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Research article

Entrepreneurs and COVID-19 pandemic: Who are more likely to close their business in Latin America and the Caribbean?

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Abstract
The COVID-19 pandemic led entrepreneurs to close numerous businesses due to reduced demand. This article aims to determine the specific characteristics of business owners in Latin America and the Caribbean, who faced closures due to low demand during the pandemic, including factors such as age, gender, income, and contextual variables such as economic sector and stringency measures. To do so, we employ a binary response model to estimate the likelihood of business closure due to low demand. Various model specifications, including both individual and contextual variables, are used to better analyze these effects. Our findings reveal a profile of entrepreneurs who were at a higher risk of closing their businesses due to reduced demand during the COVID-19 pandemic. Specifically, entrepreneurs without health insurance or emergency savings, operating within the wholesale and retail sector, were more susceptible to business closures.

Keywords: business closure; COVID-19 pandemic; Latin America; probit model; entrepreneurs.

Los empresarios y la pandemia de COVID-19 ¿Quiénes tienen más probabilidades de cerrar sus negocios en América Latina y el Caribe?

Resumen
La pandemia de COVID-19 provocó el cierre de numerosos negocios entre los empresarios debido a la reducción de la demanda. Este artículo tiene como objetivo determinar las características específicas de los propietarios de negocios en América Latina y el Caribe que enfrentaron cierres debido a la baja demanda durante la pandemia, incluyendo factores como la edad, el género, los ingresos y variables contextuales como el sector económico y las medidas de restricción. Empleamos un modelo de respuesta binaria para estimar la probabilidad de cierre del negocio debido a la baja demanda y varias especificaciones de modelos que incorporan variables individuales y contextuales para analizar mejor estos efectos. Nuestros hallazgos revelan un perfil de empresarios con mayor riesgo de cerrar sus negocios debido a la reducción de la demanda durante la pandemia de COVID-19; específicamente, aquellos sin seguro de salud o ahorros de emergencia que operan dentro del sector mayorista y minorista fueron más susceptibles al cierre de negocios.

Palabras clave: cierre de negocios; pandemia por COVID-19; América Latina; modelo probit; emprendedores.

Os empresários e a pandemia de Covid-19: Quem tem mais probabilidade de fechar seus negócios na América Latina e no Caribe?

Resumo
A pandemia de Covid-19 provocou o fechamento de inúmeros negócios entre os empresários devido à redução da demanda. Este artigo tem como objetivo determinar as características específicas dos proprietários de negócios na América Latina e no Caribe que enfrentaram fechamentos devido à baixa demanda durante a pandemia, incluindo fatores como idade, gênero, renda e variáveis contextuais, como o setor econômico e as medidas de restrição. Utilizamos um modelo de resposta binária para estimar a probabilidade de fechamento do negócio devido à baixa demanda e várias especificações de modelos que incorporam variáveis individuais e contextuais para analisar melhor esses efeitos. Nossos achados revelam um perfil de empresários com maior risco de fechar seus negócios devido à redução da demanda durante a pandemia de Covid-19; especificamente, aqueles sem seguro de saúde ou poupança de emergência que operam no setor atacadista e varejista foram mais suscetíveis ao fechamento de negócios.

Palavras-chave: fechamento de negócios; pandemia de Covid-19; América Latina; modelo probit; empreendedores.

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1. Introduction

The COVID-19 pandemic arrived in Latin America and the Caribbean (LAC) during a recession period and aggravated it (ECLAC, 2020a; ECLAC, 2020b). During the first months of the pandemic, March and April 2020, all LAC countries confirmed COVID-19 cases and governments implemented containment measures such as lockdowns, curfews, and limited access to essential businesses. This affected entrepreneurial activities in LAC led to business closures, therefore, to unemployment (Guevara-Rosero et al. 2024). In the case of LAC countries with a high percentage of informality (53%) (ECLAC, 2020a), survival-driven entrepreneurs (Berner et al., 2012), mainly informal, were the most affected. In addition, specific activities with required face-to-face contacts were more affected during the COVID-19 pandemic period. Our research hypothesis is that not only the individual characteristics of entrepreneurs affect their probability to close their business but also the characteristics of the environment where they operate.

This study aims to determine the characteristics of business owners who faced closure due to low demand during the COVID-19 pandemic in LAC and the characteristics of their environment. To do so, we estimate a binary response regression model (Probit) to disentangle the effect that both business owners' individual (socioeconomic and demographic) characteristics and COVID-19 contextual characteristics—such as stringency measures and the economic sector affectation degree—have on business owners' probability of facing the closure of their business. We use the *IDB-Cornell Coronavirus Survey* (Bottan et al., 2020a) carried out at the height of the pandemic (March-April 2020) as the primary data source, along with other alternative databases. To account for stringency measures, we use a stringency index reported by the Oxford COVID-19 Government Response Tracker (Hale et al., 2020). To account for LAC responses to the COVID-19 crises, we use the *Chronology of the policy response during the COVID-19 pandemic in Latin America and the Caribbean* (PNUD, 2020) and *Overview of government responses to the crisis* (OECD, 2020).

To the best of our knowledge, there are no studies considering individual characteristics of business owners and aspects external to companies when studying business closure during the pandemic. While there are studies analyzing business performance during that time, they focus on estimating the aggregate measure of job losses and business closures. Our approach focuses on explaining the characteristics of business owners and external aspects related to the pandemic that influence their probability of business closure.

Business failure has been tackled focusing on the commercial and financial characteristics of firms, mainly large ones (Sepúlveda and Reina, 2016; Bermudez and Bravo, 2019). Due to the lack of availability of financial information, small businesses have been explored very little (Maté-Sánchez-Val et al., 2018). The only recent study that focused on business owners' profiles differs from ours because it reports characteristics of individuals who transition from salaried employment to pursue entrepreneurship (Rocha et al., 2015).

Regarding our approach, owner characteristics might have a more important role in determining the probability of business failure for microenterprises than for large-scale entrepreneurs. Indeed, decision-making depends on some intrinsic characteristics such as education, age, gender, and marital status, among others (Ajzen, 1991), and it is important during a crisis such as the COVID-19 pandemic.

Our study adds to the literature on entrepreneurial failure by analyzing specifically the probability of business closure for entrepreneurs in LAC countries in the context of the COVID-19 crisis, focusing on the characteristics of business owners. While some studies identify some characteristics of business owners, such as education and family business (E. Halabí and N. Lussier, 2014), this study contributes to the field by providing a complete profile of entrepreneurs who are most likely to face business closure. In addition, our approach considers the environment where businesses operate (contextual characteristics), which was particularly important during the COVID-19 crisis. Among other aspects, we consider the stringency measures established in each LAC country and governmental social benefits to help people face the COVID-19 pandemic. In this way, this study contributes to a better understanding of the role of institutions in the management of health and economic crisis.

While this section introduced this research, the next section discusses relevant literature, section three details the empirical strategy, and section four analyzes the results. Finally, the last section identifies policy implications and conclusions.

2. Literature review

Business closure has been mainly related to bankruptcy (Bôrger et al., 2009; Dun and Bradstreet, 1979), which is a juridical definition linked to a company's financial situation. However, since bankruptcy is a legal status, informal firms might be excluded from this definition. Ulmer and Nielsen (1947) indicate that a business closure can be an alternative to prevent losses and it is a planned event, which does not necessarily imply failure. On the contrary, Cochran (1981) indicates that business closure is related to incompetence in management, which results in failure. Watson and Everett (1993) propose a more holistic approach of closure, defining it as a discontinuity due to a particular factor; this definition encompasses most business closure events in a crisis context such as low demand.

Several empirical approaches have been used to study business closure. On the one hand, it has been tackled through an economic approach focusing on commercial and financial characteristics of firms (Tonon Ordóñez et al., 2022). This approach has not been

employed in crisis times. Moreover, the environment and context where business owners evolve are also relevant (Wasileski et al., 2011). On the other hand, business closure has been analyzed considering an individual approach because, ultimately, the closure decision is made by the owners (Ortiz Medina, 2013). Considering individual characteristics of business owners is suitable in a context of a crisis such as the COVID-19 pandemic because it directly affected people and indirectly affected their businesses.

Regarding the economic approach, several characteristics have been identified. Bermudez and Bravo (2019) obtained that the probability of business closure decreases when accounts receivable diminishes and leverage, fixed assets and rentability increase. Sepúlveda and Reina (2016) explained business sustainability through business variables such as the product offer, reinvestment, and the economic sector.

The economic sector has also been analyzed in the COVID-19 crisis context by several authors. Donthu and Gustafsson's (2020) found that the touristic sector, including hotels and airlines, were severely affected. For instance, Asmelash and Cooper (2020) report that nearly 80% of hotel rooms were unoccupied during the pandemic. Donthu and Gustafsson (2020) indicate that airlines had to cut staff by 90% and 2020 economic benefits were almost zero. In this line, Guevara-Rosero et al. (2024) show that during the COVID-19 pandemic, people more likely to lose their jobs were women with no education; people older than 45 years old; people with no insurance; people with no savings, people with informal debts and people working in COVID-19 related high-risk activities. Xiang et al. (2021) assert that the most affected economic sectors are those with technological limitations. In the case of United States, Bartik et al. (2020) show that 43% of small business in the retail sector temporarily closed and that many of them had little cash to face the crisis derived by the COVID-19 pandemic. By analyzing firms operating in key and non-key sectors, Stemmler (2022) obtained that firms operating in key sectors reported fewer declining sales and a smaller number of fired workers, meanwhile firms operating in non-key sectors were more likely to adapt to the new scenario by engaging in online business. While there are studies regarding business performance during the pandemic, they focus on estimating job losses and business closures. Our approach focuses on explaining the characteristics of business owners that affect their business closure.

Regarding the individual approach, some authors explain the failure of firms through the individual characteristics of business owners; for instance, gender, age, and education might determine the failure of a business. As far as gender is concerned, women are more likely to close their business (Ortiz Medina, 2013; Fairlie and Robb, 2009); as asserted by Fairlie and Robb (2009), women-owned businesses are 12.9% more likely to close because those firms rely on less financial and human capital and because women have less availability of time due to caregiving activities. Moreover, although Stemmler (2022) analyzed the reduction in sales and in personnel (and no business closure), the author obtained that firms with female managers are less likely to report declining sales. Also, education is another important individual characteristic that explains business closure: according to the human capital theory, general and business-specific human capital is negatively associated with business closure (Rauch and Rijsdijk, 2013; Ortiz Medina, 2013).

The business owner's age also matters. Ortiz Medina (2013) obtained a non-linear relationship with the probability of business closure. As age increases, people might be more limited given technological advances and in turn, increase their probability of closing a business (Lévesque and Minniti, 2006). The decrease in the probability of business closure is explained by an increase in fear of changing a specific economic activity (risk aversion), which increases with age. An older business owner is more likely to refuse to close his/her business to start another one (Montes Rojas and Siga, 2009). In the COVID-19 pandemic scenario, Stemmler (2022) obtained that age does not matter regarding the probability of experiencing a decline in sales.

Other aspects related to business closure —which might be identified as characteristics of business owners— are health insurance (Chao et al., 2007) and social benefits (Martin et al., 2020). More specifically, when business owners get health insurance, indicating that they care about their health, it is more likely for them to correctly manage their business and stay in the market (Chao et al., 2007). Wolfe and Patel (2019) showed that entrepreneurs engaging in health insurance are less likely to exit self-employment. In addition, van Gelder et al. (2007), from a psychological perspective, showed that failed business owners are more likely to employ reactive strategies whereas operational business owners are more likely to pursue long-term planning strategies. There is evidence proving that social benefits diminish any crisis repercussion so that the probability of business closure decreases as well (Martin et al., 2020). Thus, government intervention can boost household demand, in turn, reducing business closure due to low demand.

3. Methodology

3.1 Data

The cross-sectional database prepared by the Inter-American Development Bank (IDB) and Cornell University, obtained from the "Coronavirus Survey - IDB/Cornell" is used in this research. The online questionnaire collects information from 17 countries in Latin America and the Caribbean: Barbados, the Bahamas, Bolivia, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guyana, Jamaica, Mexico, Panama, Peru, Suriname, Trinidad and Tobago, and Uruguay. The sample selection, which includes 230,540 observations collected

by IDB/Cornell University, ensures comparability among individuals across countries[1]. For this empirical exercise, we select information about business owners only; therefore, we keep 104,373 observations.

The survey was standardized to present the same questionnaire design to respondents from different countries. Thus, variables such as income were measured using the minimum wage of the corresponding country as the measurement unit. The questionnaire consists of six categories: financial situation, enrollment in social programs, hunger, scarcity of key assets, labor market results, and approval of different policies to curb the spread of the COVID-19 pandemic. The data collection design included weights based on demographic characteristics to correct possible biases, so our results are representative for the region.

3.2 Variables

The dependent variable in this study is a dichotomic variable that captures if a business closed due to low demand during the pandemic. It is constructed using the question of the BID-Cornell Coronavirus Survey: During the last week, have you closed your business due to low demand? According to the statistics, 43.65% of the surveyed owners closed their business due to low demand. As shown in Figure 1, Bolivia was the country with the highest proportion of respondents who have closed their business (53.44%), followed by Ecuador (51%) and Colombia, El Salvador, and Panama (47%).

The description of independent variables used in the model is detailed in Table 1.

According to the descriptive statistics shown in Table 2, considering the total number of female respondents, 32.21% said they had not closed their business due to low demand; while 32.12% of male respondents indicated that they had closed their business. Moreover, those who were in a relationship recorded a higher rate of business closure (50.41%) than those who were single or divorced (49.59%). It seems that those who did not had health insurance were more vulnerable since they reported a higher rate of business closure (54.01%) than those who had public (26.85%), private (11.99%) or both types of insurance (7.14%). Additionally, it is worth noting that the gap in terms of closure proportion between those who were not insured and those who were fully insured is almost 47 percentage points. The majority of respondents' main source of income is the Wholesale and retail sector (44.66%), the other 55.34% of respondents is divided amongst the other eight categories of main source of income. Regarding social benefits during the pandemic, the vast majority of respondents (86.24%) reported not having received them. As for pre-pandemic social benefits, most respondents did not receive them (84.54%). Respondents who could cover unforeseen expenses of up to 1.5 minimum wages, meaning that they had emergency savings, recorded a considerably lower proportion (25.81%) than those who could not cover such unforeseen expenses (74.19%) and closed their businesses.

Regarding the continuous variables, the studied business owners are 38.89 years old on average. The stringency index records a mean around 85.08 and varies in the range between 61.11 and 100. On average, as reported in Table 3, countries with the highest stringency index are Bolivia (96.3) and the Bahamas (96.3), followed by Peru (94.44), the Dominican Republic (94.57), Ecuador (93.52) and El Salvador (90.74), while the lowest stringency index was found in Uruguay (65.99) and Chile (73.15). For more information, Table A1 in Annex A describes the temporary restrictions and policies adopted by LAC countries during the COVID-19 pandemic.

3.3 Method

To analyze the probability of business closure, a probit model is employed as econometric modeling strategy. The dependent variable, y, is dichotomous: it is 1 if the individual has closed his/her business due to low demand during the COVID-19 pandemic, and zero, otherwise. The general form of the probit model is:

$$P(y=1 \mid x) = G(\beta_0+\beta_1 x_1+\cdots+\beta_k x_k) = G(\beta_0+x\beta),$$

where is a vector including the set of explanatory variables such as gender, age, being in a relationship, the level of education, health insurance, new and previous social benefit, economic sector, and emergency savings (see Table 1). The heterogeneity is captured using not only individual variables of entrepreneurs but also contextual variables regarding the country where they operate. G is a function that assumes values strictly between 0 and 1: , for all real numbers. The probit model is a nonlinear model. Therefore, it is appropriate to use the maximum likelihood estimation (MLS) (Wooldridge, 2010). Once the estimated coefficients are obtained, they cannot be directly interpreted (Wooldridge, 2010). It is necessary to estimate the partial effects of the explanatory variables on the probability of response using the partial derivative:

$$\frac{\partial p(x)}{\partial x_j} = g\,(\beta_0+x\beta_1)\,\beta_j \quad ,$$

where $g(z)\equiv\frac{dG}{dz}(z)$

Different specifications of the model are estimated considering individual characteristics (column 1 in Table 4), contextual variables (column 2 in Table 4) and individual and contextual variables (column 3 in Table 4). All these models are validated according to the confusion matrices and ROC curves (see Appendix B).

1 As detailed by Bottan et al. (2020a), the survey was conducted using weights to correct possible population biases and achieve representativeness. Moreover, weights were included so as to make the sample sizes of countries comparable using demographic and time-insensitive variables. So, the predicted probability of being in a representative survey was modeled allowing the results of this study to be representative for each Latin American and Caribbean country.

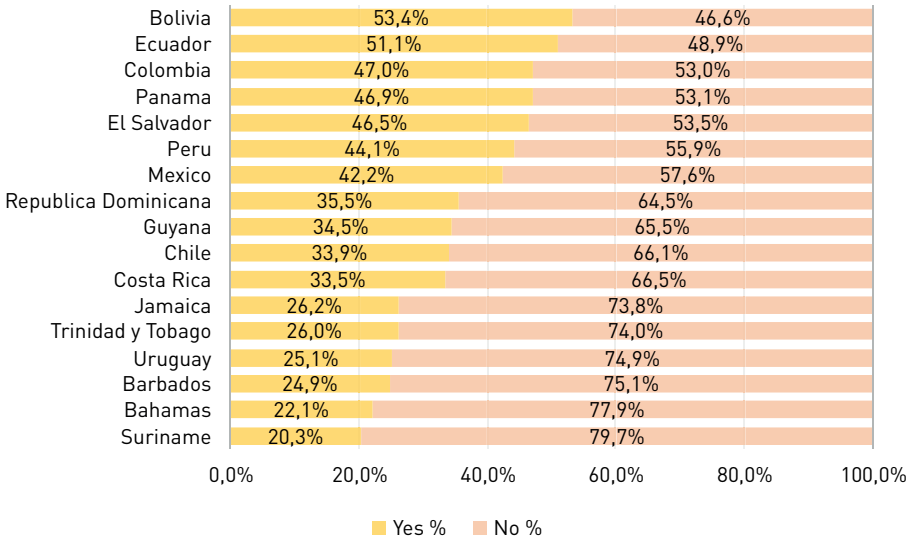

Figure 1. Business Closure due to Low Demand by Country in LAC
Source: own elaboration.

Table 1. Description of Variables

Variable name	Description
Age	A discrete numerical variable, corresponding to the age of the respondent.
Gender	A binary variable corresponding to the sex of the respondent: male (0) and female (1).
Civil status	A binary variable corresponding to the marital status of the respondent. Two categories are considered: in a relationship (0), not in a relationship (1).
Health insurance	A categorical variable indicating whether the respondent has health insurance with four options: public insurance, private insurance, both types of insurance, and no insurance (reference category).
Sector of main source of income	A categorical variable capturing the economic sector from which the respondent receives her/his main income, without necessarily implying that the line of business belongs to that sector. The categories are Construction; Restaurants and hotels; Manufacturing; Extraction and energy; Agriculture, livestock and fishing; Transport; Financial services; Wholesale and retail (reference category); and Others.
Stringency index	A continuous variable corresponding to the level of stringency to which each surveyed person was exposed to in a given country and in the specific date when he/she was surveyed. This is done as stringency measures changed over time. This variable has a 0-100 range, where 0 corresponds to low levels of stringency and 100 to the maximum level of stringency. This index, built by the University of Oxford (Hale et al., 2020), is a composite measure based on nine response indicators: school closures, workplace closures, cancellation of public events, restrictions on public gatherings, public transport closures, stay at home requirements, public information campaigns, restrictions on internal movements, international travel controls.
New social benefit	A binary variable indicating whether the respondent or any member of his/her household is a beneficiary of social programs implemented to face the COVID-19 pandemic.
Previous social benefit	A binary variable indicating whether the respondent or any member of his/her household is a beneficiary of pre-pandemic social programs.
Income range	A categorical variable corresponding to the range of minimum wage (MW). The categories are (0.5–1; 1–3; 3–15) MW and (0–0-5) MW (reference category).
Emergency savings	A binary variable indicating whether the respondent will have sufficient resources to cover unforeseen expenses equivalent to at least a half of a minimum monthly wage.
Country	A categorical variable corresponding to the country of residence of the respondent. Categories are The Bahamas, Barbados, Bolivia, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guyana, Jamaica, Panama, Peru, Suriname, Trinidad and Tobago, Uruguay, and Mexico (reference category).

Source: own elaboration.

The "marginal effect at the mean" is estimated. Using this approach allows us to interpret how the probability of closure varies when the previously mentioned explanatory variables are at their mean values. Within the context, we aim to understand the general patterns of the probability of closure in the face of a crisis; these marginal effects allow us to measure how the analyzed factors typically impact the probability of business closure based on central values of the explanatory variables.

Table 2. Descriptive Statistics of Independent Variables

Categorical variable	Frequency	Relative frequency by variable	Frequency of people who closed their business by variable	Percentage of people who closed the business by variable
Gender				
Female	72723	69.87%	30786	67.79%
Male	31358	30.13%	14630	32.21%
Civil Status				
In a relationship	43128	49.02%	20024	50.41%
Not in a relationship	44844	50.98%	19699	49.59%
Health Insurance				
No Insurance	20790	45.11%	10214	54.01%
Public	13215	28.67%	5077	26.85%
Private	7033	15.26%	2268	11.99%
Both	5051	10.96%	1351	7.14%
Sector of main source of income				
Wholesale and retail	15408	44.66%	7317	51.67%
Construction	2959	8.58%	1212	8.56%
Restaurants and hotels	2170	6.29%	1240	8.76%
Manufacturing	2671	7.74%	992	7.01%
Extraction and energy	1222	3.54%	289	2.04%
Agriculture, livestock and fishing	2338	6.78%	859	6.07%
Transport	3830	11.10%	1398	9.87%
Financial services	3594	10.42%	798	5.64%
Others	307	0.89%	56	0.40%
New social benefit				
No	83642	86.24%	36823	85.46%
Yes	13349	13.76%	6265	14.54%
Previous social benefit				
No	88242	84.54%	38419	84.33%
Yes	16131	15.46%	7139	15.67%
Country				
Ecuador	8031	7.69%	4310	9.46%
Barbados	874	0.84%	240	0.53%
Bolivia	13437	12.87%	7422	16.29%
Chile	16139	15.46%	5697	12.50%
Colombia	10398	9.96%	5207	11.43%
Costa Rica	4682	4.49%	1729	3.80%
Dominican Republic	3265	3.13%	1220	2.68%
Bahamas	358	0.34%	89	0.20%
El Salvador	6265	6.00%	3116	6.84%
Guyana	707	0.68%	268	0.59%
Jamaica	960	0.92%	277	0.61%
Mexico	10223	9.79%	4522	9.93%
Panama	6559	6.28%	3195	7.01%
Peru	10553	10.11%	4882	10.72%
Suriname	260	0.25%	62	0.14%
Trinidad and Tobago	2120	2.03%	594	1.30%
Uruguay	9542	9.14%	2728	5.99%
Emergency savings				
No	77340	74.19%	37793	83.07%
Yes	26899	25.81%	7703	16.93%
Continuous var	mean	St.dev.	Min	Max
Age	38.89	11.95	18	88
Stringency index	85.08	9.65	61.11	100

Source: own elaboration.

Table 3. Stringency Index Average by Country

Country	Stringency Index Average
Bahamas	96.3
Barbados	86.17
Bolivia	96.3
Colombia	87
Costa Rica	76.76
Dominican Republic	94.57
Ecuador	93.52
El Salvador	90.74
Guyana	84.69
Jamaica	81.64
Mexico	82.41
Panama	91.2
Peru	94.44
Suriname	80.56
Trinidad and Tobago	81.11
Uruguay	65.99

Source: own elaboration.

4. Results

Table 4 shows the estimation results of probit models that determine the factors that influence the probability of closure of a business due to low demand in the context of the COVID-19 pandemic. In column (1), the probit model includes individual characteristics of business owners; in column (2), contextual characteristics related to the economic activity, COVID-19 stringency index and social benefits; and in column (3), both individual and contextual characteristics. On average, those models classify 67% of observations correctly. The Goodness-of-Fit Evaluation for Binary Specification Hosmer-Lemeshow (see Appendix B, Tables A.8, A.9 and A.10) provides statistical evidence that there is no significant difference between the predicted and observed probabilities, i.e., there is no evidence to reject the hypothesis that the model has a good fit.

Table 4. Estimation Results of the Probability of Business Closure due to Low Demand

Dep. Var: Closure of a business due to low demand	Individual characteristics (1)		Contextual characteristics (2)		Individual and contextual characteristics (3)	
Independent variables	**Coef.**	**dy/dx**	**Coef.**	**dy/dx**	**Coef.**	**dy/dx**
Age	.0258*** (.009)	.0247*** (.009)	.0288** (.012)	.027** (.011)	.022 (.016)	.022 (.016)
Age²	-.0003** (.0001)	-.0003** (.0001)	-.0003** (.0001)	-.0002** (.0001)	-.0002 (.0001)	-.0002 (.0002)
Stringency index			.0029 (.002)	-.0013 (.0023)	.042** (.02)	.042** (.02)
		dy/dx		dy/dx		dy/dx
Female	-.128*** (.034)	-.0467*** (.012)	-.007 (.041)	-.0025 (.015)	-.046 (.054)	-.16 (.019)
Civil status Ref. Cat.: In a relationship						
Not in a relationship	-.088*** (.035)	-.032*** (.0127)	-.115*** (.043)	-.041*** (.015)	-.126 ** (.057)	-.044** (.02)
Health insurance Ref. Cat.: No insurance						
Public insurance	-.167*** (.04)	-.0613*** (.015)			-.193*** (.067)	-.068*** (.023)
Private insurance	-.132*** (.05)	-.0486*** (.019)			.009 (.09)	.003 (.034)
Both types of insurance	-.114*** (.06)	-.042** (.022)			-.098 (.096)	-.035 (.034)
Income range Ref cat.: 0.5 minimum wage (MW) or less						
0.5 – 1 MW	.284 (.05)	.112*** (.019)			.291*** (.085)	.112*** (.033)
1 – 3 MW	-.124 (.053)	-.0477** (.02)			-.143* (.085)	-.054* (.032)
3 – 15+ MW	-.508** (.061)	-.182*** (.02)			-.498*** (.095)	-.178*** (.034)
Emergency savings	-.223*** (.043)	-.081*** (.016)			-.216*** (.066)	-.0762*** (.023)
Sector of main source of income Ref cat.: Wholesale and retail						
Construction			-.189*** (.072)	-.0686*** (.26)	-.15* (.092)	-.054* (.033)
Restaurants and hotels			.059 (.08)	.022 (.031)	-.006 (.11)	-.002 (.04)
Manufacturing			-.2286*** (.078)	-.0827*** (.028)	-.16 (.1)	-.057 (.036)
Extraction and energy			-.406*** (.11)	-.144*** (.031)	-.488*** (.14)	-.166*** (.042)
Agriculture, livestock and fishing			-.183** (.081)	-.066** (.03)	-.089 (.11)	-.032 (.038)
Transport			-.171** (.069)	-.062** (.025)	-.161* (.094)	-.058* (.033)
Financial services			-.327*** (.075)	-.117*** (.026)	-.268*** (.106)	-.094*** (.036)

Table 4. Estimation Results of the Probability of Business Closure due to Low Demand (Continued)

Others			-.609*** (.21)	-.208*** (.064)	-.129 (.23)	-.046 (.082)
New social benefit			.306*** (.075)	.109*** (.027)	.439*** (.1)	.155*** (.038)
Previous social benefit			-.209*** (.065)	-.075*** (.023)	-.186** (.088)	-.065** (.03)
Country Ref cat.: Mexico						
Barbados					-.708** (.29)	-.25** (.1)
Bolivia					-.938*** (.301)	-.33*** (.12)
Colombia					-.107 (.097)	-.038 (.034)
Costa Rica					-.051 (.16)	-.018 (.056)
Dominican Republic					-.895*** (.29)	-.315*** (.1)
Bahamas					-1.16*** (.44)	-.407*** (.16)
Ecuador					-.489** (.239)	-.172** (.084)
El Salvador					-.361* (.193)	-.127* (.068)
Guyana					-.140 (.218)	-.049 (.065)
Jamaica					-.56*** (.18)	-.198*** (.062)
Panama					-.489** (.225)	-.173** (.08)
Peru					-.61** (.26)	-.215** (.092)
Suriname					-.313* (.19)	-.11* (.067)
Trinidad and Tobago					-.24** (.11)	-.085** (.04)
Uruguay					.35 (.42)	.124 (.15)
constant	-.4895	-.342	-.747			
Observations	41 893	31 544	15 867			
AUROC	0.6775	0.7242	0.719			
Sensibility	63.7%	67.29%	63.11%			
Specificity	63.31%	67.42%	69.06%			

Notes: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors in parentheses. (Ref) Reference category dy/dx: marginal effects; ey/dx: elasticity
Source: own elaboration.

Regarding the individual characteristics of business owners, the results show that age has a non-linear effect on the probability of business closure. It increases with age but starts to decrease when business owners surpass the range of 42-50 years old. The increase is because as the business owners' age increases, they can be lagged in terms of technological advances (Lévesque and Minniti, 2006). The decrease is explained by an increase in fear of changing economic activity (risk aversion). An older business owner is more likely to refuse to close his/her business to start another one (Montes Rojas and Siga, 2009). Contrary to Ortiz Medina (2013), whose study was performed in normal times before the COVID-19 pandemic, our results show that in a pandemic, the gender of a business owner appears to be statistically significant to explain the probability of closure because women are less likely to close their business with respect to men. In the same line, Stammler (2022) obtained that business managed by women are less likely to report declining sales and to have workers laid off. However, when accounting for contextual variables, gender is no longer significant but still negative.

Business owners who are not in a relationship (single, divorced, widowed) are 4.4 percentage points less likely to close their business with respect to business owners in a relationship. People in a relationship are more likely to have unexpected or urgent household expenses (health, education, among others) that can induce a business closure in exchange for liquidity. The income range also influences the probability of closing a business. People with higher income levels are less likely to close their business due to low demand during the COVID-19 pandemic. In fact, according to Bottan et al. (2020b), the negative effects in terms of business closures were stronger for the lowest income households. Having health insurance seems to reduce the probability of business closure. Indeed, business owners who are publicly and privately (only publicly, only privately) insured are 4.2 p.p. (6.13 p.p., 4.86 p.p.) less likely to close their business than those who are not publicly or privately insured. These results are in line with Chao et al. (2007) who argue that owners who maintain a good quality of life and correctly manage their health expenses are better suited to run their business. Having health insurance is also related to the characteristic of planning for the long-term of operational business owners (van Gelder et al., 2007). Njegomir et al. (2023) indicated that business insurance premiums increased the number of entrepreneurs in Serbia, showing that insurance make entrepreneurial activities safer and more certain. Business health appears to be correlated with the business owners' health. In fact, a key aspect to face the pandemic affectation was the availability of precautionary savings. Those entrepreneurs who have an emergency fund are 8.1 p.p. less likely to close their businesses.

Regarding the contextual variables, the economic sector that provides the majority of the business owners' income does matter to explain the probability of closure. During the COVID-19 pandemic, several containment measures were imposed so that certain activities would

stop their normal operations. In this context, there were diverse levels of economic impact by sectors. According to ECLAC (2020b), three levels of impact can be identified: strong, intermediate, and low. They are based on the variation in the proportion of formal employment and the changes in the contribution to the GDP of each sector. Thus, wholesale and retail activities and activities related to tourism had a strong impact due to mobility constraints, interruptions in the supply chain, and low demand related to households' precautionary savings and fear of viral contagion. In this line, our results show that when the main source of income comes from a business activity related to construction, the probability of business closure is 6.86 p.p. lower than when the main source of income is wholesale and retail. Likewise, when the main source of income comes from a business related to restaurants and hotels (tourism), the probability of business closure is not significant compared to a main source of income from the wholesale and retail sector.

In line with ECLAC (2020b) classification of economic impacts by sector, our results show that Manufacturing and Transport are sectors of intermediate economic impact since the probability of business closure is 8.27 p.p. and 6.2 p.p. lower than businesses with the Wholesale and retail sector as the main source of income. Businesses in these sectors are stronger in terms of age, size and financial structure. Thus, their affectation could result in a temporary rather than a definitive closure. It is worth noting that small businesses that have connections with larger businesses in these sectors are more vulnerable.

The COVID-19 pandemic's impact on the financial sector is controversial. On the one hand, financial activities were boosted by the necessity of virtual transactions. On the other hand, ECLAC (2020d) estimated an intermediate impact on financial activities. Our results show that the probability of closure is 11.7 p.p. lower than business owners whose main source of income is the wholesale and retail. In fact, in financial activities, teleworking can be easily implemented, which allows for the negative impact of low demand to be reduced and for the business to keep operating.

The affectation in agriculture, livestock, and fishing activities was estimated to be low (ECLAC, 2020d). Our results show that business owners whose main income comes from these sectors are 6.6 p.p. less likely to close their business than those whose main source of income is the wholesale and retail sector. Although agriculture, livestock, and fishing activities are essential, the COVID-19 pandemic crisis certainly impacted them as well, but the affectation was not as high as it was for wholesale and retail or restaurants and hotels. Another sector in which the probability of closure is lower as compared to business owners with wholesale and retail as the main source of income is Extraction and energy, at 14.4 p.p. lower. A one-point increase in stringency index increases the probability of business closure by 4.2 p.p. In general, the pandemic contention measures were expected to impact economic activity, thus affecting both supply and demand (ECLAC, 2020a). Stringency measures in LAC countries included curfews, quarantines, national and international mobility restrictions, focalized constraints by industry (total or partial functioning allowance), teleworking, and virtual education. Curfews were the most draconian measure implemented at the beginning of the pandemic by all the studied LAC countries. This measure paralyzed all the non-essential activities, forcing them to temporarily close (ECLAC, 2020c). Consumers could not buy goods and services, other than food and health-related items. On the supply side, firms could not reach their clients due to the interruption of distribution chains. Regarding the constraints on international mobility, sectors involved in trade and tourism were the most severely affected. Some constraints affected the demand of specific industries involving face-to-face activities, such as hotels, restaurants, bars, education and entertainment activities. The limitation of the capacity of these activities forced them to reduce their efficiency and production. In the context of the constraints of the pandemic, informal workers, who represent a large share of the active population in LAC countries, were strongly affected. The stringency index becomes non-significant when including the country effects because the heterogeneity in terms of stringency measures across countries follows the general heterogeneity among countries.

Regarding social benefits, there is a distinction between business owners who received them before the pandemic started and the ones who received them during the pandemic. New and previous social benefits have different effects. The former are 10.9 p.p. more likely to close their businesses while the latter are 7.5 p.p. less likely to close them. On the one hand, previous social benefits might be conceived as a stable income so it could be used to face the adverse effects of the pandemic and, in turn, reduce the probability of closing their business. On the other hand, new social benefits are allocated to business owners who were already affected by the pandemic, so they are positively associated with the probability of business closures. It is worth noting that the variables of new and previous social benefits measure different effects. While the effect of previous social benefits captures the impact that these benefits have for facing the pandemic, new social benefits, which are pandemic specific, capture the recent economic support for the people most affected by it. Even if we cannot conclude about the smoothing effect of new social benefits during crisis time, we can expect them to reduce adverse effects and crisis duration in business (Martin et al. 2020).

As for the country effects, results reveal that the probability of an individual's business closing due to low demand compared to Mexico is lower for the inhabitants of the Bahamas, Barbados, Bolivia, the Dominican Republic, Ecuador, El Salvador, Jamaica, Panama, Peru, Suriname, and Trinidad and Tobago. A

reason for the lower probability of business closure in these countries, mainly islands, is the late arrival of the COVID-19 pandemic. The number of days that elapsed since the first COVID-19 case was registered in China and when the first case was registered in countries with a lower probability of business closure, on average, was 71 days, while for countries with a non-significant different probability of business closure with respect to Mexico (Colombia, Costa Rica, Guyana and Uruguay) was 69 days.

5. Conclusions and Policy Recommendations

This study focuses on understanding the characteristics of business owners who faced closure due to low demand during the COVID-19 pandemic in Latin America and the Caribbean. Results indicate that not only individual characteristics of business owners (socioeconomic and demographic) influence business closure, but also contextual conditions caused by the COVID-19 pandemic, such as stringency measures, the country of residency, and economic sector affectation degree.

Even though previous evidence asserts that businesswomen are more likely to face closure, our results suggest that, in times of crisis, women can adapt to changes and their closure probability inverts; women are less likely than men to close their business. Moreover, it is interesting to report that some individual characteristics, such as gender and age, are no longer important when COVID-19 related contextual variables are considered. For instance, the stringency index reflects contingency measures established by governments cause a lower demand; thus, businesses are affected without distinction of gender and age of their owner. Furthermore, the stringency index becomes non-significant when including the country effects, implying that the heterogeneity across countries might be similar to the variability of stringency measures. Contrary to gender and age, the business owners' income is still important to explain the probability of closing a business after including contextual variables. As income increases, the probability of business closure decreases.

In times of crisis, business owners who are better suited for risk management are less likely to close their business. This is reflected in the effect of health insurance and emergency savings variables. Indeed, when consumption smoothing mechanisms are in place, businesses can still operate in crisis. Likewise, previous social benefits decrease the probability of business closure because this is another smoothing consumption tool. This also suggests that any type of social benefits decreases the impact of the unexpected negative shocks of the economy.

The COVID-19 pandemic affected all economic sectors, but in different magnitudes. The most affected activities were restaurants and hotels (tourism); wholesale and retail activities; and agriculture, livestock and fishing. Microentrepreneurs who work in manufacturing and transport were affected, but to a lesser extent than the aforementioned sectors. The level of affectation on entrepreneurial activities depended on their degree of adaptability to contingency measures. For instance, a restaurant owner able to implement a delivery service had a lesser probability of closing his/her business. The country of residency of the business owner is important to explain his/her business closure probability. Our results also reveal that the probability of an individual's business closing due to low demand is lower for several Latin American inhabitants (the Bahamas, Barbados, the Dominican Republic, Jamaica, Suriname, and Trinidad and Tobago) compared to the inhabitants of Mexico.

From the results, policy recommendations can be drawn. First, risk management is important to stay in the market during crisis. Therefore, entrepreneurs should engage in training programs for risk management. Second, contingency measures such as risk insurance and government programs should be implemented for helping entrepreneurial activities to survive in times of crisis. For entrepreneurial development, it is important to go beyond personal insurance and get business insurance. In this manner, business will be safer and more certain (Njegomir et al. 2023). Our results show that entrepreneurs with a higher probability of business closure are those between 45 and 49 years old. Therefore, policies targeted to this age range are suggested.

Finally, even though innovation to digital markets was "forced by the crisis", the implementation of electronic commerce was boosted significantly in Latin America and the Caribbean as a result of the pandemic. Our results suggest that business owners in wholesale and retail are more likely to close their business than those operating in other sectors. Therefore, the promotion of electronic commerce and payments makes sense to reduce the probability of business closure due to low demand, thus implying that logistics and transactions can be carried out electronically.

It is worth noting that the International Development Bank-Cornell Coronavirus Survey only accounts for sociodemographic information about the entrepreneurs. No information regarding the business themselves is available. This is a limitation of our study since the characteristics of an enterprise, for instance, financial ones, would affect its performance as stated by the existent literature (Fernández and Gutiérrez, 2012). Nevertheless, since our study focuses mainly on microentrepreneurs, personal characteristics can have a more relevant role in the decision of closing than for large-scale entrepreneurs. Since microentrepreneurs are not obliged to keep formal accounting, it is likely that firm-related information remains unavailable. Despite this limitation, our study provides interesting insights into the vulnerability of business owners in facing closure.

As extensions of this research, it might be interesting to analyze different groups of entrepreneurs by socio-economic or formality status since the affectation of the economic crisis derived from the COVID-19 pandemic could differ across different types of entrepreneurs.

Conflict of interest

The authors declare no conflict of interest.

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Annexes

Appendix A: *Evaluation Metrics (Confusion Matrices and ROC Curves)*

Two types of adjustment measures are calculated to validate the probit models: the confusion matrix and the ROC curve. When the model classifies, there could be two types of errors: false positives and false negatives. From these, it is possible to compute the hit rate, the error rate, the sensitivity, the specificity, the false negative rate and the false positive rate. Sensitivity and specificity are reported at the bottom of Table 4.

Specifically, the dichotomous variable will be classified according to a cutoff point. If the estimated probability exceeds this point, the variable will be classified as positive; that is, it will take the value of 1, and, otherwise, it will take the value of 0. It is common to use a cutoff point of 0.5; however, Medina (2003) argues that using a cutoff point of 0.5 is not adequate in all cases, such as when the sample presents imbalances between the frequency of the values of the dependent variable. It is possible to establish a new cutoff point according to the particular interest of the model. For this study, the choice of the cutoff points for specification 1, 2 and 3 were 0.44, 0.413 and 0.41, respectively.

The Receiver Operating Characteristic (ROC) curve is a visual tool to compare different classification models. In essence, it shows the relationship between the true positive rate and the false positive rate (Han et al., 2011).

Table A1. Temporary Restrictions and Policies Adopted by Countries in LAC

Country	Restrictions and policies
Colombia	• Implementation of the *Pico y Cédula* system in which citizens' mobility was restricted according to a set schedule based on the numbers in their national identification card (*cédula*). Periods of Preventive Isolation and Selective Isolation. • Restriction of national and international travel. • The manufacturing industry operated gradually and systematically. The Construction sector continued to operate with biosafety protocols. • Hotels, tourism and entertainment only operated with services that could be offered online. • Limited capacity of establishments in the commercial sector. • Supply and food provision establishments continued their activities uninterruptedly. • All educational institutions migrated to virtual education.
Bolivia	• Public and private companies that produce and supply food, hygiene products, and medicines had to conduct their activities without interruption. • The retail sector remained active under biosafety standards. Markets open only on scheduled days of the week. • Restrictions on citizens' mobility. Procedures for planned transfer. • Companies that supply gasoline, gas, diesel, and other fuel services were required to conduct their activities without interruption. • Regulation of the development of activities in the Construction sector. • Biosafety protocol continued with the production of Mining and Metallurgy. • Limited capacity of establishments in the retail sector. • All educational institutions migrated to virtual education.
Costa Rica	• Temporary closure of non-essential activities. Establishments with a health permit continued to operate. • Hotels, tourism, and entertainment only operated with services that could be offered online. • Restriction of national and international travel. • Mobility restrictions adapted to the Cantonal Risk Index. • Limiting capacity at restaurants and bars to 50%. • The construction sector could continue activities as long as they complied with sanitary measures. • Establishments in the retail sector partially opened in the cantons, districts and towns on Orange Alert. • Limited capacity rate for bars and casinos at 25%. • Capacity of public spaces limited to 50%. • Selective mandatory quarantine.
Dominican Republic	• Restriction of national and international travel. • Intercity transport suspended. • Suspension of all activities in the non-essential retail sector. • Restriction of days of operation of the new market. • Mandatory focused quarantine. • Restriction of citizen mobility in accordance with set schedules.
Ecuador	• Temporary closure of non-essential activities. Establishments with a health permit could continue to operate. • Epidemiological traffic light system that allowed cities to be categorized in order to establish restrictions. • Hotels, tourism, and entertainment operated with 30% of the permitted capacity, with the possibility of increasing to 50% according to the color of the established traffic light. • Mobility restrictions for private vehicles. Restrictions on national and international travel. • Generalized temporary mandatory quarantine. • Essential activities continued to operate uninterruptedly under biosafety protocols.

Table A1. Temporary Restrictions and Policies Adopted by Countries in LAC (Continued)

El Salvador	• Restriction of national and international travel. • Adoption of extraordinary prevention and containment measures for the national territory. • The textile industry activity linked to the pandemic was allowed. • The Agriculture and Livestock sector operated continuously as essential activities. • Cargo transport and public passenger transport was allowed with 50% capacity. • The construction sector continued to operate only for repair or mitigation work. • The trade sector allowed online, telephone, home or foreign sales mode. • Temporary restriction of non-essential activities such as hotels, tourism, and entertainment. Exception for hotels with activities in the context of the pandemic. • Adoption of virtual modality in education.
Mexico	• Restriction of national and international travel. • Selective quarantine for infections with contact tracing. • Suspension of non-essential activities. • Manufacturing industry temporarily suspended, except for strictly essential operations. • The Mining industry was considered an essential activity; regulations were issued to operate under biosafety protocols. • Construction activities were considered essential activities. • The hotel sector, restaurants, aesthetics, and parks could continue to operate under a limited capacity of 25%. Supermarkets could operate with 50% capacity. • Traffic light system adopted to restrict citizen mobility.
Panama	• Mandatory quarantine for some population groups. • Restriction of national and international travel. • Restriction of mobility by gender. • The 2020 school calendar began remotely, not in person, temporarily. • Restriction of non-essential activities.
Peru	• Restriction of national and international travel. • Mandatory quarantine for population groups. • The retail sector operated with restrictions according to the criteria of territorial targeting and incident reporting. Electronic commerce of goods for the home and related is promoted. • Hotels, tourism, and entertainment could only offer online services. • Financial services did not operate with face-to-face activities. • Restaurants and bars only operated with home delivery service and delivery to the premises. • The agricultural sector continued to operate as an essential sector, including floriculture.
Uruguay	• Citizens' mobility was limited by schedules. • Restriction of national and international travel. • Hotels, tourism, and entertainment were considered non-essential activities and could operate with online services. • Transportation and logistics continued activities under biosafety protocols. • The agricultural and livestock sector continued its operations under biosafety protocols. • Group activities in closed spaces were banned. • Transition to virtual education for all schools. • Teleworking for public offices. • Financial services operated online.

Source: own elaboration.

Table A2. Confusion Matrix for the model considering individual characteristics

	D	~D	Total
+	11095	8981	20076
-	6323	15494	21817
Total	17418	24475	41893
Classified + if Pr(D) predicted			>= .44
True D defined as Y1 != 0			
Sensitivity			63.7%
Specificity			63.31%
Positive predictive value			55.26%
Negative predictive value			71.02%
False + for true ~D			36.69%
False – for true D			36.30%
False + rate for classified +			44.74%
False – rate for classified -			28.98%
Correctly classified			63.47%

Source: own elaboration.

Table A3. Confusion Matrix for the model considering Contextual Characteristics

	D	~D	Total
+	8800	6017	14817
-	4278	19410	16727
Total	13078	18466	31544
Classified + if Pr(D) predicted			>= .413
True D defined as Y1 != 0			
Sensitivity			67.29%
Specificity			67.42%
Positive predictive value			59.39%
Negative predictive value			74.42%
False + for true ~D			32.58%
False – for true D			32.71%
False + rate for classified +			40.61%
False – rate for classified -			25.58%
Correctly classified			67.36%

Source: own elaboration.

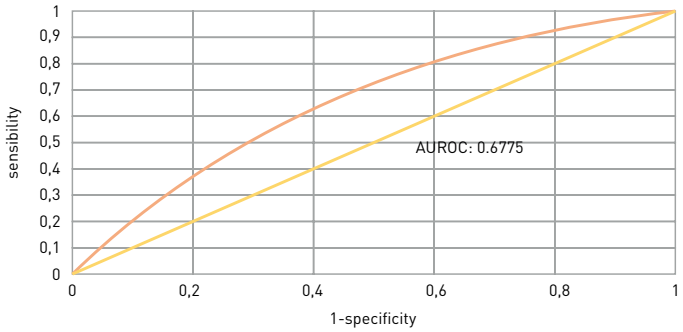

Figure A1. Area Under ROC Curve for the model considering Individual Characteristics
Source: own elaboration.

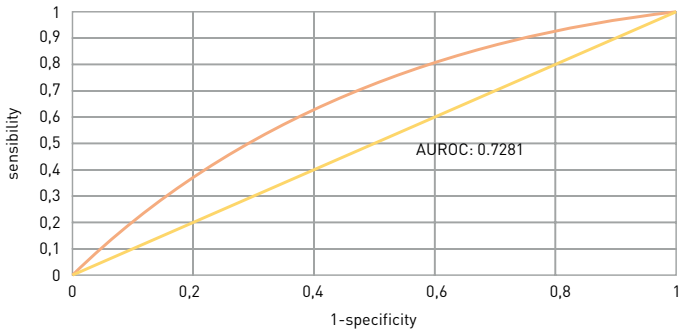

Figure A2. Area Under ROC Curve for the model considering Contextual Characteristics
Source: own elaboration.

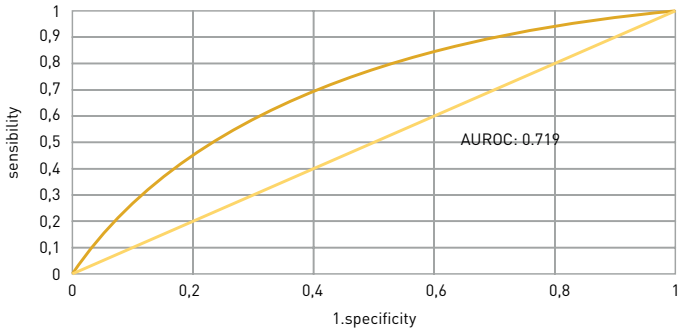

Figure A3. Area Under ROC Curve for the model considering Individual and Contextual Characteristics
Source: own elaboration.

Table A4. Confusion Matrix for the model considering Individual and Contextual Characteristics

	D	~D	Total
+	3882	3006	6888
-	2269	6710	8979
Total	7823	14996	15867
Classified + if Pr(D) predicted		>= .41	
Sensitivity		63.11%	
Specificity		69.06%	
Positive predictive value		56.36%	
Negative predictive value		74.73%	
False + for true ~D		30.94%	
False – for true D		36.89%	
False + rate for classified +		43.64%	
False – rate for classified -		25.27%	
Correctly classified		66.75%	

Source: own elaboration.

Table A5. Confusion Matrix of model considering Individual Characteristics

	D	~D	Total
+	11095	8981	20076
-	6323	15494	21817
Total	17418	24475	41893
Classified + if Pr(D) predicted		>= .44	
True D defined as Y1 != 0			
Sensitivity		63.7%	
Specificity		63.31%	
Positive predictive value		55.26%	
Negative predictive value		71.02%	
False + for true ~D		36.69%	
False – for true D		36.30%	
False + rate for classified +		44.74%	
False – rate for classified -		28.98%	
Correctly classified		63.47%	

Source: own elaboration.

Table A6. Confusion Matrix for the model using contextual characteristics

	D	~D	Total
+	8800	6017	14817
-	4278	19410	16727
Total	13078	18466	31544
Classified + if Pr(D) predicted		>= .413	
True D defined as Y1 != 0			
Sensitivity		67.29%	
Specificity		67.42%	
Positive predictive value		59.39%	
Negative predictive value		74.42%	
False + for true ~D		32.58%	
False – for true D		32.71%	
False + rate for classified +		40.61%	
False – rate for classified -		25.58%	
Correctly classified		67.36%	

Source: own elaboration.

Table A7. Confusion Matrix for the model considering Individual and Contextual Characteristics

	D	~D	Total
+	3882	3006	6888
-	2269	6710	8979
Total	7823	14996	15867
Classified + if Pr(D) predicted		>= .41	
Sensitivity		63.11%	
Specificity		69.06%	
Positive predictive value		56.36%	
Negative predictive value		74.73%	
False + for true ~D		30.94%	
False – for true D		36.89%	
False + rate for classified +		43.64%	
False – rate for classified -		25.27%	
Correctly classified		66.75%	

Source: own elaboration.

Table A8. HL test for a low number of groups g=5

Number of observations	15867
Hosmer-Lemeshow chi2(3)	4.25
Prob > chi2	0.2355

Source: own elaboration.

Table A9. HL test for g based on covariate patterns

number of observations	15867
Pearson chi2	1427.79
Prob > chi2	0.3894

Source: own elaboration.

Table A10. HL test for g based on covariates g=20

number of observations	15867
Hosmer-Lemeshow chi2(18)	20.36
Prob > chi2	0.3131

Source: own elaboration.