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Determinants of Mexican households' credit use; A simultaneous analysis by type of instrument

Determinantes del uso de crédito de los hogares mexicanos; un análisis simultáneo por tipo de instrumento

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Abstract

This paper identifies the factors that explain Mexican households' simultaneous use of debt instruments, considering the distortion caused by heterogeneity in income distribution and the potential correlation in using different instruments. The National Survey of Household Finances is used through a simultaneous equations system approach based on multivariate Probit models by type of credit, being a novel methodology for the literature and the research's main contribution. The results show that higher-income households choose formal credit, especially credit cards. In addition, middle-income quintiles use departmental cards and informal credit. Finally, low-income households also use informal credit. In conclusion, this study is relevant to understanding the existing correlation in the use of household credit and thus promotes the joint financial inclusion of debt instruments.

JEL Code: C35, D14, G21
Keywords: household debt portfolio; determinants; multivariate probit; Mexico

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Resumen

Este artículo identifica los factores que explican el uso simultáneo de los instrumentos de deuda que utilizan los hogares mexicanos, considerando la distorsión provocada por la heterogeneidad en la distribución de ingresos y la potencial correlación en el uso de distintos instrumentos. Se emplea la Encuesta Nacional de Finanzas de los Hogares mediante un enfoque de ecuaciones simultáneas basadas en modelos Probit multivariados por tipo de crédito, siendo una metodología novedosa para la literatura y la contribución principal del trabajo. Los resultados muestran que los hogares con mayor ingreso eligen el crédito formal, especialmente tarjetas de crédito. Además, quintiles de ingreso medio emplean tarjetas departamentales y crédito informal. Finalmente, los de ingresos bajos también optan por el crédito informal. En conclusión, este estudio es relevante para entender la correlación existente en la utilización del crédito de los hogares y así fomentar la inclusión financiera a través de instrumentos de deuda

Código JEL: C35, D14, G21
Palabras clave: portafolio de deuda de hogares; determinantes; sistemas de ecuaciones probit multivariado; México

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Introduction

Access to liquidity through microfinance plays an essential role in developing countries, allowing individuals and households to generate opportunities for growth and wealth generation, such as investment in human capital or taking advantage of opportunities for entrepreneurship and wealth generation (Giné and Townsend, 2003). Nevertheless, despite promoting financial inclusion, barriers still limit the development capacity of many economic agents. Santoso et al. (2022) indicate several underlying barriers to financial inclusion in developing countries, such as affordability, eligibility, accessibility, asymmetric information, and availability.

According to Mexico's National Institute of Statistics and Geography (INEGI; Spanish: Instituto Nacional de Estadística y Geografía), in 2021 only 32.7% of people between the ages of 18 and 70 have at least one formal line of credit. This fact reveals Mexico's situation regarding the financial sector and the issue of financial inclusion. The main reasons why people hesitate to join the financial sector are that they do not like to get into debt, do not satisfy the requirements, and the interest or commissions they must pay are very high. Given these limitations, household income is extremely important, as it is a determining factor for accessing the debt market.

Considering the existing situation regarding access to the debt market of Mexican households and their need to satisfy their consumption habits, there is a gap in the literature, which is the main motivation of this paper. Since the literature dealing with household indebtedness is scarce and even more so for Mexico, this research aims to analyze this phenomenon from a new perspective, simultaneously examining the use of credit in households, as there are no studies related to this topic in Mexico from this point of view. This study will help to understand what Mexican households' access to financing depends on and how the instruments they contract are interrelated.

Consequently, the questions that will guide this research are: What is the effect of the heterogeneity of income distribution on the probability of using different debt instruments in Mexican households? Is there a co-dependence in the access to different types of household credit in the country?

Thus, the first hypothesis in the research is that the highest income quintile has easier access to a more varied portfolio of formal debt instruments. In contrast, the lowest quintile makes greater use of informal credit as these may be among the only instruments available to them because the requirements tend to be laxer or even non-existent. On the other hand, the second hypothesis derived from the analysis is that access to the different credit instruments may sometimes be complementary or become substitutes, which varies depending on the households' contextual information.

The empirical analysis of the questions is carried out using a system of simultaneous equations based on multivariate Probit models, one for each type of credit, which estimates several equations simultaneously, as in a SUR -type model, but with binary inputs for each relevant equation. This method is hereafter referred to as Probit-SUR. Thus, the correlations between different credits can be incorporated as part of the analysis, assuming that Mexican households can access more than one of the debt instruments considered in the research so that none is exclusive. Furthermore, for this paper, using a Logit model is equivalent to using a Probit model since the marginal effects of the former are proportional to those of the latter.

Additionally, the use of a probabilistic simultaneous equations model (Probit-SUR) is conditioned by the use of a command validated by STATA ("cmp"), which bases its empirical procedure on maximum likelihood estimators from normal distributions. This econometric method provides the necessary and sufficient information to calculate both the marginal effects of the covariates and the co-dependence of the unobservable terms in households' access to different types of credit. Therefore, it was decided to use a multi-equation Probit approach rather than a Logit alternative. On the other hand, taking advantage of the analysis of the correlations between the unobservable components of the determinants of access to debt instruments, the analysis made it possible to determine whether these instruments act as complements or substitutes in managing household liabilities in Mexico.

The results indicate that income has a significant effect on the use of credit by Mexican households, determined by household, head of household, and financial characteristics. In this scenario, the highest income quintiles opt for formal instruments and above all for the use of credit cards, while the lowest quintile uses informal credit to a greater extent. Other results show a relation of substitutability between informal credit and department-store cards.

This paper seeks to investigate the determinants of the use of the different credit instruments to which households have access and contract since most of the literature bases its analysis on the study of individual credit instruments, ignoring the fact that households may have more than one instrument and

that this may change the relation between risk management and debt management. Furthermore, some authors analyze the presence or absence of credit within the household from a generalized perspective, minimizing the effect that the particular characteristics of each individual may have, as well as the fact that the determinants may change due to these particular factors. Thus, this paper provides a more complete and realistic analysis of how Mexican households manage their debt portfolio by simultaneously considering the interaction of several types of instruments.

The structure of the paper is as follows: Section 2 details the review of the literature, highlighting the models used and the main findings. Section 3 presents the methodology used, describing the data and the empirical strategy. Section 4 presents the results of the estimations performed. Section 5 discusses the results, contrasting them with those of other authors. Finally, section 6 presents the conclusions.

Review of the literature

In recent years, the term financial inclusion has increased in relevance, given the need and importance for more people to access the financial sector. According to the National Banking and Securities Commission (CNBV; Spanish: Comisión Nacional Bancaria y de Valores), financial inclusion is defined as the use of and access to formal financial services, distinguishing between four fundamental dimensions: access, use, protection, and education. Likewise, Rodríguez-Raga and Riaño (2016) highlight four dimensions for inclusion, adding quality and well-being instead of protection and education.

According to the different dimensions, Beck et al. (2007) specify the difference between use and access to financial products, indicating that individuals may have access to the financial sector, but they can decide to use the product or not based on different factors or the opportunity cost it represents for them. Following this distinction, this research focuses on the use of different financial products.

It is essential to highlight the role and effort of financial inclusion, which can reduce the asymmetry of information and allow low-income people to benefit from the use of the financial instruments offered by this sector. Thus, Beck et al. (2009) point out that restrictions on low-income households limit the opportunities for investment in human capital. Similarly, Asiamah et al. (2021) analyze credit demand and constraints for households in Ghana, concluding that education is the most significant factor. Likewise, Chandio and Jiang (2018) agree that education is one of the main constraints to obtaining credit.

The study of households' use of credit shows evidence of some factors determining access to or use of credit, encouraging participation in the financial sector.

One study that analyzed the determinants of access to financial instruments was conducted by Murcia (2007), focusing on mortgage credit and credit through bank cards. Using a probit model, the

author finds that belonging to the highest income level increases the probability of accessing either of both types of credit. In particular, it increases by 11.7% for mortgage credit concerning the lowest income quintile and, similarly, by 27.1% for credit through credit cards.

There is evidence for the case of Mexico in a study that analyzes the use of credit cards. Castellanos and Garrido (2010) studied the determinants of credit card ownership using characteristics of the head of household, fixed asset ownership, and the infrastructure of banking institutions through the number of POS[1] terminals and bank branches in the municipality. They confirm the influence of factors such as income, education, formal employment, and access to POS and branches on credit card use.

Rodríguez-Raga and Riaño (2016) also outlined three categories: household fixed assets, assets linked to human capital, and general household characteristics. These authors analyzed the holding of three types of financial instruments in Colombia using four Logit and Probit models: savings, credit, insurance, and finally, the holding of any of the three. This analysis was performed independently by instrument. Among its main findings was a positive relation between household income and homeownership. Additionally, the level of education of the head of household was relevant, showing that the higher the education, the greater the probability of access to formal instruments. Finally, regarding housing characteristics, having access to public services and the house's rural or urban location determines its use. Cano et al. (2013) found similar results for the same country.

Evidence on the determinants of access to and use of credit has been of concern in developing countries. Consequently, Correa and Vilchez (2022) studied the socioeconomic determinants that influence access to credit in Peruvian households in 2020. Using a Probit model, they found that income, educational level, employment, house ownership, and residence in an urban area increase the probability of accessing the credit market.

Crespo et al. (2023) studied the heterogeneity in the use of means of payment and online banking in Spain through the Financial Survey of Households from 2002 to 2020, using a purely descriptive analysis. The results show a growth pattern in the use of credit cards, especially in households with lower incomes and lower levels of education. Otherwise, the use of online banking has increased in all households.

Pérez (2023) revealed that in Ecuador, certain household characteristics and, particularly, the number of people living in the dwelling are the most significant factors with a negative relation in explaining the use of and access to credit. Additionally, home ownership—whether the home is owned or rented—positively influences access to credit. Regarding the characteristics of the head of household, age plays an important role: the older the person is, the greater the probability of accessing formal credit. This

[1]Point of sales (terminals)

is true to a certain extent since this variable has a quadratic effect, implying an inflection point where access to credit begins to decrease as people age. To determine these findings, the author used two models, Logit and Probit, where the variable to be explained is the holding of a credit.

Condori and Quispe (2023) analyzed access to agricultural credit by households in the Huancavelica region of Peru in 2012. These authors used data from the IV National Agricultural Census 2012 and the National Household Survey (ENAHO, 2012; Spanish: Encuesta Nacional de Hogares) and a Probit methodology to find the determinants that explain access to the credit market. The results show that variables such as income, education level, age, and other agricultural fixed capital factors significantly impact the availability of financing for families in Huancavelica.

Similarly, Chávez and Hernández (2023) studied financial education and credit management in Mexican households using the 2018 National Financial Inclusion Survey. By employing a multinomial probit model, these authors found that the probability of having a credit card is much higher than having an individual line of credit. In addition, they find that variables such as income, age, education, and town size positively and significantly impact whether individuals have a credit card.

González (2023) studied the financialization of Mexican households to observe their mutation within the credit-debt process. With a binary methodology using a logistic regression model, the reported income seems to be a relevant factor that explains the differentiated use of financial instruments and indebtedness patterns.

From a different perspective, various authors have shown the relevance of rural areas in the access and use of credit, stating that this extra amount generates development and growth for farms. Using a probit model, Moahid and Maharjan (2020) determined the probability of credit participation in two dimensions: formal and informal. They concluded that a sudden change in income inclines individuals to use informal credit. Conversely, Kumar et al. (2020) determined that having access to credit increases household per capita income, i.e., the opposite relation.

Methodology

Database

The National Survey on Household Finances (ENFIH; Spanish: Encuesta Nacional sobre las Finanzas de los Hogares) for 2019 was used to carry out the objective of the research, being the only version available on a national scale, which helped to have better information on Mexican households. The INEGI conducts this survey. The database contains data on household residents' characteristics, socio-demographics, general housing characteristics, wealth, and formal and informal debts contracted by household members

in the year of the interview. The data comprised 17 386 households and about 40 940 individuals, representing 86.4 million people aged 18 and over.

Dependent variable; Types of credits per household

Since the intention is to analyze the probabilities of households using the different types of credit offered by the formal and informal markets, the dependent variable is represented by dichotomous variables where it takes the value of one if the household uses financial instrument X_i, i.e., a binary variable is specified for each type of credit. The instruments studied in the database were: department-store card, credit card, payroll credit, automobile credit, mortgage credit, and informal credit.

Table 1 shows the analysis results to represent better the behavior of credit and how it is distributed among the different income quintiles. In the first instance, department-store cards are used more by middle-income quintiles, accounting for about 65%, while the highest and lowest quintiles have similar proportions between them. In the use of bank credit cards, it is evident that households with higher incomes are the ones that use them most, evidencing the ease of access that these have over households with low incomes and that, as a tool that offers many benefits, it is widely used. A similar situation occurs with payroll credits, where the two highest income quintiles account for more than 55%.

Additionally, credits involving the acquisition of durable goods such as houses or vehicles have a different dynamic since the asset is a guarantee against non-payment risk. According to the automobile credit, 52% is covered by the fifth income quintile, which is unsurprising. Nevertheless, according to the survey, households in the first income quintile use this instrument more than the second and third quintiles. This situation is relevant because it is likely that these households have used most of their income to purchase this type of good, significantly reducing the consumption of other types of goods. Regarding the use of mortgage credits, once again, the highest quintiles are those who use this instrument most, which is an expected result as wealthier households find it easier to comply with the requirements demanded by financial institutions to grant this type of financing.

Finally, informal credits are an instrument that can be acquired outside the financial system without documentation, the requirements being limited to the lender's trust in the borrower. This type of financing is attractive to low-income households. In this case, more homogeneous percentages are observed in their use, determining that the middle quintiles use this type of debt at around 22%, while the highest and lowest quintiles use between 17% and 18%. In this category, it is clear that those with more income prefer other types of instruments, particularly formal sector financing.

Table 1
Percentage of credit use by quintile

Income quintile	Departmental-store card	Credit card	Payroll credit	Automobile credit	Mortgage Credit	Informal credit
Q1	15.28%	13.39%	8.11%	12.71%	5.92%	17.75%
Q2	20.93%	15.34%	14.11%	3.69%	14.14%	21.51%
Q3	22.85%	17.46%	20.47%	10.19%	21.17%	21.99%
Q4	23.02%	23.71%	25.43%	21.38%	30.05%	21.76
Q5	17.91%	30.10%	31.87%	52.03%	28.72%	17.00%

Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021).

Independent variables; Head of household, housing, and financial characteristics

According to the literature, the age of the head of household is relevant to explain the use of credit by households since older individuals may have a more robust credit history that facilitates access to and use of credit. In addition, a quadratic term of this variable is included to represent diminishing returns, indicating that at a certain age, the opportunities to access credit are reduced because institutions do not grant credit to older individuals to reduce the risk of default (Castellanos and Garrido, 2010; Jonhson and Nino-Zarazua, 2011; Rodríguez-Raga and Riaño, 2016). Another relevant characteristic of the head of household is gender, which in this case is a binary variable that takes the value of one if male and zero if female (Evans et al., 1999; Jonhson and Nino-Zarazua, 2011; Rodríguez-Raga and Riaño, 2016).

Moreover, the education of the head of the household is also a key factor according to the literature, which shows that people with a higher level of education are better decision-makers and have greater job and income security.

The survey can separate this categorical variable by education level in the following order: no studies, elementary school, middle school, high school, bachelor's, master's, and PhD, considering the bachelor's degree as the base group for comparison (Castellanos and Garrido, 2010; Evans et al., 1999; Jonhson and Nino-Zarazua 2011; Rodríguez-Raga and Riaño, 2016). Likewise, the variable marital status of the head of household is constructed as a dichotomous variable that takes a value of one if they live with their partner and zero otherwise, under the premise that living as a couple helps risk sharing (Jonhson and Nino-Zarazua, 2011; Santoso et al., 2022; Togba, 2012). The employment status of the head of household is also included, a binary variable that indicates whether this individual is currently employed with a value equal to 1 and zero otherwise (Cano et al., 2013).

Housing characteristics are other factors analyzed to control and obtain more robust estimators. First, the number of people living in the household is used to know how the household composition affects obtaining credit (Castellanos and Garrido, 2010; Evans et al., 1999; Rodríguez-Raga and Riaño, 2016).

The size of the town to which the household belongs is also incorporated since access to branches is greater in larger towns, as well as to POSs and ATMs. Therefore, the construction of this determinant is based on a series of dichotomous variables associated with the different town sizes recorded in the survey, with micro entities having less than 2 500 inhabitants, small entities with 2 500 to 14 999 inhabitants, medium-sized entities with 15 000 to 99 999 inhabitants and large entities with 100 000 or more inhabitants (Jonhson and Nino-Zarazua, 2011; Santoso et al., 2022; Togba, 2012).

Furthermore, for the financial variables, the natural logarithm is considered for the three measures used in this study: financial assets, non-financial assets, and household debt. The first is the sum of savings in pension or payroll accounts, savings accounts, checking accounts, funds in government support accounts, AFORE[2] retirement savings, fixed-term deposits, investment funds, capitalizable life income, and other financial assets (Evans et al., 1999). The second considers the sum of the main dwelling, other real estate, household goods, businesses, vehicles, and other non-financial assets (Jonhson and Nino-Zarazua, 2011). Finally, household debt includes debt on mortgage credit for primary and secondary housing, credit, department-store, payroll, or personal card debts, automobile debts, and other non-mortgage debts.

Descriptive statistics

This section shows relevant information on the variables used to explain the distribution of the different types of credit contracted by Mexican households. Table 2 shows the behavior of each factor. The average age of the head of household is approximately 45 years old, considering people between 18 and 97 years old, and 65% of the heads of household report being men. Considering the educational level, households where the head of household has completed elementary school represent 24% of the sample, while for middle school, it increases to 29%, these being the main levels of schooling of the heads of Mexican households. Finally, there is a significant decrease in the number of households where the head of household has a postgraduate degree, with only 2%. Heads of households living with a partner represent 61% of the sample, and, as expected, most of them are employed (80%). The household composition indicates that, on average, there are 3.6 persons per household and that the location of the dwellings is clustered where there is a large population.

[2] A Retirement Funds Administrator (Spanish: Administradora de Fondos para el Retiro)

Table 2
Descriptive statistics of independent variables

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Household income	38 953 351	12 811.70	15 480.78	0	1 029 000.00
Income quintile					
Q1	11 514 712	0.2956	0.4563	0	1
Q2	8 874 158	0.2278	0.4194	0	1
Q3	7 173 622	0.1842	0.3876	0	1
Q4	6 396 666	0.1642	0.3705	0	1
Q5	4 994 197	0.1282	0.3343	0	1
Age	38 815 335	44.73	16.20	18	97
Age squared	38 815 335	2 262.80	1 607.53	324	9 409
Gender					
Female	13 626 755	0.3498	0.4769	0	1
Male	25 326 596	0.6502	0.4769	0	1
Education					
No education	1 788 368	0.0460	0.2096	0	1
Elementary school	9 279 237	0.2388	0.4264	0	1
Middle school	11 274 064	0.2902	0.4538	0	1
High school	7 700 214	0.1982	0.3986	0	1
Bachelor's degree	7 954 184	0.2047	0.4035	0	1
Master's degree	724 616	0.0187	0.1353	0	1
Ph.D.	130 454	0.0034	0.0578	0	1
Marital status					
Other	14 983 344	0.3846	0.4865	0	1
Living with a partner	23 970 007	0.6154	0.4865	0	1
Employment status					
Unemployed	7 761 050	0.1992	0.3994	0	1
Employed	31 192 301	0.8008	0.3994	0	1
Locality size					
Large	19 330 152	0.4962	0.5000	0	1
Medium	5 567 427	0.1429	0.3500	0	1
Small	5 328 254	0.1368	0.3436	0	1
Micro	8 727 518	0.2241	0.4170	0	1
Financial assets	38 953 351	59 767.61	1 011 126.00	0	108 000 000.00
Non-financial assets	38 953 351	1 141 940.00	5 136 048.00	0	904 000 000.00
Total debt	38 953 351	43 915.47	172 196.20	0	13 000 000.00

Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021), and using the Stata/SE (14.0) econometric program.

Empirical strategy; System of simultaneous equations based on multivariate probit models for each type of credit

A model based on a system of equations with multivariate probits (Probit-SUR) is used to test the hypothesis of this paper. One is used for each type of credit, adjusting for the form of the dependent variables and correcting for the correlation between existing errors, given that households may have more than one line of credit. According to Greene (2012) the multivariate Probit is similar to estimating a SUR

model from the principle of maximum likelihood estimators. From here, Cappellari and Jenkins (2003) specify the model as follows:

$$y_{im}^{*} = \alpha_m + \beta_m' X_{im} + \gamma_m' Z_{im} + \theta_m' W_{im} + \varepsilon_{im}\,, m = 1, \ldots, 6 \tag{1}$$

$$\mathrm{y_{im}} = 1 \text{ if } \mathrm{y_{im}^{*}} > 0 \text{ and zero otherwise} \tag{2}$$

Where y_{im} represents each of the use of credit responses (department-store card, credit card, payroll credit, automobile credit, mortgage credit, and informal credit). α_m indicates the intercept for each of the equations. X_{im} is a vector of variables that determine the characteristics of the head of household (age, age squared, gender, education level, marital status, and employment status). Z_{im} shows a vector of housing characteristics variables (number of people living in the house and the town size). W_{im} describes the vector of financial characteristics of the dwelling (debt and financial and non-financial assets). Finally, ε_{im} is the stochastic error term, where $(\varepsilon_1, \ldots, \varepsilon_m) \sim N(0,1)$. It is important to note th, paréntesis de cierre igual a ro subíndice jm, for all ρ_{jm} for all $j \neq m$.

Results

This section identifies the determinants that affect the probability of how Mexican households use the different credits to which they have access using the Probit-SUR model described above. Before discussing the research results, it should be noted that, due to the nature of the data, macroeconomic variables were not included since the study is cross-sectional and only for Mexico. These variables do not show variability (variance = 0) since the economic environment in which the unit of analysis is developed is invariant. Therefore, this study is equivalent to analyzing the determinants from a microeconomic perspective, keeping the environment constant.

Figure 1 shows the marginal probabilities for each type of financial product for the different income quintiles, analyzing the impact of income heterogeneity on households' access to different means of credit to satisfy their consumption habits. This graph analyzes the six credit categories regarding four income categories and compares them with the richest households (fifth income quintile).

Among the most noteworthy results is that individuals with higher incomes, i.e., those belonging to the fifth quintile, are the ones who most use and favor three instruments: credit cards, payroll credits, and automobile credits. Households with high incomes prefer to join or continue in the formal sector,

benefiting from the facilities that banks grant them, such as bonuses for credit card use or the facility to defer their payments over time at zero interest.

Middle-income quintiles (third and fourth) prefer using department-store cards, perhaps because of the ease of procedures or because of details related to the costs and documentation required by these types of institutions. Mortgage credits also tend to be preferred by these quintiles, and despite representing a very small variation, they show greater home purchases than the richest quintile.

Thus, it is important to analyze this event and try to understand whether the transaction is full credit or there is a sharing of the debt with the partner. Informal credit shows a somewhat different behavior from that of the formal sector. First, it has a more homogeneous use for the first four quintiles, which range from a 2% to a 4% probability compared to the highest quintile. Second, all quintiles have a higher probability of using it, and this is due to its ease of access and the fact that most of them do not have added costs, such as an interest rate or an associated term. Therefore, it is an instrument that many Mexican households use; it could even be said that it is the only one they can access, especially the lowest-income households. Brau and Woller (2004) state that in developing countries, there is an exclusion of the lowest-income households from the formal sector, which is why they use informal credit.

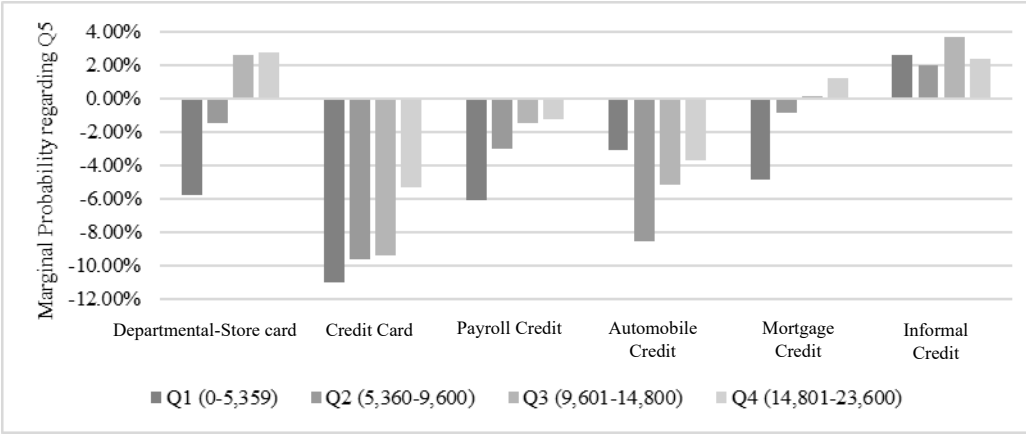

Figure 1. Marginal income probabilities for the different types of credit
Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021), and based on estimates in Stata/SE (14.0)
All income quintiles' effects are statistically significant at 1% level

Table 3 shows the results obtained through the multivariate Probit-SUR. Regarding the control variables of characteristics of the head of household, all reflect statistically significant results, with the age of the head of household being more relevant in the use of mortgage credit despite being relatively

low values. This indicates that the higher the age, the greater the probability of accessing a credit of this type. Conversely, older age shows a lower probability of accessing a department-store card. Gender indicates that women are more likely to use almost all credit instruments except for mortgage credit. Khandker et al. (1998) point out that women use funds more efficiently, as demonstrated in this study.

Along the same lines, education indicates that having a postgraduate degree reduces the probability of using credit compared to having a bachelor's degree. On the other hand, people with lower levels of education are more likely to have access to instruments such as department-store cards, mortgage credit, and informal credit. Similarly, it is important to note that having no educational qualifications has a very strong effect on the probability of using informal credit.

The marital status, referring to living or not with a partner, indicates that this risk-sharing makes it more likely to use formal instruments, except for mortgage credit through banking institutions, which may not be used due to the facilities offered by shared credits or housing credits granted by INFONAVIT[3]. Employment status indicates a credit division, being relevant for the use of credit cards, payroll credit, and informal credit, which have as a primary requirement the status of being employed.

Housing characteristics also play an important role in explaining the use of household debt, where the number of people living in a household is more important for the use of department-store cards. One explanation for this phenomenon may be that people with more children use this means to purchase consumer goods, such as clothing and footwear. The size of the town in which the home is located shows a decrease in the probability of using credit for the most part, except for payroll credit and informal credit, where the latter is expected to be used more in those towns for which access to bank branches is more difficult.

[3] Workers' Housing Institute (Spanish: Instituto de la Vivienda para los Trabajadores)

Table 3
Marginal probabilities of the System of Equations based on a multivariate Probit model (Probit-SUR) by credit type

	Departmental-store card	Credit Card	Payroll Credit	Automobile Credit	Mortgage Credit	Informal Credit
Income quintile (Q5 =1)						
Q1 (0-5 359)	-0.0576***	-0.1100***	-0.0607***	-0.0309***	-0.0483***	0.0263***
	(-0.00043)	(-0.000355)	(-0.000258)	(-0.000184)	(-0.000236)	(-0.000429)
Q2 (5 360-9 600)	-0.0144***	-0.0964***	-0.0301***	-0.0851***	-0.0088***	0.0200***
	(-0.000389)	(-0.000321)	(-0.000218)	(-0.000224)	(-0.000182)	(-0.000388)
Q3 (9 601-14 800)	0.0263****	-0.0940***	-0.0147***	-0.0513***	0.0016***	0.0368***
	(-0.000364)	(-0.000295)	(-0.000193)	(-0.000156)	(-0.000158)	(-0.000363)
Q4 (14 801-23 600)	0.0274***	-0.0532***	-0.0126***	-0.0371***	0.0125***	0.0241***
	(-0.000345)	(-0.000273)	(-0.000176)	(-0.000127)	(-0.00014)	(-0.000345)
Age	-0.00671***	-0.000523***	0.00191***	-0.00181***	0.00413***	-0.00160***
	(-0.0000454)	(-0.0000389)	(-0.0000282)	(-0.0000225)	(-0.0000247)	(-0.0000451)
Age squared	5.77e-05***	1.66e-05***	-1.45e-05***	2.04e-05***	-4.14e-05***	7.88e-06***
	(-4.97e-07)	(-4.24e-07)	(-3.11e-07)	(-2.44e-07)	(-2.72e-07)	(-4.94e-07)
Gender (Male = 1)	-0.00127***	-0.00368***	-0.0160***	-0.0115***	0.000594***	-0.00654***
	(-0.000246)	(-0.000206)	(-0.000139)	(-0.000109)	(-0.000118)	(-0.000245)
Education (Bachelor's degree=1)						
No education	-0.0164***	-0.195***	-0.133***	-0.0893***	-0.00737***	0.146***
	(-0.000857)	(-0.000837)	(-0.000905)	(-0.000787)	(-0.000635)	(-0.000819)
Elementary school	0.0665***	-0.0868***	-0.0629***	-0.0749***	0.0195***	0.0655***
	(-0.000374)	(-0.000313)	(-0.000235)	(-0.00023)	(-0.000187)	(-0.000372)
Middle school	0.0654***	-0.112***	-0.0301***	-0.0548***	0.0131***	0.0518***
	(-0.000314)	(-0.00026)	(-0.000172)	(-0.000146)	(-0.000145)	(-0.000313)
High school	0.0495***	-0.0651***	-0.0188***	-0.0350***	0.0206***	0.0384***
	(-0.000322)	(-0.000261)	(-0.00017)	(-0.00013)	(-0.00014)	(-0.000321)
Master's degree	-0.0209***	-0.0199***	-0.00916***	-0.00326***	-0.00410***	-0.0699***
	(-0.000735)	(-0.000548)	(-0.000338)	(-0.000213)	(-0.00028)	(-0.000746)
Ph.D.	-0.0167***	-0.00357**	-0.0267***	-0.0349***	-0.000808	-0.164***
	(-0.00175)	(-0.00127)	(-0.000825)	(-0.000535)	(-0.000658)	(-0.00197)

Marital status (Lives with a partner=1)	0.0379*** (-0.000252)	0.00547*** (-0.000213)	0.00670*** (-0.000146)	0.0123*** (-0.000116)	-0.0210*** (-0.00012)	-0.0364*** (-0.00025)
Employment status (Employed=1)	-0.00284*** (-0.000376)	0.0137*** (-0.000322)	0.000433 (-0.00023)	-0.00742*** (-0.00017)	-0.0182*** (-0.000191)	0.0309*** (-0.000375)
Number of people in the household	0.0119*** (-0.0000626)	-0.00259*** (-0.0000543)	0.00115*** (-0.0000369)	-0.00342*** (-0.0000323)	0.00890*** (-0.0000288)	0.0310*** (-0.0000615)
Financial assets (ln)	0.00538*** (-0.000023)	0.000766*** (-0.0000194)	0.00140*** (-0.0000132)	0.0000474*** (-0.0000106)	0.00234*** (-0.0000112)	0.00266*** (-0.0000229)
Non-financial assets (ln)	0.00159*** (-0.0000404)	0.00688*** (-0.0000356)	-0.00425*** (-0.0000222)	0.00189*** (-0.0000208)	-0.00671*** (-0.0000175)	-0.00919*** (-0.0000397)
Total debt (ln)	-0.0180*** (-0.000062)	0.0157*** (-0.0000529)	0.0251*** (-0.0000377)	0.0298*** (-0.0000325)	0.0332*** (-0.0000345)	0.0113*** (-0.0000619)
Locality size (Large = 1)						
Micro	-0.0324*** (-0.000313)	-0.0217*** (-0.000273)	0.000505* (-0.000197)	-0.0147*** (-0.000186)	-0.0373*** (-0.000185)	0.0482*** (-0.000309)
Small	-0.0202*** (-0.000326)	-0.0361*** (-0.000282)	0.0349*** (-0.000178)	0.00989*** (-0.000152)	-0.0241*** (-0.000168)	0.0467*** (-0.000321)
Medium	-0.0306*** (-0.000314)	-0.00883*** (-0.000264)	0.00693*** (-0.000179)	-0.00196*** (-0.000147)	-0.0165*** (-0.000149)	0.0135*** (-0.000311)

Note: *** p<0.001, ** p<0.05, * p<0.1, and standard error in parentheses
Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021), and based on estimates in Stata/SE (14.0)

Finally, having a greater number of financial assets allows greater access to any type of credit, while a household's non-financial assets show greater use of the department-store card, credit card, automobile credit, and informal credit. On the other hand, household debt increases the probability of using more credit because through it people generate a longer history despite having, in theory, a limited payment capacity.

Alternatively, a linear probability model in simultaneous equations (LPM-SUR) was estimated to test the robustness of the Probit-SUR method. This alternative model showed very low R-squared fit values in each estimated equation, which is evidence that this methodology does not reflect an adequate goodness of fit in a context of limited dependent variables (dummy) associated with access to each type of credit. This is evidence that the methodology chosen in this paper, Probit-SUR, which is an important part of its contribution to the literature, is a better alternative to explain the alternatives in the use of credit in Mexican households. The estimates of the alternative MPL-SUR method are presented in Table A1 in the annex section.

Another result derived from the model is the correlations of the errors between the types of credit used by households, which may demonstrate a certain degree of complementarity or substitutability between the different credit instruments. Table 4 shows that the highest correlation (negative) is between department-store cards and informal credit, showing a certain degree of substitution between these instruments, which is an area of opportunity for those companies that offer department-store cards.

It was also found that there is a substitution between mortgage credit and informal credit with auto credit. The first reason could be that having an automobile credit, which tends to be of high value, limits the household's ability to pay and, in turn, prevents using another high-value credit. On the other hand, if the household has the income to acquire a vehicle through formal credit, it is unnecessary to borrow from family and friends since there is a preference for the benefits offered by banking institutions over the low cost of accessing informal credit.

Table 4
Estimated correlations between the unobserved terms (errors) of the different types of household credit

	Departmental-store card	Credit Card	Payroll Credit	Automobile Credit	Mortgage Credit	Informal Credit
Departmental-store card	1					
Credit Card	-0.007***	1				
Payroll Credit	-0.030***	-0.049***	1			
Automobile Credit	0.046***	0.091***	-0.075***	1		
Mortgage Credit	-0.002***	-0.058***	-0.044***	-0.228***	1	
Informal Credit	-0.322***	-0.199***	-0.062***	-0.226***	0.031***	1

Note: *** p<0.001, ** p<0.05, * p<0.1
Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021), and based on estimates in Stata/SE (14.0).

Discussion

The results show similarities with the existing literature, which can be contrasted despite using a different methodology and a different measurement of household income than most of the research reviewed. Accordingly, the main findings of the research show that higher-income households are more inclined to use formal instruments, using credit cards in greater proportion. This result is comparable to that of Castellanos and Garrido (2010), who found that the higher the income, the greater the probability of having access to credit cards. Conversely, Togba (2012) finds that higher income reduces the probability of using formal sources of credit.

On the other hand, the results also indicate that the lowest income quintile is more likely to use informal credit than the highest, evidencing the difficult access that low-income households face to formal sources of financing because they do not have the characteristics desired by financial institutions for granting credit. Santoso et al. (2022) support this result. They found that for 2017, 2018, and 2019, the lowest-income households or those in the lowest quintile prefer credit granted by another person or member of the household.

Although there are similarities between the literature reviewed and the results obtained, one of the limitations is the separation by type of employment into formal and informal, so it is unknown to which group the employed heads of household belong, even though this may be important for accessing the financial system. Another variable that limits this analysis is the calculation of non-financial assets, which are subject to the subjective amounts held by the owner. This research opens the way for future studies on the access that individuals or households have to the financial sector, also using variables referring to savings and insurance to analyze Mexico's progress in terms of financial inclusion and to contrast results with other emerging economies.

Conclusions

This paper aims to analyze the determinants of the use of different types of credit available to households in Mexico, specifically how the income distribution of households influences their choice of credit instruments. Classified by head of household, housing, and financial characteristics, this research simultaneously analyzes the use of six credit types: department-store cards, credit cards, payroll, automobile, mortgage, and informal credits. Furthermore, the complementarity or substitutability between the different instruments is studied.

The main results indicate that the highest-income quintile uses formal instruments such as payroll credit, mortgages, and primarily credit cards, while the lowest-income quintile only uses informal

credit. This may be due to the difficult access to other instruments, considering the requirements of financial institutions. The middle-income quintiles prefer department-store cards and informal credit; in fact, there is a slight substitution between these two instruments.

The door remains open for new areas of opportunity to be explored to complement this work, such as the inclusion of variables on the term and interest rate associated with the different credits, to identify whether the limitations to access or use of any type of formal credit is discouraged by the conditions and costs applied by the institutions.

This research clarifies how households manage their debt portfolio, depending on their characteristics, and confirms the hypothesis raised in this paper on the use of credit by Mexican households. Moreover, this paper demonstrates the lack of access to capital, which may decrease the welfare of individuals and households in general. Although usually more expensive, access to formal credit provides stability to those with access to it, protecting individuals against uncertainty and increasing investment and growth opportunities. It is therefore necessary to generate public policies that promote financial inclusion, especially for lower-income households, as this can help them increase their well-being.

Nonetheless, it is important to remember that while formal credit offers several advantages, responsible borrowing and careful financial planning are crucial. Borrowers should consider their repayment capacity, interest rates, and terms and conditions, and ensure they can meet their obligations to avoid falling into debt traps.

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Annex

Table A1
Estimations using a linear probability model in a system of equations (LPM-SUR)

Independent variables	Departmental-store card	Credit Card	Payroll Credit	Automobile Credit	Mortgage Credit	Informal Credit
Income quintiles (Q5 = 1)						
Q1 (0-5 359)	-0.0545***	-0.123***	-0.0609***	-0.0741***	-0.0261***	0.0294***
	(0.000428)	(0.000364)	(0.000247)	(0.000207)	(0.000206)	(0.000426)
Q2 (5 360-9 600)	-0.0140***	-0.114***	-0.0402***	-0.1000***	-0.00866***	0.0206***
	(0.000390)	(0.000332)	(0.000225)	0.000188	(0.000188)	(0.000388)
Q3 (9 601-14 800)	0.0274***	-0.114***	-0.0273***	-0.0988***	-0.00122***	0.0373***
	(0.000366)	(0.000311)	(0.000211)	(0.000177)	(0.000176)	(0.000364)
Q4 (14 801-23 600)	0.0292***	-0.0708***	-0.0237***	-0.0874***	0.00942***	0.0245***
	(0.000347)	(0.000295)	(0.000201)	(0.000168)	(0.000167)	(0.000346)
Age	-0.00668***	-0.000457***	0.00226***	-0.00129***	0.00408***	-0.00175***
	(0.0000455)	(0.0000387)	(0.0000263)	(0.0000220)	(0.0000219)	(0.0000452)
Age squared	0.0000578***	0.0000157***	-0.0000188***	0.0000135***	-0.0000399***	0.0000100***
	(4.97e-07)	(4.22e-07)	(2.87e-07)	(2.4e-07)	(2.39e-07)	(4.94e-07)
Gender (Male=1)	-0.000786**	-0.00307***	-0.0156***	-0.00947***	0.000712***	-0.00572***
	(0.000246)	(0.000209)	(0.000142)	(0.000119)	(0.000118)	(0.000244)
Education (Bachelor's degree=1)						
No education	-0.0135***	-0.177***	-0.0727***	-0.0665***	0.0226***	0.144***
	(0.000832)	(0.000707)	(0.000481)	(0.000402)	(0.000400)	(0.000828)
Elementary school	0.0668***	-0.0986***	-0.0611***	-0.0754***	0.0230***	0.0638***
	(0.000375)	(0.000319)	(0.000217)	(0.000181)	(0.000180)	(0.000373)
Middle school	0.0656***	-0.120***	-0.0394***	-0.0726***	0.0167***	0.0511***
	(0.000315)	(0.000268)	(0.000182)	(0.000152)	(0.000152)	(0.000313)
High school	0.0497***	-0.0770***	-0.0265***	-0.0630***	0.0295***	0.0376***
	(0.000323)	(0.000274)	(0.000186)	(0.000156)	(0.000155)	(0.000321)
Master's degree	-0.0176***	-0.0206***	-0.00510***	0.0220***	0.0144***	-0.0651***
	(0.000719)	(0.000611)	(0.000415)	(0.000347)	(0.000346)	(0.000715)

Ph.D.	-0.0137***	0.00227	-0.0256***	-0.0389***	-0.0347***	-0.130***
	(0.00171)	(0.00145)	(0.000987)	(0.000825)	(0.000822)	(0.00170)
Marital status (Lives with a partner=1)	0.0371***	0.00672***	0.00640***	0.0155***	-0.0183***	-0.0361***
	(0.000252)	(0.000214)	(0.000146)	(0.000122)	(0.000121)	(0.000251)
Employment status (Employed=1)	-0.00262***	0.0109***	0.00149***	-0.0108***	-0.0141***	0.0291***
	(0.000372)	(0.000316)	(0.000215)	(0.000180)	(0.000179)	(0.000370)
Number of people in the household	0.0120***	-0.00304***	0.00109***	-0.00427***	0.00881***	0.0316***
	(0.0000631)	(0.0000537)	(0.0000365)	(0.0000305)	(0.0000304)	(0.0000628)
Financial assets (ln)	0.00533***	0.000651***	0.00125***	-0.000237***	0.00260***	0.00263***
	(0.0000230)	(0.0000196)	(0.0000133)	(0.0000111)	(0.0000111)	(0.0000229)
Non-financial assets (ln)	0.00153***	0.00644***	-0.00429***	0.00232***	-0.00755***	-0.00933***
	(0.0000402)	(0.0000342)	(0.0000232)	(0.0000194)	(0.0000193)	(0.0000400)
Total debt (ln)	-0.0188***	0.0144***	0.0247***	0.0294***	0.0348***	0.0103***
	(0.0000622)	(0.0000529)	(0.0000359)	(0.0000300)	(0.0000299)	(0.0000619)
Locality size (Large = 1)						
Micro	-0.0321***	-0.0215***	0.00968***	-0.00762***	-0.0280***	0.0481***
	(0.000313)	(0.000266)	(0.000180)	(0.000151)	(0.000150)	(0.000311)
Small	-0.0207***	-0.0372***	0.0400***	0.00901***	-0.0246***	0.0449***
	(0.000326)	(0.000277)	(0.000188)	(0.000157)	(0.000157)	(0.000324)
Medium	-0.0302***	-0.0115***	0.00986***	-0.00338***	-0.0235***	0.0126***
	(0.000313)	(0.000266)	(0.000181)	(0.000151)	(0.000151)	(0.000312)
Constant	0.597***	0.169***	-0.110***	-0.0709***	-0.301***	0.248***
	(0.00125)	(0.00106)	(0.000721)	(0.000602)	(0.000600)	(0.00124)
R-squared	0.0250	0.0607	0.0551	0.1411	0.0973	0.0302
Quantity	20 528 063	20 528 063	20 528 063	20 528 063	20 528 063	20 528 063

Note: *** p<0.001, ** p<0.05, * p<0.1, and standard error in parentheses
Source: Authors' elaboration with data from the Encuesta Nacional de Financiamiento de los Hogares (ENFIH, 2019), INEGI (2021). and based on estimates in Stata/SE (14.0)