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RESEARCH ARTICLE

Microcredit

DETERMINANTS OF THE DEMAND FOR FORMAL AND INFORMAL MICROCREDIT IN THE MAIN MARKETPLACES OF PASTO, 2021

DETERMINANTES DE LA DEMANDA DE MICROCRÉDITO FORMAL E INFORMAL EN LAS PRINCIPALES PLAZAS DE MERCADO DE LA CIUDAD DE PASTO, AÑO 2021

DETERMINANTES DA DEMANDA POR MICROCRÉDITO FORMAL E INFORMAL NOS MERCADOS NA CIDADE DE PASTO, ANO 2021

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Abstract

The central purpose of the study is to analyze the determinants of the demand for formal and informal microcredit in the marketplaces of Pasto, 2021. The research has a mixed approach, with an initially descriptive and then correlational scope. A survey was applied to a representative sample of 344 traders in the four marketplaces of the city. The results show that 33% of the traders had access to formal microcredit, 33% to informal microcredit, and 15% combined both microcredits. The determining variables in the demand for formal microcredit were income, business age, gender, trust in formal financial institutions, and access to informal loans. In the informal loan demand model, in addition to income, business age, gender, homeownership, and access to formal microcredit were identified as explanatory factors. Among the most relevant conclusions obtained from this research is that formal and informal microcredit are rival products, but not mutually exclusive. Likewise, the characteristics and the destination given to the resources differ between microcredits; income is an important variable in access to formal microcredit and reduces the probability of access to informal microcredit, as well as business age and home ownership. On the other hand, the propensity of women to acquire informal financing is greater than that of men.

Keywords: credit; debt, financing; informality; loan.
JEL: E41; G10; M21; O16; O17; P34.

Resumen

El propósito central del estudio es analizar los factores determinantes de la demanda de microcrédito formal e informal en las plazas de mercado de la ciudad de Pasto, año 2021. La investigación tiene un enfoque mixto, con un alcance, inicialmente, descriptivo y, luego, correlacional. Se aplicó una encuesta a una muestra representativa de 344 comerciantes de las cuatro plazas de mercado de la ciudad. Los resultados muestran que el 33% los comerciantes accedieron a microcrédito formal, el 33% a microcrédito informal y el 15% combinaron ambos microcréditos. Las variables determinantes en la demanda de microcrédito formal fueron ingresos, antigüedad, sexo, confianza en las instituciones financieras formales y el acceso a préstamos informales. En el modelo de demanda de préstamo informal se identificaron como factores explicativos, además del ingreso, la antigüedad y el sexo, el tener vivienda propia y acceder a

microcrédito formal. Dentro de las conclusiones más relevantes que se obtuvieron a partir de esta investigación se destaca que el microcrédito formal y el informal son productos rivales, pero no excluyentes. Asimismo, las características y el destino que se le da a los recursos difieren entre microcréditos; el ingreso es una variable importante en el acceso al microcrédito formal y reduce la probabilidad del acceso al informal, al igual que la antigüedad del negocio y tener vivienda propia. Por otro lado, la propensión de las mujeres de adquirir financiamiento informal es mayor que la de los hombres.

Palabras clave: crédito; deuda; financiación; informalidad; préstamo.
JEL: E41; G10; M21; O16; O17; P34.

Resumo

O objetivo central do estudo é analisar os determinantes da demanda por microcrédito formal e informal nos mercados da cidade de Pasto, no ano de 2021. A pesquisa tem uma abordagem mista, com um escopo inicialmente descritivo e depois correlacional. Uma pesquisa foi aplicada a uma amostra representativa de 344 comerciantes nos quatro mercados da cidade. Os resultados mostram que 33% dos comerciantes acessaram o microcrédito formal, 33% o microcrédito informal e 15% combinaram os dois microcréditos. Os determinantes da demanda por microcrédito formal foram renda, senioridade, gênero, confiança em instituições financeiras formais e acesso a empréstimos informais. No modelo de demanda de empréstimos informais, além da renda, da senioridade e do gênero, a propriedade da casa e o acesso ao microcrédito formal foram identificados como fatores explicativos. Entre as conclusões mais relevantes obtidas com esta pesquisa está a de que o microcrédito formal e o informal são produtos rivais, mas não mutuamente exclusivos. Da mesma forma, as características e o destino dado aos recursos diferem entre os microcréditos; a renda é uma variável importante no acesso ao microcrédito formal e reduz a probabilidade de acesso ao microcrédito informal, assim como a idade do negócio e a casa própria. Por outro lado, a propensão das mulheres a adquirir financiamento informal é maior do que a dos homens.

Palavras-chave: crédito; dívida; financiamento; informalidade; empréstimo.
JEL: E41; G10; M21; P34; O16; O17.

Introduction

The study of microcredit is of great importance in a city like Pasto, where the levels of poverty, informality, and inequality are higher than the national average. However, currently, studies on the phenomenon of formal and informal microcredit in the city are scarce. In particular, there is no analysis that enables the determination of its characteristics in the marketplaces of Pasto, the complexity of access to this financing mechanism, its level of satisfaction, and a strategy for its greater contribution to local and regional economic development. Additionally, there is no analysis regarding informal microcredit, which has often become a social and economic problem that negatively affects microenterprise development and the well-being of its users. In this regard, this research contributes to the understanding of this phenomenon in a highly informal context, with the purpose of identifying and analyzing the determining factors in the demand for formal and informal microcredit in the marketplaces of Pasto in 2021. To achieve this objective, a survey was conducted with a representative sample of 344 merchants from the city's four marketplaces: El Potrerillo, El Tejar, Los Dos Puentes, and Jongovito.

This article is organized into four sections in addition to the introduction. The first section presents a brief literature review on formal and informal microcredit, particularly on its demand, including related international, national, and regional studies. The second section describes the methodology used in the research, data collection, determination of variables, and estimation of the microcredit demand model. The third section outlines the results of the model estimations for both formal and informal microcredit demand, along with their respective relationships and adjustment tests, which are expanded upon in the Appendices. The final section presents the conclusions drawn from this research.

Literature Review

References on the Demand for Formal and Informal Microcredit Worldwide

Microcredit emerged in the 1970s as a tool to combat poverty and the inequality of economic opportunities in developing countries (Marbán, 2007; 2008). These microloans are small-scale loans aimed at low-income individuals living in socially and economically vulnerable conditions who lack access to traditional banking. Their primary purpose is to finance their projects or small productive units. In this sense, microcredit becomes a crucial instrument for strengthening local economic development (Bercovich, 2004).

Despite its importance, commercial banks do not offer financial services to the poorest populations, considering it a highly risky financial activity. This is due to the fact that these individuals lack guarantees, financial education, solvency, and credit history, and are geographically dispersed, which would result in high operational costs (Argandoña, 2009; Carvallo and Pineda, 2010; Delfiner and Perón, 2007; Foschiatto and Stumpo, 2006; García and Díaz, 2011). In this regard, Madestam (2014) states that the supply of microcredit under the described conditions is common in countries without strong legal institutions and is concentrated in areas with low-income levels. Lacalle (2002), in his study "Microcréditos: de pobres a microempresarios [Microcredits: From Poor to Microentrepreneurs]", points out that Latin America has a large informal sector characterized by precarious employment and low incomes, which requires capital, though it is very scarce. This situation forces those in need of financing to resort to informal credit from family members or so-called loan sharks.

Regarding studies on the determinants of the demand for formal and informal microcredit, two studies, one in Asia and another in Latin America, provide insight into the most determining variables and their behavior. Nguyen (2007), in his study of credit in rural households in Vietnam, found that education has an inverse U-shaped relationship with credit, meaning that households with the lowest and highest educational levels have fewer loans. Additionally, it is noted that household size and rural employment are more significant variables than education and distance from the financial institution. Meanwhile, Carvallo et al. (2016), in their study "Determinantes de

la demanda potencial de microcrédito en Argentina, [Determinants of Potential Microcredit Demand in Argentina]" assert that, for households, employment type, informality, age, marital status, and credit recurrence are determinants in the probability of applying for microcredit for productive purposes.

References on the Demand for Formal and Informal Microcredit in Colombia

At the national level, there are significant studies that analyze formal and informal microcredit, particularly its demand. Marulanda (2005) highlights that the lowest strata of the Colombian population concentrate the most microcredit applications, especially informal ones. Additionally, the funds obtained through these loans are primarily used for debt repayment, investment, and housing.

Murcia (2007), in his study on the determinants of access to credit for Colombian households, identifies variables such as income, wealth, geographical location, access to social security, education level, and age as factors influencing the probability of obtaining formal credit. Similarly, he notes that a large percentage of the population with savings does not have financial loans.

In a study titled "Una mirada al Grameen Bank y al microcrédito en Colombia [A Look at Grameen Bank and Microcredit in Colombia]", Villarreal (2008) explores the concept of microcredit and its methodology, especially the group lending model. He also analyzes microcredit in Colombia, particularly in terms of amounts and interest rates between 2003 and 2008. He emphasizes that the disbursement of microcredit in the country has grown significantly and points out that interest rates are high due to problems of asymmetric information.

Ibarra (2008) in his research "Impacto financiero de los prestadiarios en microempresarios del barrio Santa María del suroccidente de Barranquilla [Financial Impact of Lenders on

Microentrepreneurs in the Santa María Neighborhood of Barranquilla's Southwest]", analyzed the reasons why informal loans are acquired, the advantages and disadvantages of the relationship between informal lenders and microentrepreneurs, and the difference in interest rates between the traditional financial sector and informal lenders. The study highlights that microentrepreneurs prefer informal loans for reasons such as the lack of paperwork, the quick and convenient process, home delivery of money, payment collection at their business or home, minimal guarantee requirements, credit offers despite previous loans, the possibility of receiving a larger loan with good repayment history, and customer service that extends into the night.

Asobancaria (2014), in its analysis of the characteristics of microcredit in the urban areas of the country, found that informal loans are chosen by Colombians because they do not have the same restrictions on payment frequency imposed by the financial system. As Ibarra (2008) also pointed out, Asobancaria emphasizes that individuals and households view the extensive paperwork, fear of default or losing collateral, and high interest rates as barriers to financial inclusion, which stood at 52% between 2010 and 2013.

In the study "El impacto financiero del préstamo gota a gota en las microempresas de Villavicencio [The Financial Impact of Gota a Gota Loans on Microenterprises in Villavicencio]" Rodríguez (2015), highlights that the main problem with these loans is their high interest rates (20% monthly) and the inverse relationship between the demand for informal microcredit and the level of education and social status. The reasons why microentrepreneurs do not access formal credit include the fear of being reported to credit bureaus, the risk of foreclosure, excessive paperwork, a lack of payment and savings culture, and the urgent need for money.

Hernández and Oviedo (2016), in their study on the informal credit market in Colombia, analyzed the demand for informal loans based on data from the Encuesta Longitudinal Colombiana (ELCA) [Colombian Longitudinal Survey] from Universidad de los Andes. Their results indicate that around 20% of loans were informal, 43% of which came from loan sharks, with amounts concentrated below the legal minimum wage, mainly paid on a monthly (65%) and daily (16%)

basis. Individuals with lower education, income, and economic stability, such as the self-employed, were more likely to access informal microcredit. Additionally, the results from binomial and multinomial regression models show that the probability of accessing informal loans increased with smaller loan amounts, shorter repayment periods, and shorter terms. They also found that guarantees did not play a significant role in informal loans.

Iregui et al. (2016) conducted a study to identify the probability of a household having formal or informal credit in both urban and rural areas. They also used the ELCA as their data source. The results show that 30% of urban households and 40% of rural households had informal loans, either from shopkeepers, loan sharks, friends, pawnshops, or catalog sellers. The estimates revealed a positive relationship between the probability of a household having credit and factors such as being the household head, being married, having a higher education level, higher income, homeownership, and labor market participation. They also highlight that income and education negatively correlate with the probability of obtaining informal credit.

Fernández (2017), in his study "Impacto de la informalidad laboral sobre el acceso a crédito formal [The Impact of Informal Labor on Access to Formal Credit]", determined that an informal worker in Colombia is 10% less likely to obtain formal credit than a formal worker. He notes that age is not a determining factor in access to formal credit, nor are transfers and gender. In the case of informal credit, however, there is a strong negative impact due to its role as a substitute. He also concludes that savings, income, and homeownership are positive determinants in accessing formal credit.

In the study by Castro et al. (2020) ¿Qué factores inciden en la demanda de crédito de la microempresa en Colombia? [What Factors Affect Microenterprise Credit Demand in Colombia?], it is determined that formalization, financial education, and internet usage influence the probability of applying for formal credit. Additionally, factors such as gender, geographic location, number of employees, sales, business age, and economic activity explain access to formal or informal loans.

Some national and institutional studies have established that the main reason for not having formal microcredit is not needing it, followed by other reasons such as being reported to credit bureaus and the inability to repay the debt (Asociación Nacional de Instituciones Financieras [ANIF], 2020; Banca de las Oportunidades, 2018; 2020).

References on the Demand for Formal and Informal Microcredit in the Region

Studies on both formal and informal microcredit in the region are very limited. Madroñero and Ramos (2010) analyzed the impact of microcredit on the microenterprise sector of Pasto. In their analysis, they highlight that the main sources of financing are financial institutions, with around 4% coming from informal lenders. Additionally, they point out that the interest rates charged by moneylenders are nearly four times higher than formal rates.

The research conducted by Arboleda et al. (2015), focused on the creation of a company dedicated to microcredit in the city, underscores the participation of the so-called *gota a gota* system, which represents 13.7% of the total credit market, and notes that 16.4% of people rely on other sources such as family and friends. They also assert that the formal financial sector denies loans due to factors such as negative credit bureau reports, and a lack of commercial and credit history, among other reasons.

Burgos et al. (2021), in their study on microcredit in the manufacturing industry in Pasto, point out significant financing difficulties in this sector, which stem from inadequate credit conditions due to poor management and organization. This hinders access to formal credit, causing businesses to turn to informal credit options. On the other hand, Benavides and Moncayo (2009), who study the importance of group lending in the rural sector of Pasto, based on the experience of the microfinance institution *Contactar*, contribute to the research by noting that the fees charged are reasonable. They also find that 11.20% of borrowers have informal loans, with interest rates averaging twice as high as those offered by the institution.

Methodology

The determinants of the demand for formal and informal microcredit can be identified based on user information, which is primarily collected through surveys. These surveys consider variables such as choice, frequency, ownership, barriers or obstacles to use, informal credit, financial education, and financial usage, among other aspects (OECD/CAF, 2020).

In this regard, the research was based on information obtained from the research project titled "Situación actual del acceso al microcrédito de los vendedores de las plazas de mercado de San Juan de Pasto, año 2021 [Current situation of access to microcredit by vendors in the marketplaces of San Juan de Pasto, 2021]", funded by the University of Nariño. Data was collected using a probabilistic and stratified sampling design, through surveys applied to a sample of 344 vendors from the four marketplaces (MP) of Pasto, with a 95% confidence level and a 5% margin of error.

The sampling framework was based on the lists of fixed sales stalls by sector from the marketplaces of El Potrerillo, El Tejar, Los Dos Puentes, and Jongovito, using data provided by the Dirección Administrativa de Plazas de Mercado de la Alcaldía Municipal de Pasto [Administrative Directorate of Marketplaces of the Municipal Government of Pasto] in 2021. These surveys were distributed across each marketplace (Table 1). The survey consisted of 124 questions covering personal and household socio-economic information, business information, access to formal and informal credit, perceptions of this access, quality and satisfaction, and financial education.

Table 1

Distribution of surveys by marketplaces in Pasto, 2021.

Marketplace	Number of surveys
El Potrerillo Marketplace	255
El Tejar Marketplace	71

Los Dos Puentes Marketplace	15
Jongovito Marketplace	3
Total	**344**

Source: prepared by the authors.

As seen in the literature review, formal and informal microcredit have different characteristics regarding amounts, terms, purpose, advantages, and other aspects. Likewise, the perception of merchants regarding the service offered by formal financial institutions and informal lenders differs between them. Taking these considerations into account, and assuming that the motivations for accessing one source of financing or another may vary, this study aims to analyze the variables associated with the demand for formal or informal financing by the merchants of the MP (marketplaces) of Pasto, using the estimation of probit models.

Thus, the choice of variables associated with the demand for formal microcredit and informal microcredit, respectively, was based on a review of recent literature related to credit access for households and businesses (Castro et al., 2020; Murcia, 2007; Nguyen, 2007). The selected variables can be grouped into three categories: economic characteristics of the businesses, socioeconomic characteristics of individuals, and characteristics related to access to financial services.

Regarding the last group of variables, it is worth noting that the microcredit demand model includes dummy variables for trust in the formal financial sector and access to informal microcredit, while the informal microcredit demand model adds dummy variables for trust in the formal financial sector and access to microcredit. The reason for this is that, on the one hand, the literature has shown that distrust in financial institutions is an obstacle to accessing formal financing, and on the other hand, adding microcredit or informal microcredit, depending on the model, allows capturing the degree of complementarity or competition, although not necessarily mutually exclusive, between the two forms of financing. In this regard, Fernández (2017) suggests that in the demand for formal credit, the informal loan variable may be a regressor, as it can take the form of a substitute or complementary good to formal credit. The incorporation of the proxy

for the alternative financing source in each model captures the degree of substitution or complementarity between financial products (Table 2).

Table 2

Variables of the formal and informal microcredit demand model

Variables	Definition and assigned values	
Independent variable		
Formal microcredit	Merchants with access to microcredit=1	Otherwise =0
Dependent variables		
NL (Monthly sales income)	Natural logarithm of income from monthly sales	
Business size	Microenterprise with at least one dependent worker=1	Otherwise =0
Business age	Years of business age	
Business age ^2	Years of business age squared	
Savings	Merchants with some form of savings =1	Otherwise =0
Financial education	Merchants with knowledge of financial aspects =1	Otherwise =0
NL (Total assets value)	Natural logarithm of the business's asset value	
Formality	Businesses with a commercial registry and unique tax registry =1	Otherwise =0
Informal microcredit	Merchants with access to informal microcredit =2	Otherwise =0
Trust	Merchants with a good or very good perception of trust in formal financial institutions	Otherwise =1
Gender	Male =1	Female =0
Homeownership	Merchants with their own housing = 1	Otherwise =0

Source: prepared by the authors.

Estimation of the Formal and Informal Microcredit Demand Model

For estimating the demand for formal microcredit, Model 1 is proposed, as represented in Equation 1, which includes the variables presented in Table 2:

$$y = \beta_0 + \beta_1 Sales\ income + \beta_2 Bussines\ size \quad (1)$$
$$+ \beta_3 Bussines\ age + \beta_4 Bussines\ age^2$$
$$+\beta_5 Savings + \beta_6 Financial\ education + \beta_7 VaAsset\ value$$
$$+ \beta_8 Formality + \beta_9 Trust\ + \beta_{10}\ Informal\ credit + \beta_{11}\ Gender$$
$$+ \beta_{12}\ Homeownership$$

Meanwhile, to evaluate the demand for informal microcredit, Model 2 is proposed, as described in Equation 2, based on the variables from Table 2:

$$y = \beta_0 + \beta_1 Sales\ income + \beta_2 Bussines\ size \quad (2) +$$
$$\beta_3 Bussines\ age\ \ \beta_4 Bussines\ age^2 + \beta_5 Savings \quad +$$
$$\beta_6 Finalcial\ education + \beta_7 Asset\ value + \beta_8 Formality + \beta_9 Trust\ +$$
$$\beta_{10}\ Formal\ credit + \beta_{11}\ Gender + \beta_{12}\ Homeownership\ (2)ç$$

To estimate the variables associated with formal and informal microcredit demand, probit models will be used. In Model 1 of formal microcredit demand, the dependent variable will take the value of 1 if the person obtains formal microcredit, and zero otherwise. In Model 2 of informal microcredit demand, the dependent variable will take the value of 1 if the person obtains informal microcredit, and zero otherwise. The probit model is formally expressed in Equation 3:

$$P\ (x\beta) =\ \theta(\beta_0 + x\beta) \quad (3)$$

Here θ, represents the standard normal cumulative distribution function in the form of an integral, which ensures values strictly between zero and one: $0 < \theta(z) < 1$ for all real numbers z, as shown below (Equation 4):

$$\theta\ (z) = \int_{-\infty}^{z} \quad \emptyset\ (v)dv \qquad (4)$$

Where $\emptyset(z)$ is the standard normal density function, as indicated in Equation 5:

$$\emptyset\ (z) = (2\pi)^{-1/2} exp(-\frac{z^2}{2}) \qquad (5)$$

This establishes strictly bounded values between zero and one for the function θ(z). Another way to obtain value ranges in a probit model is through the use of an underlying latent variable. Let y* be an unobservable or latent variable, with characteristics described in the following Equation 6:

$$y^* = \beta_0 + x\beta + e, y = 1[y^* > 0] \quad (6)$$

In this equation, y takes the value of one if $y^* > 0$ and is zero if $y^* \leq 0$. Assuming e is independent of x, and follows a standard normal distribution. This equation, combined with the established assumptions, offers important elements to calculate the response probability for y, as seen in Equation 7:

$$P(x\beta) = P(x) = P[e > -(\beta_0 + x\beta)|x| = 1 - \theta[-(\beta_0 + x\beta)] = \theta\ (\beta_0 + x\beta) \quad (7)$$

This is exactly the same as in [1].

As stated by Rosales et al. (2009), it can be affirmed regarding the goodness of fit of the proposed model that the coefficient of determination under Ordinary Least Squares (OLS) is not compatible with maximum likelihood estimates. In this sense, the pseudo-R^2 and the percentage of correct predictions are good indicators of the fit for probabilistic models. In this sense, the pseudo-R^2 is a measure that: “is based on the specification of probabilistic models and provides a reliable result for determining the goodness of fit of the models being analyzed” (Rosales et al., 2009, p. 118). Thus, the pseudo-R^2 estimator can be expressed as shown in Equation 8:"

$$p - seudo\ R^2 = 1 - \frac{l_{NR}}{l_R} \qquad (8)$$

Where, l_{NR} is the maximum of the natural logarithm of the unrestricted model; l_R is the natural logarithm of the restricted model. These values are obtained by estimating each model separately and extracting the log-likelihood result. This estimator is interpreted similarly to the R^2 in classical linear regression but should not be overemphasized for models where the dependent variable is dichotomous (Gujarati, 2003, as cited by Rosales et al., 2009, p. 118).

Furthermore, as stated by Rosales et al. (2009), the percentage of correct estimates is a calculation that allows determining if the predictions match the results obtained.

The procedure involves creating a dummy variable from which the predicted values can be compared with the observed ones. To do so, the probability that Y_i=1 is predicted given the explanatory variables, in relation to the data examined for the same qualitative variable. If $F(X\beta)$>0.5 then Y_i=1 and if $F(X\beta)$<0.5 the prediction is Y_i=0. Based on this disaggregation, it is possible to obtain a record of how accurate the predictions of probabilistic models are (Rosales et al., 2009, p. 118).

Accordingly, the correct predictions (of $Y=0$ or Y=1), would be those that coincide with the observed data, and the total percentage of correct predictions results from the ratio of correct predictions to the total number of observations (Rosales et al., 2009).

Results

The results of the probit models for estimating formal and informal microcredit demand, as well as the goodness-of-fit tests, are shown in Appendices (1, 2, 3, 4, 5, and 6). Since the coefficients of probability models are not directly interpretable, Table 3 presents the average marginal effects of the variables associated with the demand for formal and informal microcredit.

Table 3

Average Marginal Effects of Formal and Informal Microcredit Demand in the Marketplaces of Pasto, 2021

	(1)	(2)
Variables	**Formal Microcredit**	**Informal Microcredit**
NL (Monthly income)	0.0447**	-0.0484**
	(0.0227)	(0.0235)
Business size	0.0782	0.0586
	(0.0580)	(0.0585)
Business age	0.0122**	0.0126**
	(0.00573)	(0.00574)
Business age ^2	-0.000226**	-0.000238**
	(0.000107)	(0.000107)
Savings	-0.0332	-0.0166
	(0.0526)	(0.0530)
Financial education	0.0517	0.0149
	(0.0894)	(0.0901)
NL (Total assets)	0.0129	0.0196
	(0.0177)	(0.0176)
Business formality	-0.118	-0.190
	(0.151)	(0.161)
Trust in formal financial institutions	0.226***	0.0246
	(0.0474)	(0.0533)
Informal microcredit	-0.132**	
	(0.0524)	
Gender	-0.152**	-0.166***
	(0.0608)	(0.0615)
Homeownership	-0.0147	-0.213***
	(0.0549)	(0.0509)
Formal microcredit		-0.134**
		(0.0531)

	(1)	(2)
Variables	**Formal Microcredit**	**Informal Microcredit**
Observations	335	335

*** p<0.01, ** p<0.05, * p<0.1

Source: prepared by the authors.

Based on the data described in Table 3, it is concluded that monthly sales income in the main marketplaces of Pasto is positively associated with microcredit demand. Specifically, a 1% increase in monthly sales income raises the probability that traders will apply for microcredit by 4.47%. Likewise, the age of the businesses shows a statistically significant association with applying for microcredit; each additional year that the company has been in the market increases the probability of requesting credit by 1.2%. Moreover, the variables "age" and "age squared" indicate that both younger and older businesses are less likely to access microcredit than mature businesses.

Regarding the competition between formal and informal microcredit, two variables reflecting this condition were added: trust in formal institutions and the use of informal microcredit. These variables are significantly associated with the request for formal microcredit. Trust in formal financial institutions increases the likelihood that a trader will access microcredit by 22.6%, compared to those with low or average trust in such institutions. If a trader has an informal loan compared to those who do not, the likelihood of accessing microcredit decreases by 13.2%, suggesting a competitive rather than complementary relationship between formal and informal financing types.

In terms of gender, men, compared to women, are 15.2% less likely to request formal microcredit, which suggests that women in marketplaces are more risk-averse and, therefore, more inclined to acquire formal microcredit than men.

The results also indicate insufficient statistical evidence of a positive association between formal microcredit demand and business size, asset value, and financial education. Similarly, there is no statistically significant evidence of an association between savings and formal microcredit

demand. However, the relationship was found to be negative, suggesting that having savings reduces the likelihood of requesting this type of credit. Variables such as the business's commercial registration and whether the trader owns a home show an unexpected relationship, though they are not statistically significant. According to the model, formal microcredit demand may decrease if the trader has a higher degree of formality than other traders and owns a home compared to those who do not.

On the side of the informal credit demand model, it is found that, unlike formal microcredit demand, a 1% increase in monthly business income reduces the likelihood of turning to informal loans by 4.84%. This reflects that informal loans are mainly aimed at lower-income businesses that seek small loan amounts, often to meet urgent liquidity needs for both businesses and households.

Regarding business age, informal loan demand increases when businesses are more mature and decreases for younger or much older businesses, mirroring the behavior seen in formal microcredit demand. Once again, this situation reveals that business experience and knowledge affect the decision to seek formal or informal credit.

The variable for trust in formal financial institutions has a positive but insignificant relationship with informal loan demand. Nevertheless, this would mean that the decision to take informal credit is not dependent on trust in such institutions. This may hold true since these loans are often requested urgently to address primarily short-term needs.

Having formal microcredit negatively affects the probability of obtaining an informal loan (13.4%). This reaffirms the competitive, though not necessarily exclusive, relationship between formal and informal credit, considering that formal financing has different characteristics from informal financing. Moreover, the purpose of the resources provided to traders varies depending on whether the financing is formal or informal.

Men, compared to women, are less likely to turn to informal loans (16.6%), a finding similar to that found in the formal microcredit demand model, also indicating a greater propensity for women to acquire financing and a lower risk aversion in the city's marketplaces.

The data reported by the model also indicates that homeownership reduces the likelihood of taking informal loans. This result suggests that homeownership might mitigate liquidity issues faced by businesses and households in a scenario of unstable incomes, which marketplace traders regularly encounter.

Business size and savings, as in the case of microcredit demand, were not statistically significant variables associated with informal credit demand. This is also evident in national analyses (Castro et al., 2020). Similarly, asset value and informal loan demand have a positive, though insignificant, association.

The relationship between financial education and informal loan demand, despite being statistically insignificant, is counterintuitive. It would be expected that better financial education would reduce the likelihood of acquiring informal loans. However, it is also true that beyond receiving training on financial aspects, it would be more important to observe the quality and relevance of these financial programs, as well as their impact on businesses. Regardless, addressing the urgent financial needs that informal loans cover is reason enough to acquire an informal loan, whether the conditions are well-known or not.

Conclusions

The importance of studying the demand for formal and informal microcredit in the marketplaces of Pasto contributes to understanding the financing issues faced by a significant microenterprise sector in the city, which exhibits high levels of informality. The credit risk profiles of this sector, characterized by a lack of credit history, guarantees, and evidence of repayment capacity, have partially excluded them from traditional financing and have led them to opt for informal financing to some extent. This study is pioneering in the region regarding the analysis of

microcredit demand, which may lead to more effective financial inclusion policies in this sector and to studies in other areas where formal and informal financing exist.

The research model identified the key determinants of formal microcredit demand as income, business age, gender, trust in formal financial institutions, and access to informal loans. Higher sales income, higher business age, being female rather than male, and having trust in formal entities increase the likelihood of accessing formal microcredit while having an informal loan decreases those probabilities.

Conversely, in the model for informal loan demand, factors such as income and seniority of the microenterprise, gender, homeownership, and access to formal microcredit were associated with its demand. Specifically, lower sales income, higher business age, and being female increase the chances of seeking informal credit, while having formal loans and homeownership reduce those chances.

This study successfully identified that gender, sales income, and business age are associated with the demand for both formal and informal microcredit. The propensity of women to obtain financing is higher than that of men, which aligns with findings by Castro et al. (2020). As sales income increases, so does the likelihood of seeking microcredit, while the likelihood of seeking informal microcredit decreases, suggesting that businesses with lower sales income lack the conditions to access formal microcredit, thus resorting to informal alternatives. Business age is linked to access to financing; older businesses are less likely to remain informal, indicating a pattern explained by the low accumulation of experience when businesses are just starting out.

Specifically, trust in the formal financial system influences the demand for formal microcredit, which is logical, as agents who trust formal financial institutions are more likely to participate in the formal financial market. However, the demand for informal microcredit is

independent of trust in financial institutions. This can be understood considering that informal loans respond to different motivations and characteristics than formal microcredits.

Additionally, the negative correlation between informal microcredit demand and formal microcredit demand corroborates that formal and informal microcredit are rival products. However, using one product does not necessarily exclude the use of the alternative, especially since the characteristics and purposes of the funds differ between formal and informal microcredit.

Homeownership has no relationship with the demand for formal microcredit. In fact, owning a property is not listed among the requirements for accessing formal microcredit. However, owning a home reduces the likelihood of seeking informal loans, indicating that traders without homeownership are more likely to turn to informal microcredit.

The models of microcredit demand revealed that women have greater access to financing than men, indicating that they exhibit a higher aversion to risk. Sales income influences access to financing; as sales income increases, so do the probabilities of demanding formal microcredit, while the likelihood of seeking informal microcredit decreases, suggesting that formal microcredit is not reaching more vulnerable sectors.

Business age shows a U-shaped association with access to financing; younger and older businesses (Banca de las Oportunidades, 2020) are less likely to seek either formal or informal microcredit, which can be explained by barriers within the formal financial system, the lack of accumulated experience in young businesses, and declining growth expectations as traders age. However, some variables were not significant in the demand models for formal and informal microcredit in the marketplaces, including business size, asset value, business formality, savings, and financial education.

Overall, microentrepreneurs often have a high credit risk profile due to a lack of credit history, guarantees, and demonstrated repayment capacity, resulting in reduced access to financing. The lack of information regarding the microentrepreneur's profile is a critical factor that hinders access to formal financing. Finally, the issues surrounding access to informal microcredit are evident, as these loans, being outside of regulation, carry high interest rates well above usury limits, and failing to meet these obligations or being late on payments can jeopardize the lives and economic stability of businesses and households, consistent with findings by Hernández and Oviedo (2016).

Ethical Considerations

This study did not require approval from an Ethics or Bioethics Committee since it did not involve any living resources, agents, biological samples, or personal data that could pose any risk to life, the environment, or human rights.

Conflict of Interest

All authors contributed significantly to the document and declare that there is no conflict of interest related to the article.

Author Contribution Statement

Marco Antonio Burgos Flórez: Conceptualization, Research, Methodology, Supervision, Visualization. Luis Hernando Portillo Riascos: Conceptualization, Research, Methodology, Project Management. Edinson Ortiz Benavides: Validation, Writing: Review and Editing

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Appendices

Appendix 1

Estimated Coefficients in the Probit Models

	(1)	(2)
Variables	**Microcredit**	**Informal Microcredit**
nly	0.126*	-0.135**
	(0.0649)	(0.0670)
newtam	0.221	0.164
	(0.165)	(0.164)
business age	0.0343**	0.0352**
	(0.0164)	(0.0164)
business age2	-0.000636**	-0.000665**
	(0.000305)	(0.000307)
savings	-0.0937	-0.0463
	(0.149)	(0.148)
financialedu	0.146	0.0416
	(0.252)	(0.252)
cop	0.0363	0.0548
	(0.0499)	(0.0493)
rcam	-0.332	-0.532
	(0.426)	(0.453)
trust	0.638***	0.0687
	(0.146)	(0.149)
informalm	-0.371**	

	(0.151)	
gender	-0.427**	-0.463***
	(0.175)	(0.177)
homeownership	-0.0413	-0.596***
	(0.155)	(0.153)
formalm		-0.375**
		(0.152)
Constant	-3.023***	1.156
	(1.125)	(1.123)
Observations	335	335

*** p<0.01, ** p<0.05, * p<0.1

Source: prepared by the authors

Appendix 2

Classification Tables

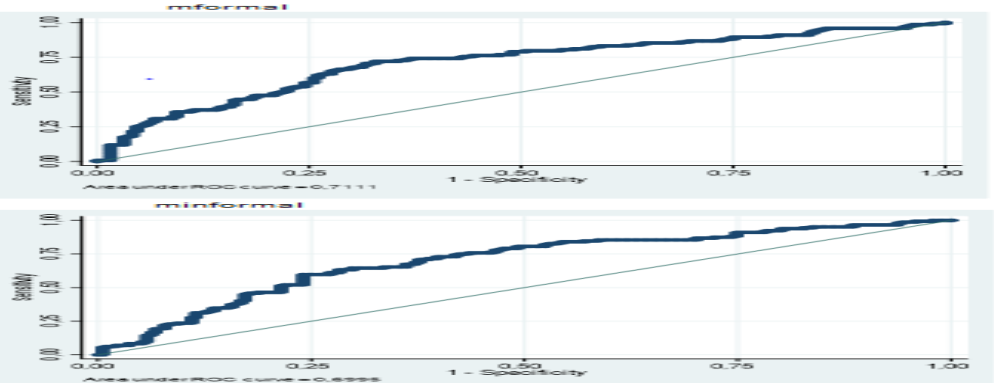
Probit model for mformal		
True ---	**----**	
Classified D	~D	Total
75	44	119
68	148	216
Total 143	192	335
Classified + if predicted Pr(D)>= .5		
True D defined as mformal != 0		
Sensitivity	Pr(+ D)	52,45%
Specificity	Pr(-~D)	77,08%
Positive predictive value	Pr(D +)	63,03%
Negative predictive value	Pr(~D -)	68,52%
False + rate for true ~D	Pr(+~D)	22,92%
False - rate for true D	Pr(- D)	47,55%
False + rate for classified +	Pr(~D +)	36,97%
False - rate for classified -		
Correctly classified		66,57%

Probit model for minformal		
True --------		
Classified D	~D	Total
79	46	125
65	145	210
Total 144	191	335
Classified + if predicted Pr(D) >= .5		
True D defined as minformal != 0		
Sensitivity	Pr(+ D)	54,86%
Specificity	Pr(-~D)	75,92%
Positive predictive value	Pr(D +)	63,20%
Negative predictive value	Pr(~D -)	69,05%
False + rate for true	Pr(+~D)	24,08%
False - rate for true	Pr(- D)	45,14%
False + rate for classified	Pr(~D +)	36,80%
False - rate for classified	Pr(D -)	30,95%
Correctly classified		66,87%

Source: prepared by the authors

Appendix 3

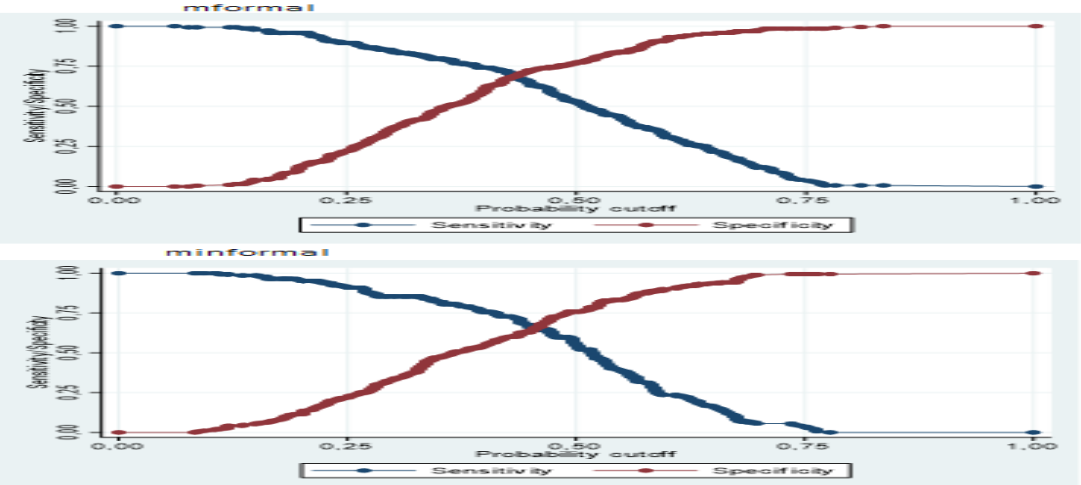
Sensitivity Curves



Source: prepared by the authors

Appendix 4

ROC Curves



Source: prepared by the authors

Appendix 5

Description of Variables in the Estimated Models

	(1)	(2)	(3)	(4)	(5)
Variables	**N**	**mean**	**sd**	**min**	**max**
nly	343	14.91	1.289	10.60	20.91
formalm	343	0.423	0.495	0	1
business age	343	21.23	14.61	1	65
business age2	343	663.6	777.4	1	4,225
gender	343	0.257	0.437	0	1
finaedu2	343	0.0933	0.291	0	1
newtam	343	0.367	0.483	0	1
trust	343	0.528	0.500	0	1
informalm	343	0.426	0.495	0	1
savings	343	0.449	0.498	0	1
homeown	343	0.423	0.495	0	1
cop	335	15.04	1.599	11.51	20.03
rcam	343	0.0321	0.176	0	1

Source: prepared by the authors

Appendix 6

Correlation of Variables

Variables													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) formalm	1												
(2) infonnalm	-0,1160*	1											
(3) h1y	0,1292*	-0,1066*	1										
(4) newtam	0,0824	-0,0444	0,3408*	1									
(5) businessage	0,0164	-0,0221	-0,1522*	-0,1306*	1								
(6) businessage2	-0,0174	-0,0399	-0,1748*	-0,0926	0,9501*	1							
(7) ahmo	-0,0131	-0,0302	0,0872	-0,0556	-0,0596	-0,0525	1						
(8) finanedu2	0,0096	0,028	-0,0432	-0,0573	-0,0243	-0,0137	-0,0074	1					
(9) e	0,0334	0,0021	0,2809*	0,1647*	-0,1340*	-0,1330*	0,1875*	0,0459	1				
(10) rcam	-0,0218	-0,0563	0,1752*	0,1702*	-0,0516	-0,0477	0,0353	-0,0015	0,3007*	1			
(I 1) trust	0,2303*	0,0231	-0,0448	-0,0423	0,0658	0,0542	0,0556	0,0224	-0,0563	-0,06	1		
(12) gender	-0,0838	-0,1412	0,2506*	0,0786	-0,0509	-0,0756	0,0737	0,087	0,1456*	0,1204*	-0,046	1	
(13) homeowner	-0,0036	-0,2234*	-0,0689	0,0212	0,2078*	0,1821*	0,07	-0,0513	-0,0625	-0,0888	-0,0652	0,0108	1

*** p<0 .01,** p<0 .05, * p<O.l

Source: prepared by the authors.