovation	-	-	0.0386*** (0.01)	0.0464** (0.02)
	Market Innovation	-	-	0.0500*** (0.01)	0.0451* (0.02)
	Teleworking	-	-	0.0270** (0.01)	0.0221 (0.02)
	Digitalitation	-	-	0.0399*** (0.01)	-
Number of workers	Small (10-49)	0.0277** (0.03)	-0.0091 (0.03)	-0.0091 (0.03)	-0.0050 (0.03)
	Medium (50-199)	0.0705* (0.03)	-0.0126 (0.05)	-0.0126 (0.05)	-0.0097 (0.05)
	Big (>200)	0.0476 (0.05)	-0.0089 (0.08)	-0.0089 (0.08)	-0.0035 (0.08)
Sales	Small (100,000-1M)	0.0622*** (0.01)	0.0581** (0.03)	0.0581** (0.03)	0.0567** (0.03)
	Medium(1-2M)	0.0548** (0.02)	0.0902** (0.04)	0.0902** (0.04)	0.0925** (0.04)
	Big (2-5M)	0.0622* (0.04)	0.0178 (0.05)	0.0178 (0.05)	0.0246 (0.05)
	Very Big (>5M)	0.0837** (0.05)	0.1034 (0.08)	0.1034 (0.08)	0.1037 (0.08)
Age		-0.0245*** (0.01)	-0.0158 (0.01)	-0.0241*** (0.01)	-0.0150 (0.01)
Sex		0.0038 (0.01)	-0.0157 (0.02)	0.0033 (0.01)	-0.0160 (0.02)
Labour	Change in Labour Journey	0.2661*** (0.01)	0.2462*** (0.02)	0.2677*** (0.01)	0.2467*** (0.02)
	Increase the number of workers	0.4755*** (0.05)	0.4531*** (0.08)	0.4735*** (0.05)	0.4525*** (0.09)

	Reduction of number of workers	-0.0185 (0.02)	0.0455 (0.04)	-0.0188 (0.02)	0.0461 (0.04)
Sectors	Farming sector	0.1088*** (0.03)	0.0213 (0.13)	0.1072*** (0.03)	0.0152 (0.13)
	Industrial sector	- 0.0525*** (0.02)	-0.0573* (0.04)	- 0.0532*** (0.02)	-0.0578* (0.03)
	Tourist sector	-0.0321 (0.02)	-0.0745** (0.03)	-0.0357 (0.02)	-0.0789** (0.04)
	Recreational sector	- 0.1100*** (0.03)	-0.1080** (0.05)	- 0.1132*** (0.03)	-0.1106** (0.05)
	Transport sector	-0.0023 (0.03)	-0.0466** (0.08)	-0.0045 (0.03)	-0.0459 (0.09)
Constant		0.1945*** (0.02)	0.2112*** (0.04)	0.1960*** (0.02)	0.2462*** (0.04)
Observations		1733	577	1733	577
R2		35.88%	28.73%	35.95%	28.81%

Note: Depend variable: level operation

In this case, the operation level is affected for the same variables of the open/close models and with the same direction. The youngest entrepreneurs have more options to have their company at a higher operating level, reducing by 2.45% the level of operation for every additional 10 years of the entrepreneur from 25 years; however, the sex of the entrepreneur is irrelevant in this crisis to operate at higher or lower level. The size measured for the sales and number of workers increase the level of operating in the pandemic (model 3). Here we can see that the effect by sales in the operating level is more significance and bigger (6.22%, 5.48%, 6.22% and 8.37%, respectively) that by number of workers (increase in 2.77% the operating level if the firm is 10-49 worker, and 7.05% if the number of workers is 50-199; probably more workers are not significance because the variable big and very big sales are related with high number of workers).

In the case of innovation diversification, each additional type of innovation developed and implemented by the company due to the pandemic, increased by 3.92% the level of operation. When broken down by type of innovation (model 5), some variables relative to the size measured in sales and workers lose their significance (only small and medium size by sales are significance, with a positive effect 5.81% and 9.02% respectively, over the operation level), but all those related to innovation show a positive effect on the level of operability. In this way, the implementation of some product innovation increases by 3.53% the level of operation, process innovation by 3.79%, marketing innovation 3.86%, market innovation by 5%, telework by 2.70% and digitalization by 3.99%.

In addition, labor flexibility has enabled firms to increase their level of operation in relation to companies that have chosen to make their workers redundant, in the case of firms that have changed the work journey, increases of 26.61%, and in the case of companies that have increased the number of workers, have increased on average their operativity by 47.55% (as a result of their own business expansion cycle, but residual in the data set with 31 companies from the 1730). On the contrary, it is noted that fims that have suspended their employees do not have significant differences in their operational capacity with respect to dismissal.

In relation with the control sector variables, the data show that the industry is more affected that services sector, -5.25% of operation level, and within the services sector, the entertainment sector with 11% less operational. Furthermore, the farming sector is the lower affected (operation level increase in this sector a 10.88%) in the begin of the pandemic, which is logical since it was the sector where most exceptions were made to the national strike.

By segregating companies by digitization (models 4 and 6), it is observed that the coefficients have similar values, and even the significance of characteristics such as size is lost (by turnover and by number of workers), which raises the possibility that the fundamental characteristic of adaptation is the digitalization itself, being irrelevant the heterogeneity of sales and workers to define the level of business functioning. Among the types of innovation carried out, product, process or teleworking innovation is not significant, while the impact of marketing innovation increases (4.64%) and that of the market decreases (4.51%).

5. Conclusions

In this research, we can see the first look at the impact of pandemic in the economy of Quito, Ecuador, especially in the small firms that represent the principal economic and labor motor in the city and in the country. We can observe that any countries, like Latin America countries, have a bigger risk to collapse because there is not an innovative tradition region, and the firms produce goods and services of low add value (not industrialized, especially from farming sector and commodities goods).

The low innovative level generates more vulnerability, that is transferred to the economy and population because it is more sensitive for its inability to react and adapt, origin of the innovation, under the evolutionist school's vision and the perspective of the dynamic capabilities. The diversification of innovative skills, that is, the increase of innovation in its variety of types (product, process, marketing, market, telecommuting and digitalization) have enabled firms with greater dynamism in their skills to operate at a significantly higher level depending on the variety of innovations made, leading to a fundamental relationship between adaptive capacity, entrepreneurial dynamism, and innovative diversification. We can conclude that the increase of number of types of innovation, which shows the innovative character of the firm and the entrepreneur, increased the probability to continue operating to the firm (between a 3.5 and a 5% by any type of innovation developed). Analyzing particularly each innovation, we can observe that especially the market innovation is the innovations with a bigger marginal effect for continuous open (5%).

Working flexibility and adaptation of the working environment, through changing working hours and teleworking, the new situation during the pandemic has allowed these companies to continue to operate and to show relatively better signs of performance than companies that have chosen to dismiss or suspend their workers. This effect is congruent with the need to adapt to the new reality and the capability of the firm through of the workers.The available data about the entrepreneur reveals that there is not difference by sex, but yes by age, reducing each ten years the level of operation in pandemic in a 2.45%, which tells us about the intergenerational differences in dynamism of their abilities.

Finally, any sectors are more affected that others. For example, to belong farming and transport sector, which had to continuous working and whose demand is no too affected in the crisis, increase the probability to continuous open respect the services sectors, but to belong to the entertainment and tourist sector, reduces the probability, because this activity was forbidden for the government with de declaration of Exception State and the logical low of the demand of this services in the population.

Recommendations

The fundamental role of digitalization in Latin America is revealed by disaggregating these companies and observing that variables evidently related to the level of performance such as sales or the number of workers, including some innovation variables, are revealed not to be significant, being therefore the digitalization the key variable to explain the higher level of performance and adaptive ability.

We conclude that the principal recommendation must be that all firms have to boost the digitization like the first step to increase the ability of adaptation, and continue with the introduction of each type of innovations that are possible.The recommendation for public policy is that the public institutions help providing the process of transformation of the business fabric toward an innovative economy through training, capacitation, tax advantages for innovative firms… facilitating the convergent with other rivals' firms from countries more developed.

Finally, we recommend repeat this research and check if the firms that have survived for the pandemic are digitalized and if the firms that this research identify that better ability to adapt continue operating, have grown or are close.

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Annexes: 1. Detailed methodology and applied survey. 2. Descriptive statistics.

Annex 1. Detailed methodology and applied survey

While it is true that Latin America is characterized by its high informality, most people even among the informal ones have registered a RUC (single register of taxpayers, requirement necessary to issue very simple invoices with an identification) with which they can invoice, a different question is that they do not do it or do it for an amount less than the real (partial informality), and thus in the database used.

As regards the selection bias of companies, the contacts of these companies have been taken at random from the database. To avoid cognitive bias, telephone interviews have been conducted by completing the survey by students trained for this purpose to ensure that respondents understand it. Regarding the bias of the answers, an attempt has been made to avoid open questions so as not to create discomfort for the respondents about their economic-business situation and to guarantee a higher level of truthfulness. In addition, the answers offered objective choices about the operation and performance of the company (number of employees, range of sales, etc.). However, there is the possibility that there is a bias that respondents lie during the interview, although to minimize these cases an introduction has been made by the interviewer explaining the academic and research purpose of the survey and the non-intervention of state entities.

In order to be able to carry out the survey, a random sampling stratified by size of company was carried out on the basis of data of all the companies identified before the Chamber of Commerce or SRI (eliminating previously the companies registered in both bases). In addition, the RUC code is requested in the survey, to verify that the same company only responds once or its data has been duplicated in the database. Table A1 shows the details of the questions that were included in the survey.

Table A1 - Construction of questions

Variable	Observ.	Mean (Standard desviation)	Construction
Open	1,730	0.5514 (0.4975)	The firm has closed totally for the pandemic = 0; the firm has functioned (more or less) = 1.
Operating level	1730		Discrete variable that distributes in multiples of 10 the operating level of the company (0, 10, 20…100%).
Age	1,759	2.3240 (1.1466)	The age of principal entrepreneur is <25 years = 0; 26-35 years = 1; 36-45 years = 2; 46-55 years = 3; 56-65 years = 4; >66 years = 5.
Sex	1,760	0.3505 (0.4772)	The principal entrepreneur is a man = 0; woman = 1.
Sales	1,755	0.5356 (0.9432)	The range of normal sales (yearly) is <100,000$ = 0; 100,000-1 million $ = 1; 1-2 million $ = 3; 2-5 millions $ = 4; more of 5 million $ = 5.
Workers (size)	1,759	0.4179 (0.8268)	Dummies with the number of workers: 1-9 workers = 0 (not included); 10-49 workers = 1;

			50-99 workers = 2; 100-199 workers = 3; >200 workers = 4.
Innovations	1,760	1.9773 (1.2240)	Number of types of innovations realized (0-6)[1]
Product Innovation	1,760	0.2705 (0.4443)	Dummy. If the firms realized any product innovation = 1.
Process Innovation	1,760	0.2040 (0.4031)	Dummy. If the firms realized any process innovation = 1.
Marketing Innovation	1,760	0.4722 (0.4994)	Dummy. If the firms realized any marketing innovation = 1.
Market Innovation	1,760	0.3017 (0.4591)	Dummy. If the firms realized any market innovation = 1.
Teleworking	1,760	0.4295 (0.4952)	Dummy. If the firms realized teleworking = 1.
Digitalization	1,760	0.3006 (0.3006)	Dummy. If the firms realized changes of digitalization = 1.
Changes labours	1,760	0.4653 (0.4989)	Dummy. If the firms changed the journey or form of working = 1; vs to fire workers, suspending labour or similar = 0
Farming sector[2]	1,760	0.0443 (0.2059)	Dummy. The firm belongs to the farming sector = 1.
Industrial sector	1,760	0.1443 (0.3515)	Dummy. The firm belongs to the industrial sector = 1.
Tourist sector	1,760	0.0727 (0.2598)	Dummy. The firm belongs to the tourist sector = 1.
Entertainment sector	1,760	0.0273 (0.1629)	Dummy. The firm belongs to the entertainment sector = 1.
Transport sector	1,760	0.0403 (0.1968)	Dummy. The firm belongs to the transport sector = 1.

ovative attitude Number of types of innovation realized

[1] Only one firm said that realized zero innovations since the begin of pandemic.

[2] It has been selected five economic sectors dummies: farming sector, industry sector vs service sector. In addition, has included those most affected (tourism and entertainment) and the less affected (transport) vs otherwise.

Annex 2. Descriptive Statistics of the Results of the Applied Survey

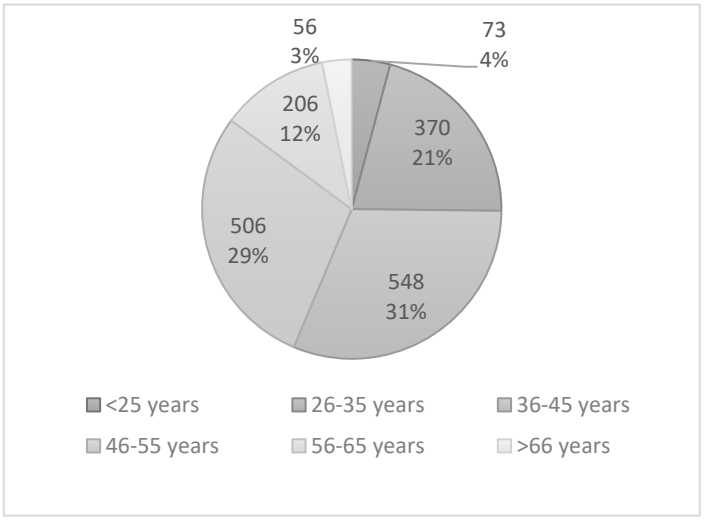

Figure 2.1. Firms by age of the entrepreuner

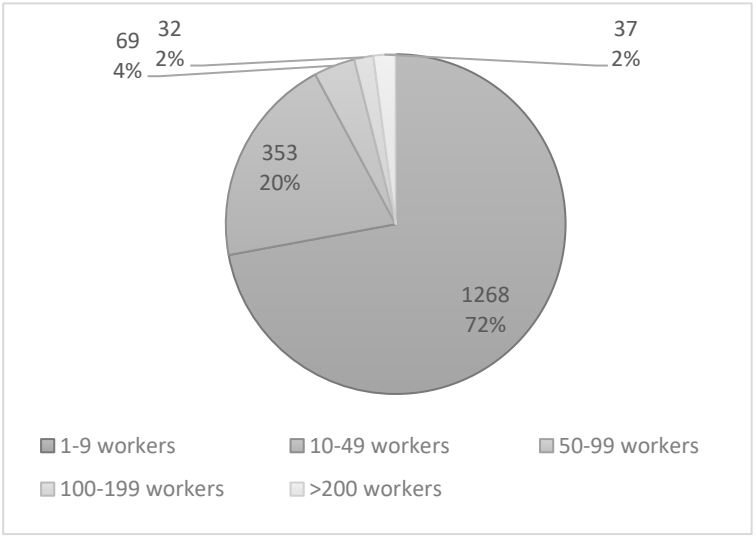

Figure 2.2. Firms by number of workers

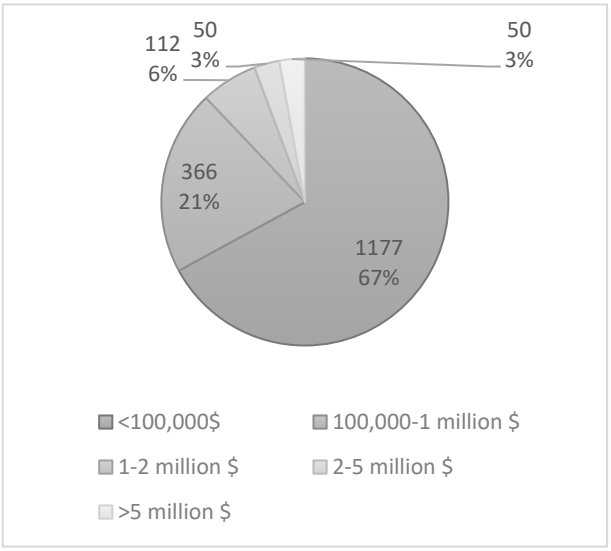

Figure 2.3. Firms by sales range.

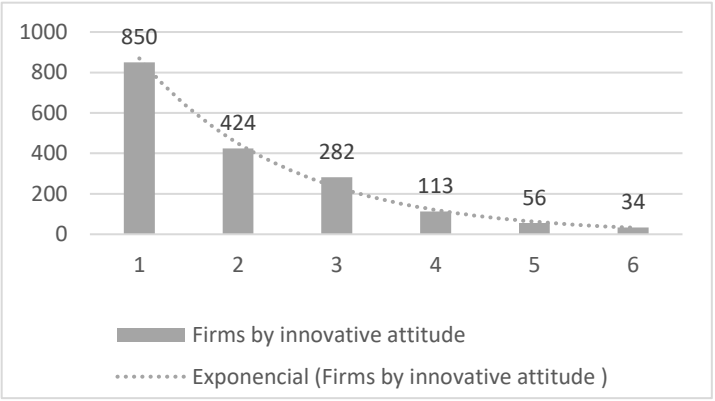

Figure 2.4. Firms by innovative attitude. Number of types of innovation realized

Table A1. Business density: Number of business per 1000 inhabitants and Size of Enterprises (%)

Country	Business density	% Micro	% Small	% Medium	% Large
Argentina	27,672	88,74%	8,09%	2,66%	0,52%
Brazil	13,833	69,55%	22,85%	5,62%	1,99%
Colombia	24,498	87,63%	10,66%	1,33%	0,37%
Ecuador	31,334	93,00%	5,40%	1,30%	0,30%
Germany	51,164	90,51%	7,51%	1,52%	0,46%
Mexico	57,717	94,63%	4,69%	0,56%	0,12%
Spain	100,857	96,53%	2,89%	0,52%	0,06%
U.S.	35,604	95,39%	3,63%	0,79%	0,18%

Source: Adapted from SME Finance Forum (2019) and World Bank (2020).

Regional and Sectoral Economic Studies: https://www.usc.gal/economet/rses.htm