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HOLDING AND USING CREDIT CARDS IN MEXICO

TESINA

QUE PARA OBTENER EL TÍTULO DE

LICENCIADA EN ECONOMÍA

PRESENTA

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*A mi papá, por su guía e inspiración;
por enseñarme el valor de la rectitud y la perseverancia.*

Abstract

Mexico is an under-banked country where most people do not use the financial system. Bearing this context in mind, this research analyses which factors, such as household characteristics and access to banking infrastructure, influence Mexican families to hold and use a credit card. I use a two-stage selection model for the analysis and find that factors such as literacy, ethnicity and living in a rural area can affect, if not determine, a person's access to credit cards. Additionally, I find that policies that seek to grow the network of Point-Of-Sales terminals can have a positive effect on the number of cardholders and card usage. Along the research I highlight the importance of having more and better data to analyse the credit card market in Mexico, in order to promote the adoption of this electronic means of payment, since the existing data is limited and has several important flaws.

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Introduction

The means of payment play a key role in trade, since they provide a platform to carry out transactions. A world without means of payment would entail significant costs for both consumers and merchants. The provision to all economic agents of standardized means of payment, displaying extensive acceptance networks and a satisfactory level of security, makes it possible to overcome day-to-day difficulties and greatly facilitate trade. Additionally, some means of payment, such as credit card, can also be a financial instrument that allows people to exchange present and future consumption. Therefore, credit cards can provide protection to dramatic changes in income or alleviate constraints that don't allow people to invest in human capital, for instance. Unfortunately, in countries with under-banking problems, such as Mexico, most people do not have access to the financial system, which excludes them from adopting means of payment different from cash.

It is convenient to point out the conceptual difference that exists between systems and means of payment. The payment system is the set of instruments, banking procedures and infrastructure to transfer funds between banks, which guarantees the circulation of resources. Means or instruments of payment are the instruments that the agents themselves use to pay for the goods, services and financial assets they acquire. Means of payment constitute the central components of the payment systems. There is a correspondence between the development of a system and the use of the means of payment associated with that system, since most payment instruments relay on the infrastructure of that system.¹ Checks and credit cards are the most traditional non-cash means of payment; however, its use has never been very extensive among the Mexican population.

In this research I will analyse what factors, such as household characteristics and access to banking infrastructure, influence Mexican families to hold and use a credit card. My research is primarily based on the empirical research article of Castellanos and Garrido 2010², since their empirical approach helps to answer to the aim of this research. In order to analyse the Mexican credit card market, I will use data from the National Banking and Securities Commission (CNBV, according to its initials in Spanish), since it allows for over-time comparisons. Some of the main highlights are that the number of credit cards in the market has remained relatively constant overtime and that they are less used than debit cards.

¹ Jallath and Negrín, 'Evolución y Estructura de Los Medios de Pago Distintos al Efectivo En México'.

² Castellanos and Garrido, 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'.

In order to determine what factors, influence household's decision to acquire a credit card, I will use data from the National Survey of Household Income and Spending 2018 (ENIGH for its initials in Spanish) to estimate a two-stage selection model. Additionally, I will compare my findings to the results in Castellanos and Garrido (2010) in order to analyse changes of credit card acquisition and usage after twelve years.

The rest of the document is organised as follows: the first section describes the Mexican credit card market overtime, the second section summarises some related literature, the third section describes the data and presents descriptive statistics, the fourth section presents the econometric model and the fifth section shows the results. Finally, the last section contains some concluding remarks and recommendations.

I. The Mexican Card Market

A relatively small percentage of the Mexican population has access to the credit card market. In Mexico, like in several other countries, four agents participate in a transaction paid by credit card: the cardholder who makes the payment, the bank that issues the card, the merchant that receives the payment, and the merchant's bank, called the acquiring bank. In general, the acquiring bank charges the affiliate merchant a percentage of the transaction value; the acquiring bank, in turn, transfers most of that percentage to the card issuing bank since it is the latter that incurs credit risk. The liquidation is carried out independently, without the participation of the Central Bank. International transactions are directly controlled by Visa and Mastercard, which are related to the three systems described above. Almost all Mexican banks issue credit cards and are affiliated with Visa or Mastercard or both.³

The credit card market in Mexico began to develop in the 1970s, although Dinners Club-type service cards had been introduced to the market since the 1950s.⁴ The first credit card in Mexico was launched in 1968 by the *Banco Nacional de México* (*Banamex*, now *Citibanamex*) and was called *Bancomático*. In 1969, another important bank in Mexico, *Bancomer*, issued its card affiliated to the *Bank of America* system. In that same year, a group of banks issued the third bank card in the Mexican market called "Carnet", nowadays MasterCard. In 1967, the First American National Bank of Nashville made available a new credit card named *MasterCharge*, which in 1979 changed its name to what we now all know as MasterCard.⁵ Later, in August 1969, ten banks founded the company *Promoción y Operación* (today PROSA) bringing the Carnet credit card to the market. Among them were: *Banco de Londres y México* (today Banco Santander), *Banco Comercial Mexicano* (today Scotiabank) and eight other institutions of that time. These ten banks joined in a kind of "joint-venture" to take out the Carnet, since there were high sunk costs required to put a credit card in the market.⁶

Before credit cards, international company cards were circulating that allowed travellers to make payments. It was a system of "travel and entertainment" cards that emerged in the United States in the 1950s.⁷ It's worth mentioning that banks had advantages over "travel and entertainment" card companies, primarily because of their merchantability and financial

³ Bank for International Settlements, 'Principios Aplicables a Las Infraestructuras Del Mercado Financiero'.

⁴ Jallath and Negrín, 'Evolución y Estructura de Los Medios de Pago Distintos al Efectivo En México'.

⁵ Secretaría de Hacienda y Crédito, 'Historia de la tarjeta de crédito'.

⁶ Bátiz-Lazo, *El Nacimiento de La Tarjeta de Crédito Bancaria En México y España*.

⁷ Centro de Estudios Espinosa Yglesias, 'Análisis Comparado Sobre La Crisis y Los Rescates Financieros de México (1995) y Los Estados Unidos (2008)'.

muscle. Banks had massive customer bases of users and merchants that allowed them to connect to two markets. This is the foundation of what economists often call "two-sided markets." Banks not only had a broader user base, but also had greater financial capacity, which in turn allowed them to offer revolving lines of credit to the consumer and liquidity to offer merchants immediate payment by presenting sales vouchers.⁸ I will be analysing the effect of multi-sided markets later on this text by introducing the effect of banking infrastructure, such as bank branches, ATMs and Point-of-Sales terminals (POS terminals) on credit card acquisition and use.

Despite the rapid introduction of plastic payments during the past century, the banking crisis of 1994-95 led to a considerable contraction in the number of credit cards. Before the crisis there were around 14 million cards on the market.⁹ The rise in interest rates and restrictions on card issuance, that resulted from the increase in past due loans and regulatory restrictions, explain the reduction of approximately 50% in credit cards that occurred in the following two years. The regulation prevented banks from issuing credit cards without having an explicit request signed by the customer for that purpose. Issuing cards without a prior request was a common practice for banks.¹⁰ After the sharp adjustment in 1995 and 1996, the number of credit cards stood at around 7 million cards, a number that remained stable until 2000.¹¹

As shown in Figure 1, year 2002 started with around 6 million and 400 thousand cards in circulation, this number increased steadily until year 2006 when it grew rapidly until the start of the 2008 financial crisis. Until the Global Financial Crisis, as the Mexican economy grew, more people were able to have a credit card. Similar to 1994, in 2008 the crisis led to a, less dramatic, contraction of the number of credit cards in the market. The number of credit cards started to increase again by the beginning of 2011 and maintained a steady growth until the first quarter of 2018, when it decreased dramatically from almost 33 million by the beginning of the 4th quarter of 2017 to 26 million credit cards in the beginning of 2018. This downfall could have to do with the change of federal administration and the uncertainty around the effect of some federal policies.

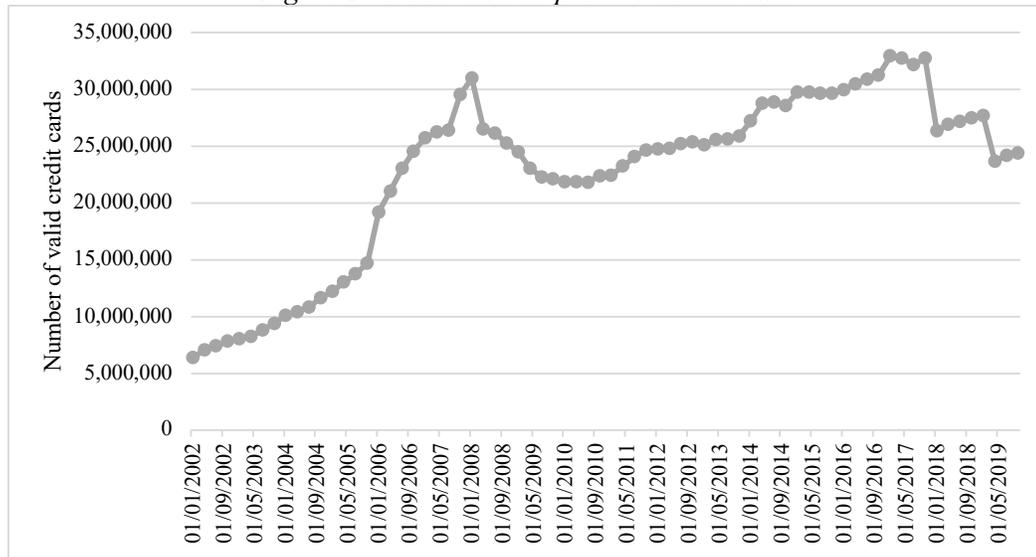
⁸ Batiz-Lazo, Bernardo and Del Ángel Mobarak, 'The Dawn of the Plastic Jungle'.

⁹ Jallath and Negrín, 'Evolución y Estructura de Los Medios de Pago Distintos al Efectivo En México'.

¹⁰ Jallath and Negrín.

¹¹ Jallath and Negrín.

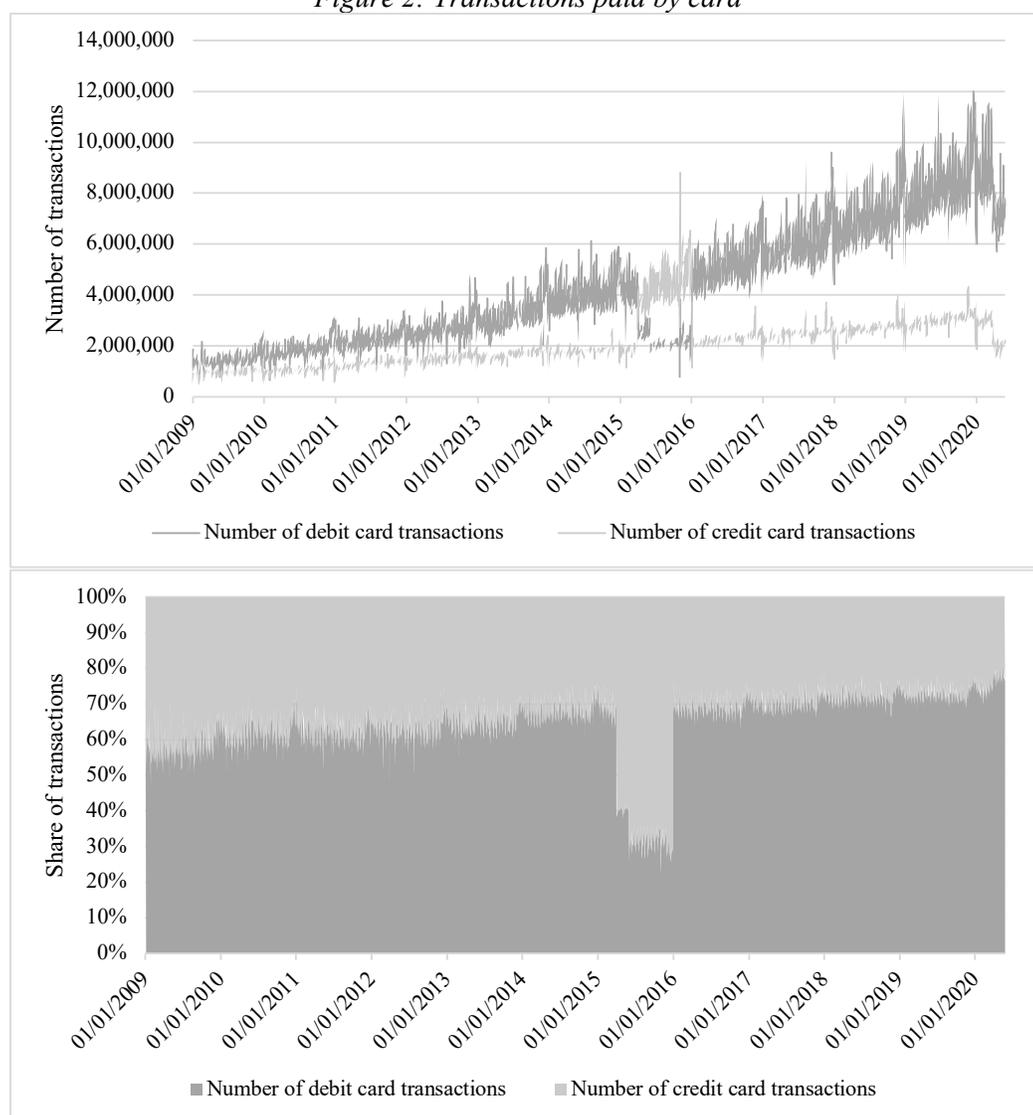
Figure 1: Credit card acquisition across time



Self-made with data from: Estructura de información (SIE, Banco de México), 'Número de Tarjetas de Crédito y Débito'.

Additional to the number of valid credit cards in circulation, I am interested in studying whether the cards are actually being used or not. A common measurement of card usage is the number of card transactions. Figure 2 displays the number of card transactions over time and compares the share of debit and credit card transactions. We can see that the use of both credit and debit cards have an upward slope, although the credit card using tendency is a lot slower than the debit card tendency. In consequence, we can clearly see that credit card transactions have been relatively decreasing over time, in comparison with debit card transactions, except for a very atypical period between 2015 and 2016.

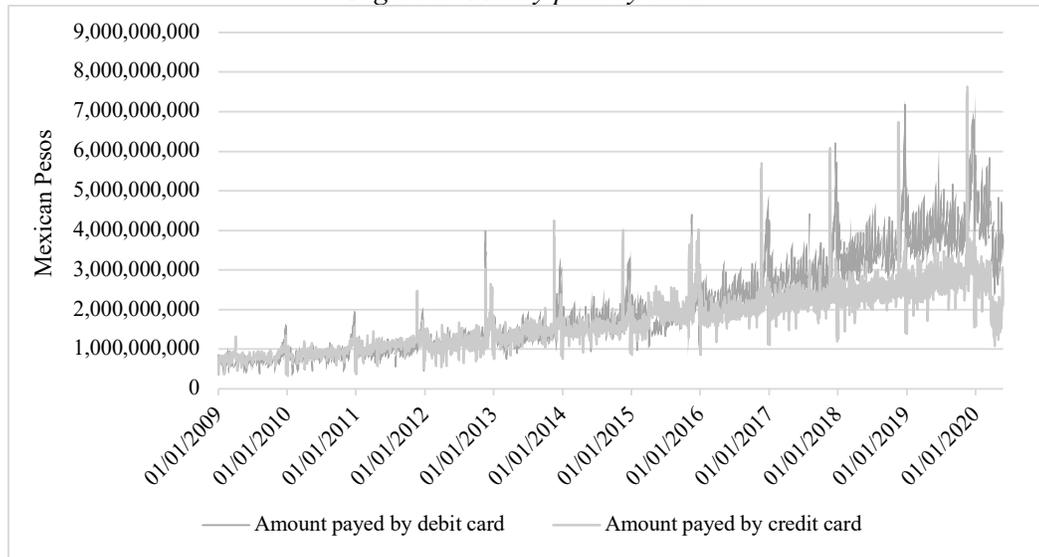
Figure 2: Transactions paid by card



Self-made with data from: Estructura de información (SIE, Banco de México), 'Número de Operaciones Realizadas Con Tarjetas'.

It is also useful to look at the amount of money spent by card when analysing card usage since this is considered a measure of card usage. Figure 3 shows the quantity of Mexican pesos paid by card over time. The tendency of amounts paid with card are both upward slopping. However, we can see that before 2012, the amounts paid by credit card was slightly larger than the amounts paid with debit card; during 2012 these quantities seem relatively equivalent and from 2013 and on, the quantities paid with credit card are relatively smaller in comparison to debit card payments. This pattern suggests that individuals opt for debit cards instead of credit cards as a payment instrument.

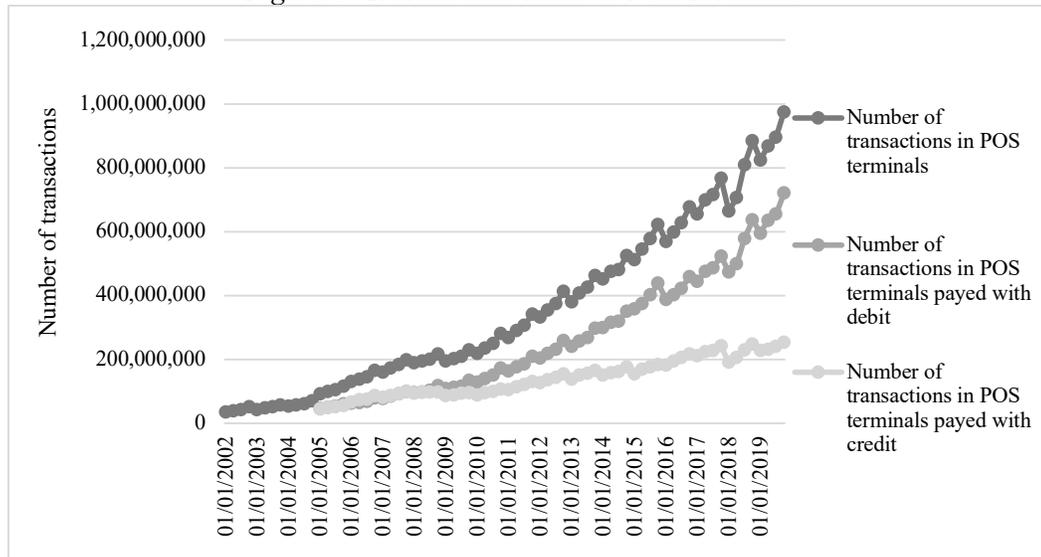
Figure 3: Money paid by card



Self-made with data from: Estructura de información (SIE, Banco de México), 'Monto Operado a Través de Tarjetas'.

Another important aspect to analyse is the evolution of card payments as the network of POS terminals has grown. In Figure 4, we can see that the relation of the number of POS terminals and card payments is positive. This is intuitive considering the two-sided market theory mentioned before. From Figure 4 we can clearly observe that the number of transactions carried out with credit card is significantly smaller than the number of transactions carried out with debit card. This could have to do with the large commissions imposed by banks on cardholders each time one was to use a credit card.

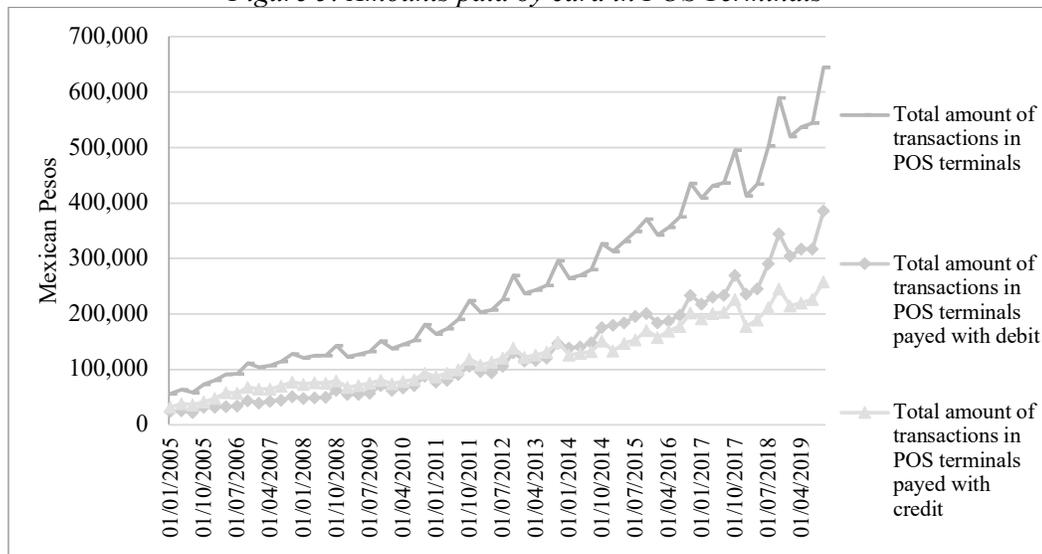
Figure 4: Transactions made in POS Terminals



Self-made with data from: Estructura de información (SIE, Banco de México), 'Operaciones En TPV'.

Even though the number of transactions is significantly different between credit and debit cards, the amount of money spent with both is relatively similar, as shown in Figure 5. This implies that credit cards are used to pay larger sums of money than debit cards. Actually, before 2010 the amount spent by credit card was larger than the amount spent with debit. From 2013 and on, the amount spent with debit has been larger than the amount spent with credit, but it has remained relatively close. It is not until 2018 that these tendencies start to grow apart.

Figure 5: Amounts paid by card in POS Terminals

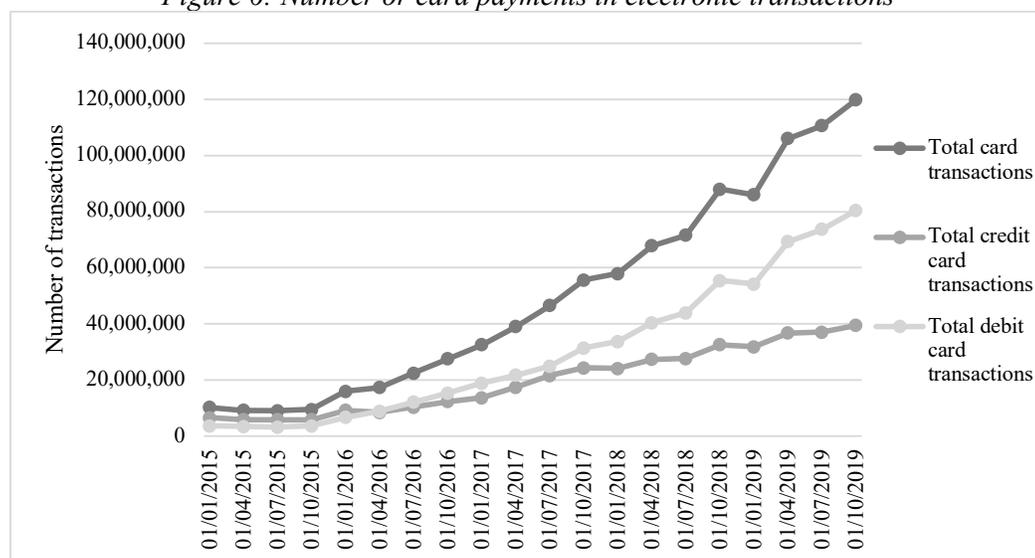


Self-made with data from: Estructura de información (SIE, Banco de México).

Why are we seeing a tendency of less use of credit cards? In part, it could be due to financial education campaigns. In particular, the National Commission for the Protection and Defense of Users of Financial Services (CONDUSEF for its initials in Spanish) has launched several campaigns for the responsible use of credit cards since the financial crisis of 2008. These campaigns highlight the importance of not spending on credit cards more than what one earns in order to avoid paying large amounts on interest rates. A common misinterpretation of this is that one should simply avoid using a credit card altogether. As a matter of fact, of the 18 million 224 thousand 157 registered credit cards up to June 2018, 51% were used without paying interest, according to the annual report of Banxico. Almost half of the credit cards in the market are used only as a means of payment and not as a financing instrument.¹²

The last factor I will discuss in this section will be the use of cards in electronic transactions. In Figures 6 and 7 we can see a similar tendency than before: debit cards are more used than credit cards, but credit cards represent a larger proportion of the money spent by card. This is relevant in an economy that is seeing an important growth of e-commerce and online transactions since a larger sum of money of these transactions is paid with credit instead of debit.

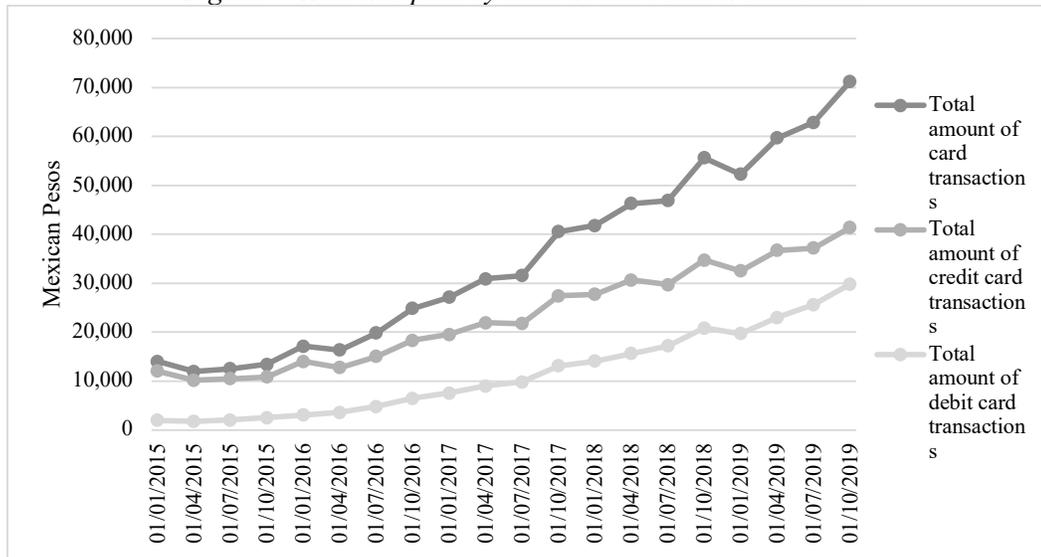
Figure 6: Number of card payments in electronic transactions



Self-made with data from: Estructura de información (SIE, Banco de México), 'Operaciones En TPV de Comercio Electrónico'.

¹² Banco de México, 'Indicadores Básicos de Tarjetas de Crédito'.

Figure 7: Amounts paid by card in electronic transactions



Self-made with data from: Estructura de información (SIE, Banco de México).

The evolution of the payment instrument has rapidly changed over the years and it continues to change. In this rapidly changing environment, it is very surprising to see that the number of credit cards has remained relatively constant over time in Mexico and could imply that financial inclusion policies have failed to integrate a considerable portion of the population into the formal credit market over the years.

II. Related literature

The literature of credit card ownership and use that is relevant for this project is primarily empirical, not without noticing that theoretical research on this matter is also plentiful and often contains analysis of other means of payment such as a debit cards or checks. Although research on the matter is mainly empirical, there is very limited data available to study payment instruments in Mexico, which constraints possible research on the topic. In this section I will review some articles that have studied the credit card market in Mexico using data from ENIGH in previous years, their approaches and main findings. I decided to focus on this sort of literature since ENIGH is one of the most reliable sources of consumer credit information available in Mexico.

First, Cerda and Negrín (2002)¹³ use data from ENIGH 1994-2000 to characterise the quality of bank credit card users. They find that the proportion of households that had not yet used a credit card but whose credit rating was high, according to their income, education and other sociodemographic characteristics, grew in the reference period. This might have to do, however with the characteristics of the period analysed, since it includes a large financial crisis.

Second, Castellanos and Garrido (2010)¹⁴ analyse the data of credit card holding and usage in Mexico with ENIGH 2006 and through a sample selection model. The main findings are that some features of the household, such as income, head's education level and ownership of assets are related with the decision of having a credit card. They also find a positive effect of POS terminals in the acquisition and expenditure decisions, which they interpret as evidence in favour of the two-sided model of credit cards and implies that the use of credit cards would be fostered further if the POS network is expanded. The authors also highlight the importance of having more and better data regarding financial instruments, such as credit cards, at the individual level to improve research on the topic and make better policy recommendations since this instrument is provided to one specific person and not to whole households.

Third, Abundis López (2013)¹⁵ analyses the effect of consumption credit in the capability of Mexican families to increase their expenditure on goods and services. In order to do so, the author estimates the marginal propensities to consume of households with and

¹³ Negrin and Cerda, *Evolucion de la calidad de los usuarios de tarjetas de credito en Mexico*.

¹⁴ Castellanos and Garrido, 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'.

¹⁵ Abundis López, 'El crédito al consumo en México y sus efectos en el ingreso de los hogares (2000-2010)'.

without consumption credit per income decile using data from ENIGH 2010. He finds that consumer credit alleviates the liquidity constraints of the poorest deciles and increases their marginal propensity to consume. This phenomenon is also discussed in Castellanos and Garrido since credit cards are a financial instrument that allow households to expand their expenditure frontier.

The most recent study of the credit card market using data from ENIGH is from Santiago-Ayala and Ceballos-Mina (2019)¹⁶. This article analyses the effects of credit card possession on the structure and distribution of spending by Mexican families in with data of 2016. The authors use a two-stage quantile regression approach to estimate the determinants of total household consumption and the effect of credit cards by type of expenditure (i.e. durable goods and health). Their main results are that credit cards have a positive effect on aggregate consumption, mainly driven by an increase of expenditure in health, clothing, communications and entertainment. Surprisingly, they find no significant effects on education or durable good spending, which is contrary to what was found in Castellanos and Garrido (2010). They also find that the effects of credit cards are greater in the upper part of the consumption distribution, meaning that credit cards as financial instruments do not help reduce the inequality gap. This finding could be due to the fact that the vast majority of poor households do not have access to the credit card market and when they do, they have to pay more expensive fees and interest rates than richer households.

The main difference between Santiago-Ayala and Ceballos-Mina (2019) and the present research is that the authors study the effects of credit card possession in the total household expenditure, whereas I am interested in studying card usage through credit card expenditure. Since a large part of the sample does not have a credit card, which translates into a lot of zeros in the data, a quantile regression is not the right econometric approach to address the decision of card use. The econometric design should first model the decision of cardholding and then model card usage.

In general, the empirical literature on consumer credit highlights the importance of controlling, for sociodemographic variables, human capital, income and wealth aspects of households. Additionally, all the articles mentioned above highlight the Mexican underbanking and the limited penetration of credit cards and other financial instruments to the poorest Mexican households. This literature review highlights the need to study what factors

¹⁶ Santiago-Ayala and Ceballos-Mina, ‘The Effects of Credit Cards on Consumption Structure and Inequality in Mexican Households | Revista Finanzas y Política Económica’.

affect the decision of the Mexican families to acquire a credit card in order to better understand the phenomenon and provide useful policy recommendations to financial authorities.

In the following sections I will analyse data from ENIGH in order to better understand the relationship between household characteristics and credit card acquisition, bearing in mind the model specifications of the articles described in this section.

III. Data description

The National Institute of Statistics and Geography (INEGI) is in charge of carrying out the National Survey of Household Income and Expenses (ENIGH, for its initials in Spanish). The main objective of this biannual survey is to collect detailed microdata of the amount, structure and distribution of household income and the destination of household expenses in durable and non-durable consumer goods. It also contains information on the housing infrastructure, family composition of households, as well as the economic activity of each of its members.¹⁷

Since 2002, the ENIGH incorporated into its questionnaire a series of questions aimed at identifying whether any of the people who live in the household had bank and/or commercial credit cards, as well as how much they spend with them in each good and service considered in the survey. In 2004, the survey had a second modification regarding this issue, when asking households which financial or commercial institution had granted them credit cards. However, the expense register maintained its aggregation in terms of the type of card (bank and commercial), which limits the precision with which the patterns of use of these instruments can be studied.

Although this new information makes the ENIGH an important source of data to carry out empirical studies of the possession and use of credit cards, it is worth highlighting that a major flaw of the survey, for the purpose of the present research, is that it doesn't allow the identification of the cardholder within the household. This is an important limitation since banks use characteristics of individuals and not of households to decide whether or not they are credit subjects. Another reason why this is a limitation is that, since the data structure includes card acquisition per household and not household member, we cannot compute comparisons of card acquisition by individual characteristics (such as sex) within the same household. Therefore, a possible improvement to the ENIGH questionnaire would be to request the cardholder's details or, at least, the relation of the cardholder to the head of the household. This claim was also highlighted in Castellanos and Garrido (2010), although the ENIGH 2006 did ask respondents for the name of the bank or institution that issued the card and included some descriptive tables about the number of cards per bank and card usage

¹⁷ Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'.

indicators per bank.¹⁸ In order to mitigate this limitation, I will assume that the head of the household is the cardholder.

In 2018, the card payments module was changed, affecting the data available with the survey. With the new series, we cannot distinguish between bank and commercial credit cards and we only have information on the amount paid by credit card in the reference period and the amount paid in the last quarter. In spite of these flaws, this dataset is the best suitable for this research since it contains detailed information of household expenses and the method of payment associated with the transaction, noting with regret that it does not distinguish between commercial credit card and bank credit card.

For the purpose of this research I will use the following modules of the survey:

1. “Hogares”, which includes information about inhabitants and domestic workers in the household, access to food for household members, household equipment, time to transfer to the hospital, household consumption habits and estimates of food and transportation spending. The observation unit of this module is the household.
2. “Población”, which includes sociodemographic characteristics of household members. The observation unit of this module is the individual, to make this module compatible with the rest of the dataset, I considered information of the head of household.
3. “Gastoshogares”, which contains the monetary and non-monetary expenses that the household made in the reference period, as well as the estimate of the rent expenses. The observation unit of this module is the household.
4. “Gastotarjeta”, which includes household expenses that were covered by a bank and/or commercial credit card. The observation unit of this module is the household.
5. “Ingreso”, which includes information of income and capital returns from household members older than 12 years old. The observation unit of this module is the individual, to make this module compatible with the rest of the dataset, I considered income of the head of household.
6. “Trabajos”, which shows the activity condition of household members older than 12 years old and some occupational characteristics during the reference period. The observation unit of this module is the individual, to make this module compatible with the rest of the dataset, I considered characteristics of the head of household.

¹⁸ Castellanos and Garrido, ‘Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006’.

7. “concentradohogar”, which records the concentrated summary by household, income and expenses in every possible way. The observation unit of this module is the household.
8. Financial Inclusion Database of 2018¹⁹, which displays statistics at state and municipal levels, on access and use of financial services by banking institutions, cooperative savings and loan companies and popular financial companies. All these are based on the information registered in the regulatory reports by the entities subject to the supervision and regulation of the CNBV.

Additionally, Table 1 of the Appendix displays all the selected variables considered for this analysis.

Descriptive statistics

Information displayed in Table 1 describes some of the most important variables of the sample for the present analysis. Some important remarks are that these variables correspond to the head of household, with 18 years or more. We can see that only 26.5% of the sample (that is, 245747 observations) is a cardholder and only 7.9% of the sample has used a card in the reference period. The variables of expenditure are quantities spent in Mexican Pesos (MXN).

¹⁹ Comisión Nacional Bancaria y de Valores, ‘Bases de Datos de Inclusión Financiera’.

Table 1: Descriptive statistics of some relevant variables

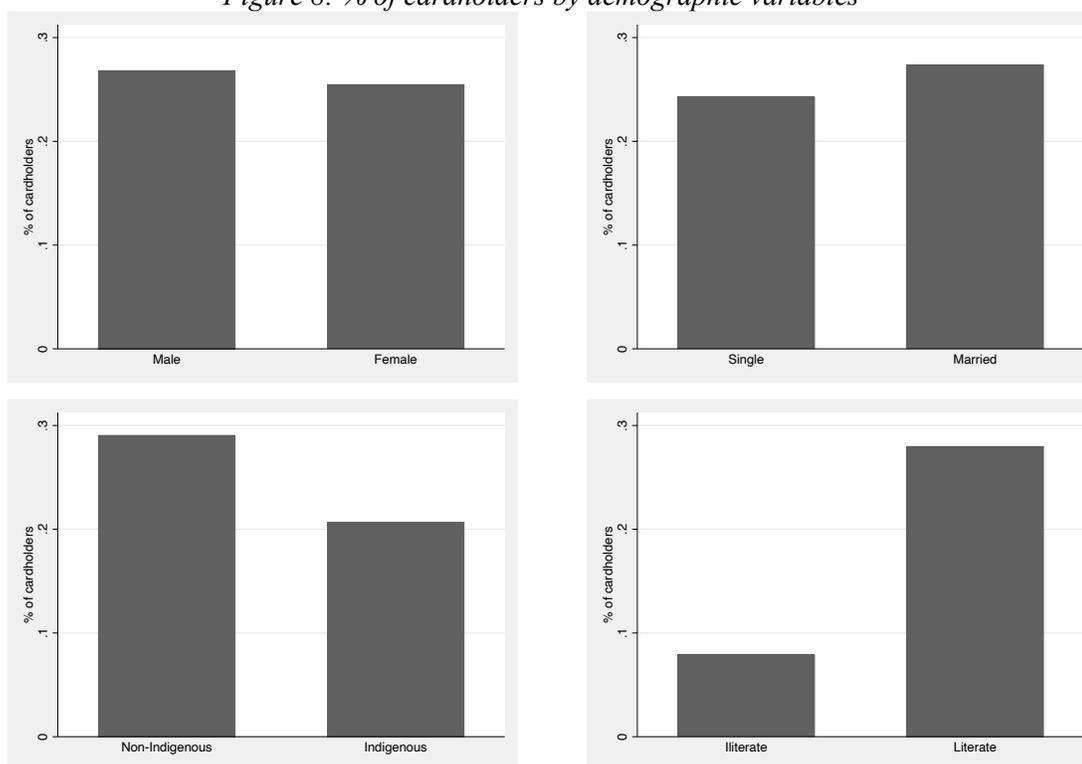
| Variables | Obs | Mean | Std.Dev. | Min | Max |
|--------------------|--------|----------|----------|-----|---------|
| card | 245747 | 0.265 | 0.441 | 0 | 1 |
| card_expen | 19552 | 4435.106 | 13743.59 | 10 | 595800 |
| card_expen_durable | 6002 | 7205.755 | 22377.47 | 20 | 595800 |
| card_expen_educ | 680 | 4770.488 | 7900.617 | 45 | 75200 |
| card_expen_food | 1296 | 2706.564 | 3699.107 | 29 | 80000 |
| card_expen_health | 568 | 4921.085 | 15097.29 | 10 | 250000 |
| card_expen_other | 9896 | 3161.549 | 6241.028 | 10 | 189000 |
| cardpay | 245747 | 0.079 | 0.27 | 0 | 1 |
| age | 245747 | 48.395 | 15.729 | 18 | 97 |
| age2 | 245747 | 2589.499 | 1657.829 | 324 | 9409 |
| atm | 247214 | 238.355 | 336.865 | 0 | 2208 |
| bank | 247214 | 48.138 | 65.518 | 0 | 346 |
| busi_posterminal | 247214 | 3225.604 | 4830.279 | 0 | 25683 |
| current_income | 245747 | 49700.34 | 76263.97 | 0 | 4500000 |
| elderly | 245747 | 0.268 | 0.569 | 0 | 5 |
| female | 245747 | 0.269 | 0.443 | 0 | 1 |
| internet | 245747 | 0.346 | 0.476 | 0 | 1 |
| mobile | 245747 | 0.868 | 0.339 | 0 | 1 |
| lcontract | 149011 | 0.515 | 0.5 | 0 | 1 |
| married | 245747 | 0.7 | 0.458 | 0 | 1 |
| members | 245747 | 3.604 | 1.804 | 1 | 22 |
| posterminal | 247214 | 4942.231 | 7431.548 | 0 | 40480 |
| rural | 245747 | 0.437 | 0.496 | 0 | 1 |
| self_employed | 205429 | 0.262 | 0.44 | 0 | 1 |
| young | 245747 | 0.792 | 1.011 | 0 | 11 |

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

In Figure 8-10, I compared the share of cardholders considering different sociodemographic variables, education level and household expenditure by education and card acquisition.

As shown in Figure 8, there seems to be a very short statistical difference between males and females when it comes to card acquisition. After running a t-test on this difference, I found that males tend to own cards 1.4% times more than females. Even though this is a relatively small difference, it still reflects some gender gap in card acquisition, especially if we recall this is only considering heads of households. Additionally, illiterate and indigenous people seem to be less likely to hold a card. This probably has to do with income and structural differences in access to public services such as education: typically, indigenous people in Mexico have lower levels of education attainment than non-indigenous people, which could also explain the differences in income, but that analysis goes beyond the scope of this research.

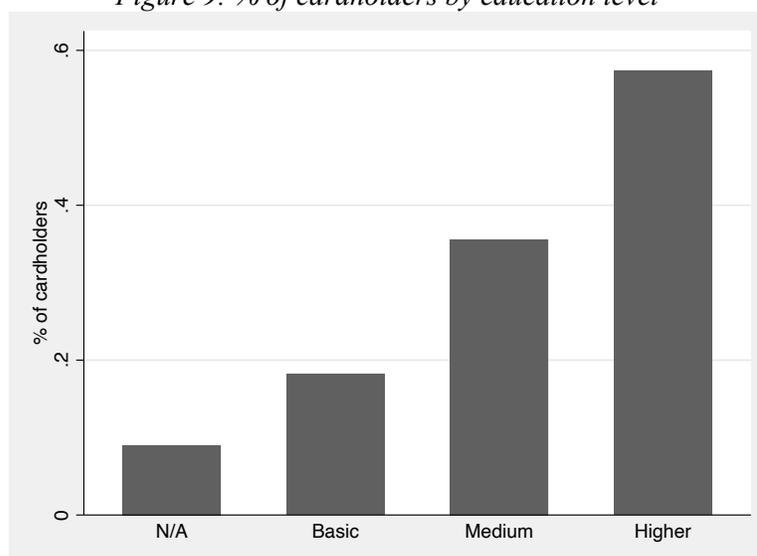
Figure 8: % of cardholders by demographic variables



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

As shown in Figure 9, the share of cardholders seems to increase with higher education levels. Moreover, Table 2 displays correlations between income, education, rural areas, ethnicity and literacy. We can see that income is positively correlated with education (as documented in an extensive literature), and that literacy is negatively correlated with being indigenous or living in a rural area. Additionally, we can see that indigenous and rural are positively correlated, this may be due to the fact that most indigenous people in Mexico live in rural areas. Also, rural is negatively correlated with education and literacy, this probably has to do with the under-provision of basic services, such as education, in rural areas. We can also see that, to some extent, education captures the effect of ethnicity and literacy, but they are not perfectly collinear.

Figure 9: % of cardholders by education level



Self-made with data from: Instituto Nacional de Estadística y Geografía, ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’; Comisión Nacional Bancaria y de Valores, ‘Bases de Datos de Inclusión Financiera’.

Table 2: Correlation matrix

| | current_income | educlevel | literacy | indi | rural |
|----------------|----------------|-----------|------------|----------|-------|
| current_income | 1 | | | | |
| educlevel | 0.292*** | 1 | | | |
| literacy | 0.0987*** | 0.389*** | 1 | | |
| indi | -0.0979*** | -0.136*** | -0.0981*** | 1 | |
| rural | -0.150*** | -0.338*** | -0.157*** | 0.128*** | 1 |

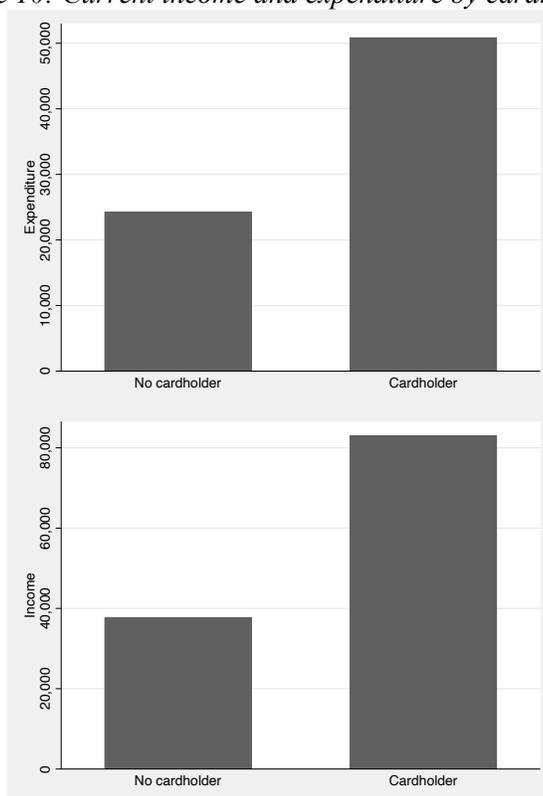
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Self-made with data from: Instituto Nacional de Estadística y Geografía, ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’; Comisión Nacional Bancaria y de Valores, ‘Bases de Datos de Inclusión Financiera’.

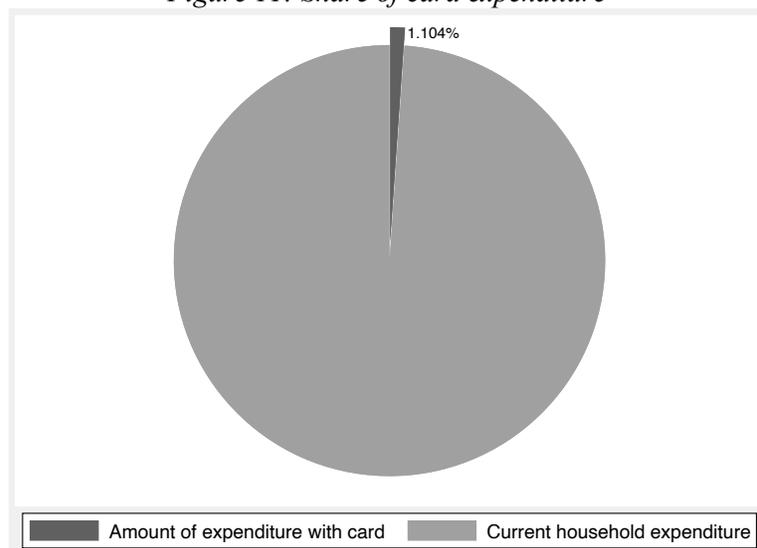
Figure 10 clearly shows that people with cards have higher income and higher expenditure. We could think that credit cards are, in fact, helping households to be less constraint with their expenditure. However, we cannot attribute higher expenditure only to card acquisition. Specially if we look at the share of card expenditure in overall expenditure in Figure 11, we can see that cards don’t seem to be a very important payment instrument for households.

Figure 10: Current income and expenditure by cardholders



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

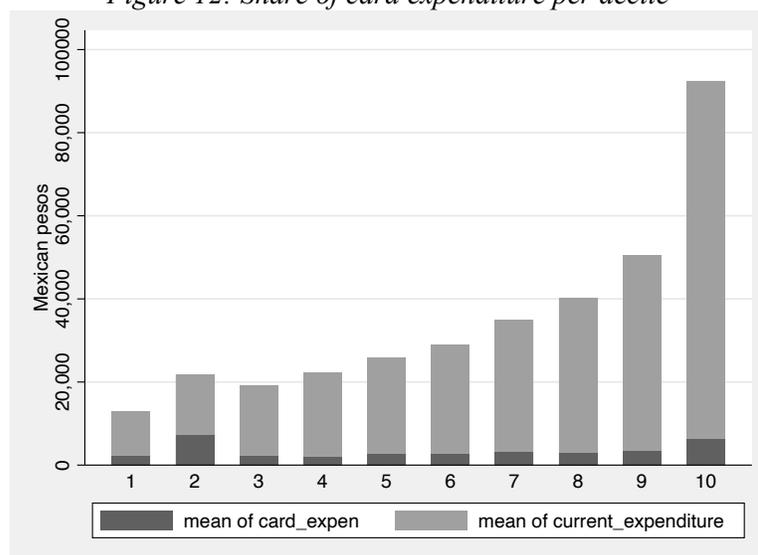
Figure 11: Share of card expenditure



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 12 displays the share of card expenditure per decile of household income, 1 being the poorest decile and 10 being the richest decile. In accordance to Figure 11, Figure 12 shows that card expenditure represents a tiny portion of overall household expenditure. However, we can see that card expenditure grows with income, noting that for the second decile, card expenditure is larger than all the other deciles of income. This may suggest that the second income decile is benefiting from the financial instrument of credit card, since it is allowing them to expand their consumption frontier.

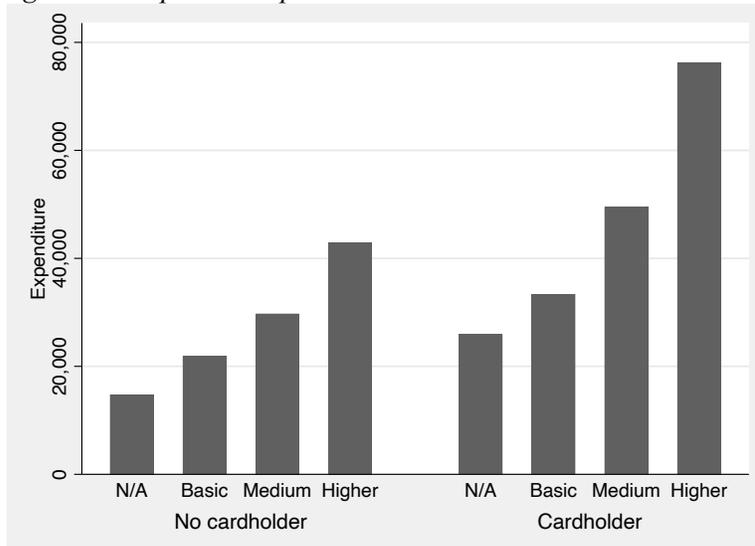
Figure 12: Share of card expenditure per decile



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

However, we can think that higher expenditure by families with cards is correlated with higher education, since more educated people tend to have more knowledge of financial instruments and payment methods. But, as shown in Figure 13, cardholders will have a higher expenditure than non-cardholders regardless of their education level. This might imply that income and education are capturing different effects on card usage. Also, if we consider that the correlation coefficient between income and education level, shown in Table 2, we can see that education and income are, in fact, correlated but not perfectly correlated. I will take this into consideration when estimating the two-stage model by not including both of these variables in the selection and outcome equations.

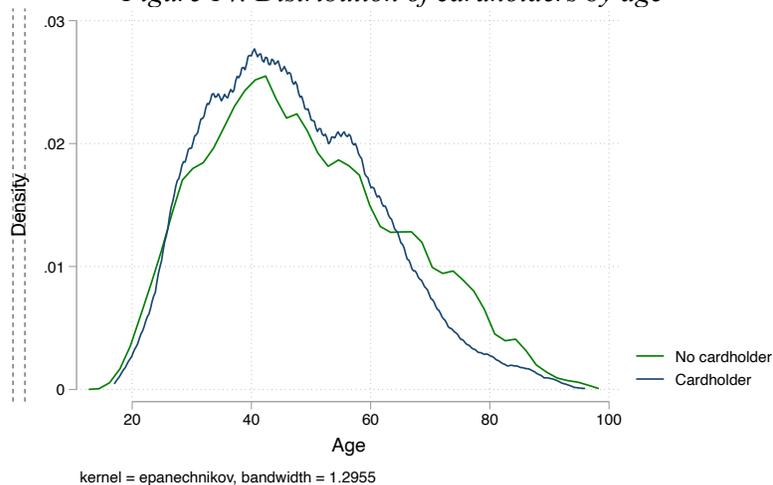
Figure 13: Expenditure per education level with and without card



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 14 presents the distribution of cardholders by age. We can see that there are more cardholders in productive ages, which is intuitive if we think that financial institutions normally restrict consumer credit to very young or very old people, or in other words, people that typically don't work for an income.

Figure 14: Distribution of cardholders by age

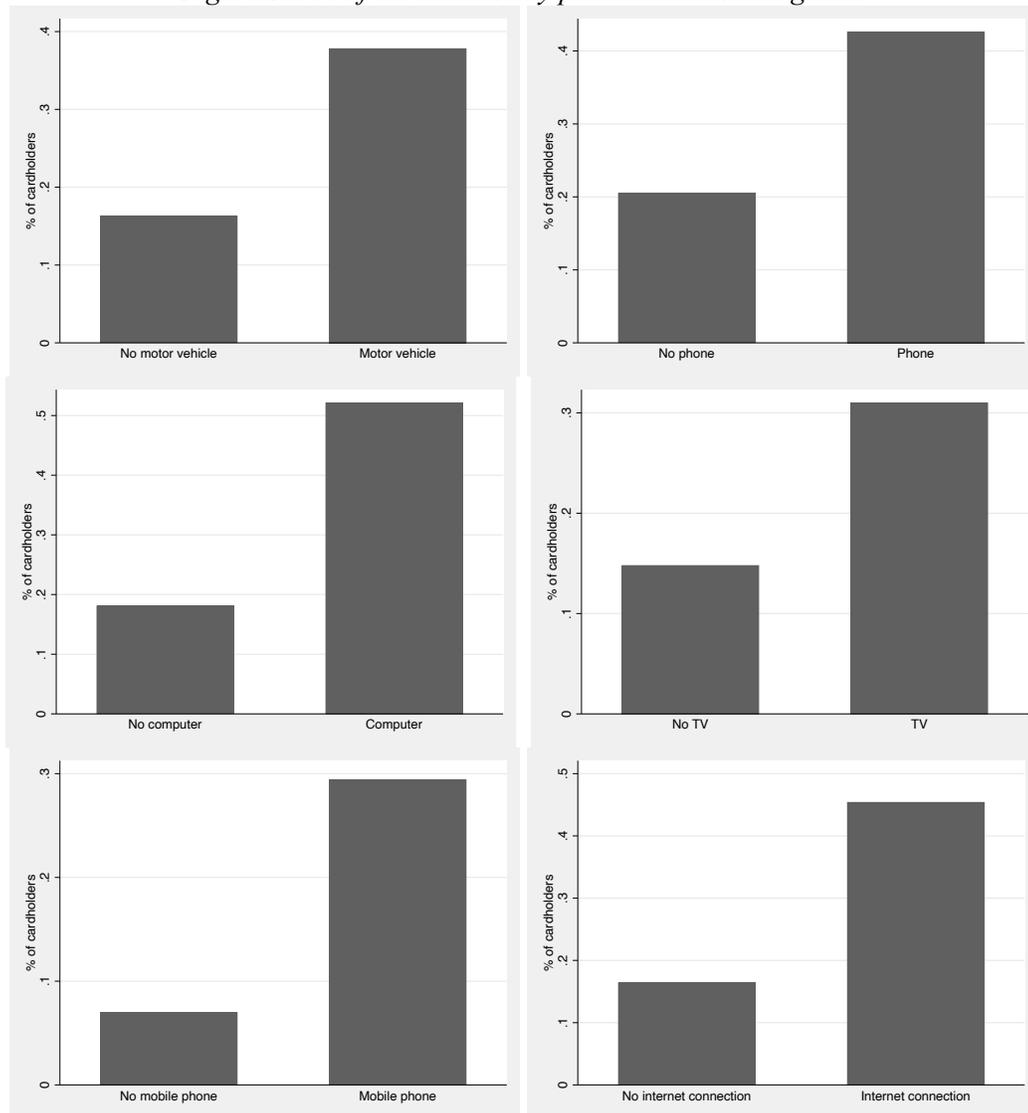


Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Some other remarks are worth highlighting. First, as shown in Figure 15, the possession of durable goods such as vehicles, computers and TV seem to be related to card acquisition. I believe this has to do with the fact that people that are more driven to modern technologies, are more driven to acquiring a card. Unlike stated in Castellanos and Garrido²⁰, banks don't usually require collateral to give credit cards, such as vehicles or other durable goods, in order to back up consumer credit, they focus primarily on stable income. Although these correlations seem interesting, I will not include these variables in the regression analysis since it makes no practical sense. As a matter of fact, and of verification, I consulted several commercial bank websites to verify that assets, such as vehicles, are not a requested in a credit card application form.

²⁰ Castellanos and Garrido, 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'.

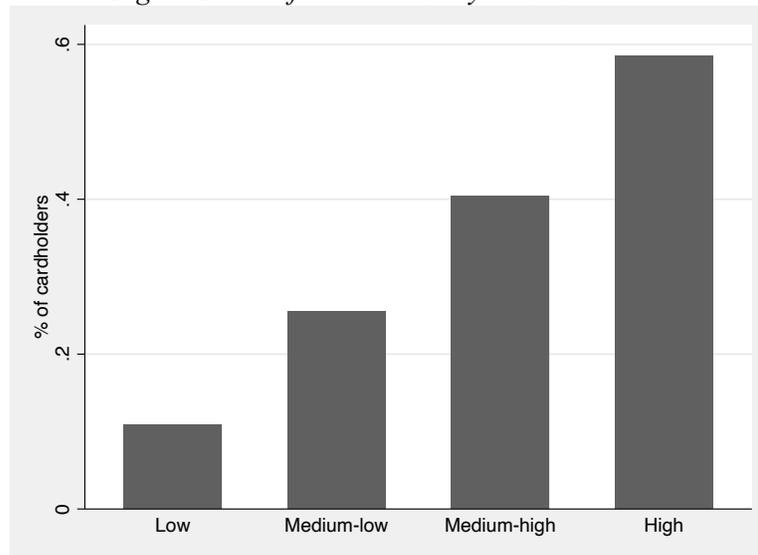
Figure 15: % of cardholders by possession durable goods



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

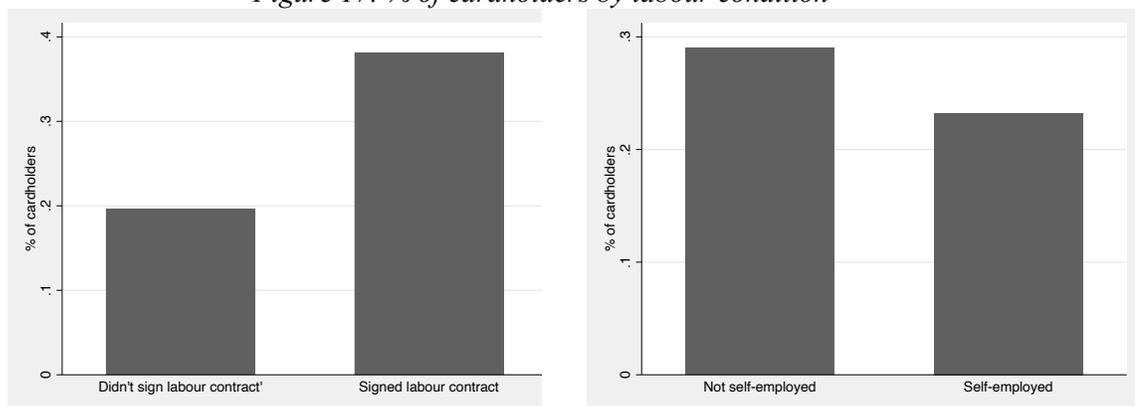
Second, as shown in Figure 16, economic level, defined in ENIGH as low, medium-low, medium-high and high, seems to be highly correlated with card acquisition, which makes a lot of sense if we consider that the higher the income it is more likely to be given consumer credit. However, income alone is not enough for most financial institutions to give out credit, they usually require proof of stable income. As shown in Figure 17, people with a labour contract are more likely to be cardholders than people without a contract and, at the same time, self-employed people tend to be less likely to own a card since it is usually considered a less secure type of employment.

Figure 16: % of cardholders by economic level



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

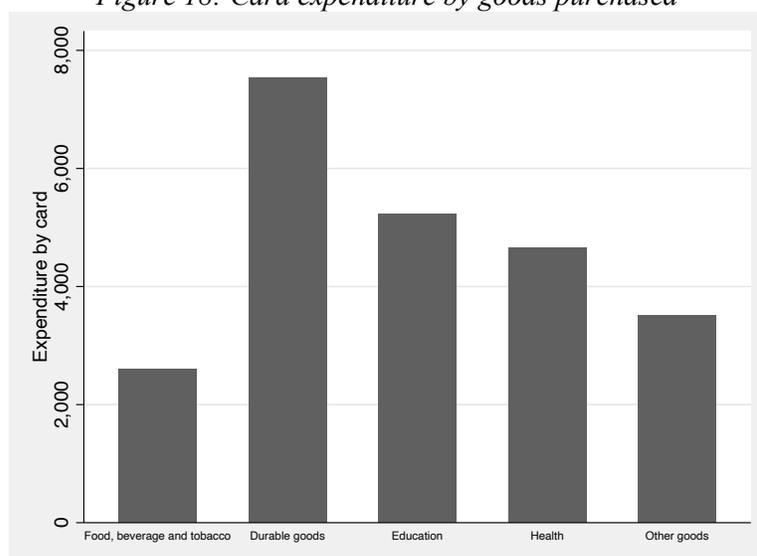
Figure 17: % of cardholders by labour condition



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

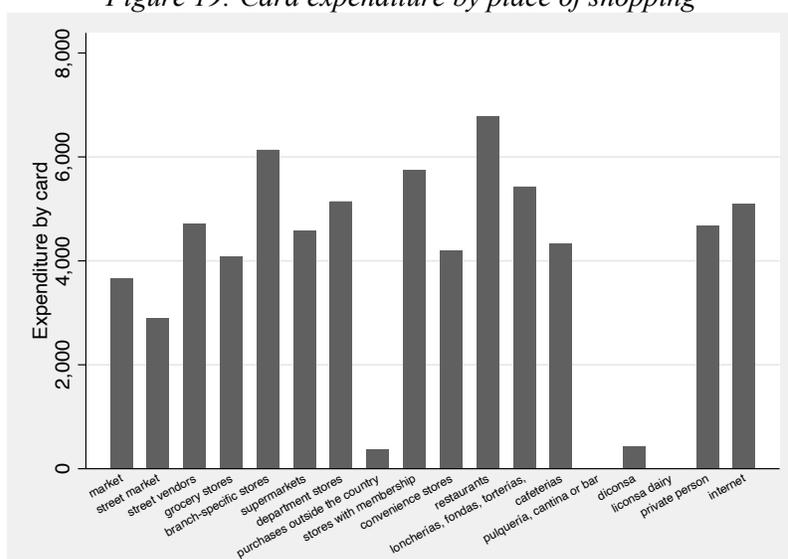
Third, as shown in Figure 18, households with card tend to spend more money on durable goods than human capital investments such as education and health. Additionally, as shown in Figure 19, the businesses with higher card expenditure are restaurants, branch-specific stores and membership stores (such as Sam's Club, Costco, and so on). Without considering restaurants, these establishments usually sell durable goods, which could explain that households with card spend more money on this sort of products. In order to confirm this assumption, let us look at Figures 20-23.

Figure 18: Card expenditure by goods purchased



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

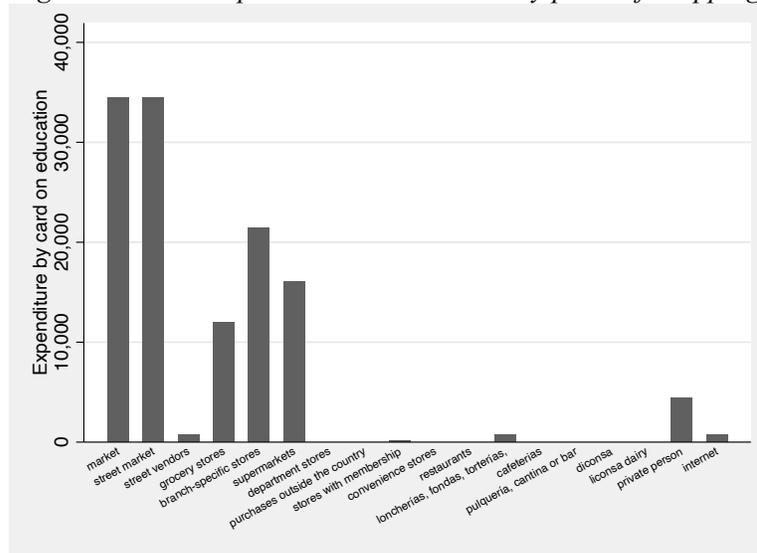
Figure 19: Card expenditure by place of shopping



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 20 shows the places where people shop for educational items with card. These items can go from pens and pencils to student books, backpacks and other school supplies. As shown in the figure, the most common places where people shop for these items are markets and street markets, followed by branch-specific stores and supermarkets.

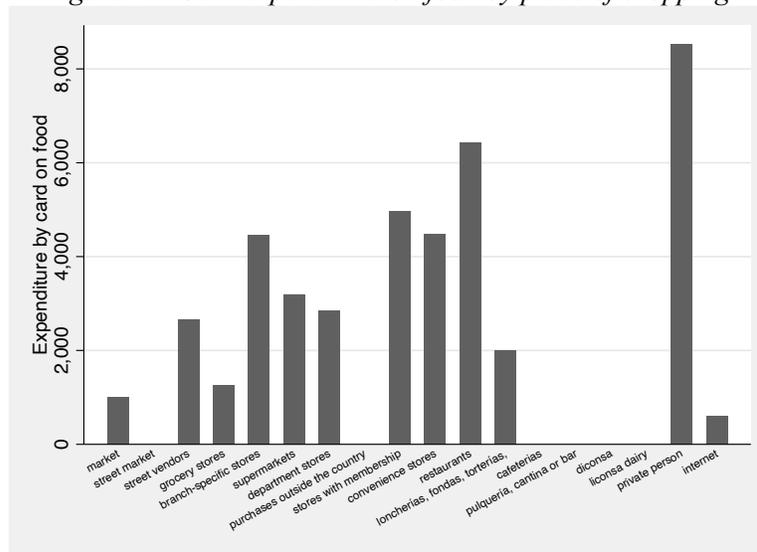
Figure 20: Card expenditure on education by place of shopping



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 21 shows credit card expenditure on food. We see that people shop for food in a broader range of establishments going from street vendors to department stores and restaurants. The only relatively odd relationship shown in this graph is the card expenditure on "private person", which might be reflecting a) informality or b) limitations of the existing data.

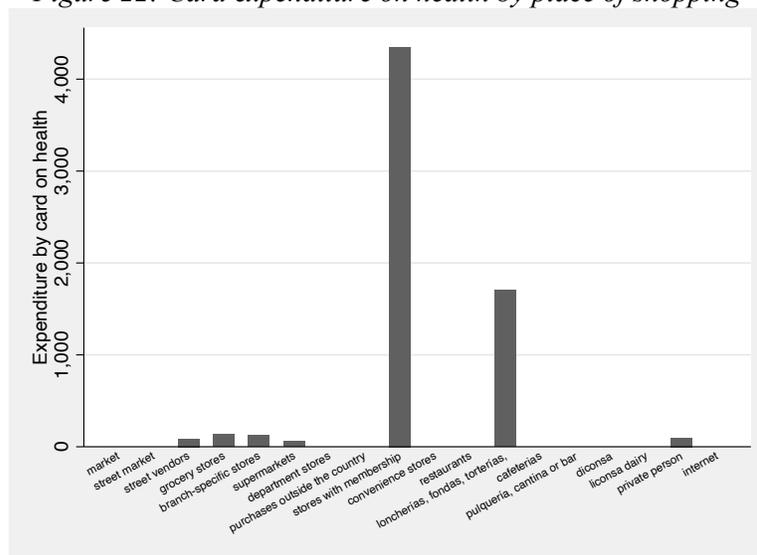
Figure 21: Card expenditure on food by place of shopping



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

As for health expenditure, Figure 22 shows that card expenditure on this category is majorly concentrated in stores with memberships, that could be pharmacies, and *loncherías*, which are typically family restaurants. Again, this can be a sign of either informality or bad quality data since *loncherías* don't usually sell medicines (not even prescription-free medicines).

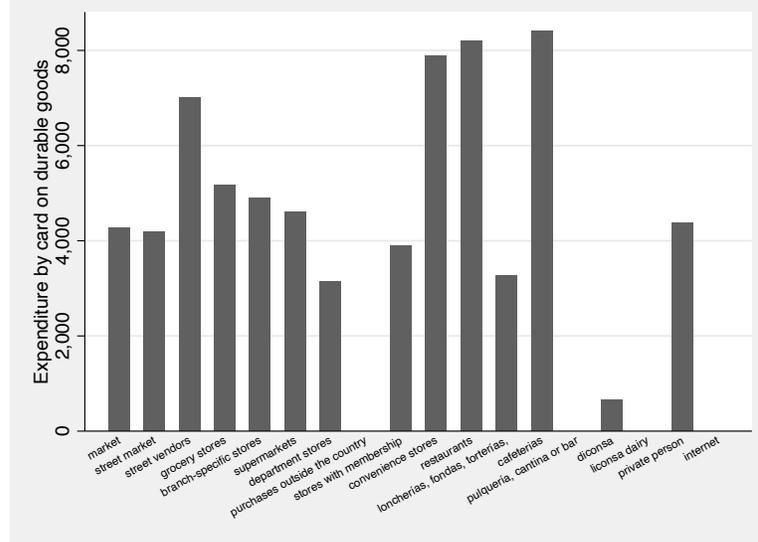
Figure 22: Card expenditure on health by place of shopping



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 23 shows card expenditure on durable goods by place of shopping. This graph shows the oddest of relationships since it suggests that most durable goods are bought in cafeterías and restaurants. The shopping behaviour shown in Figure 23 follows no economic intuition whatsoever and is another sign of high informality or problems with the data since people are not reporting correctly their shopping habits or the survey itself is not correctly designed to report credit card expenditure.

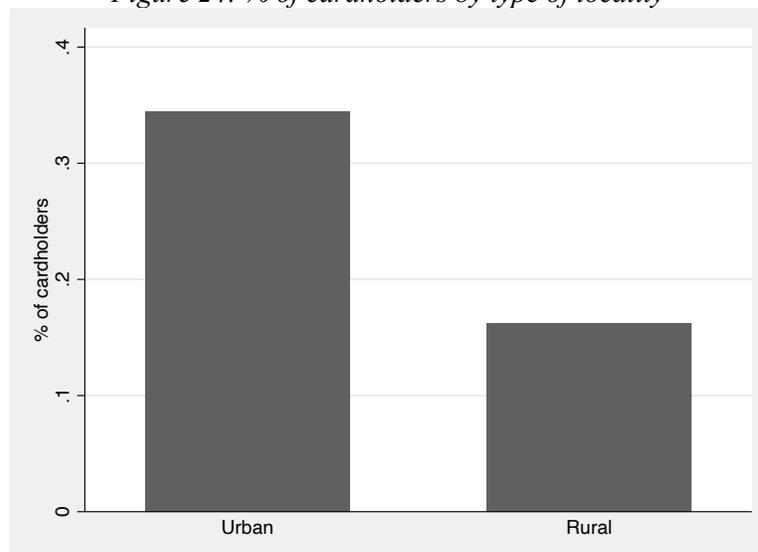
Figure 23: Card expenditure on durable goods by place of shopping



Self-made with data from: Instituto Nacional de Estadística y Geografía, ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’; Comisión Nacional Bancaria y de Valores, ‘Bases de Datos de Inclusión Financiera’.

I should now like to refer briefly to another aspect mentioned before, indigenous people tend to live in rural areas where they have less access to basic services, therefore we would expect to see that rural areas have less access to banking infrastructure. As seen in Figure 24, the share of cardholders in rural areas is significantly less than in urban areas. I suggest this is due to the lack of banking infrastructure in rural Mexico.

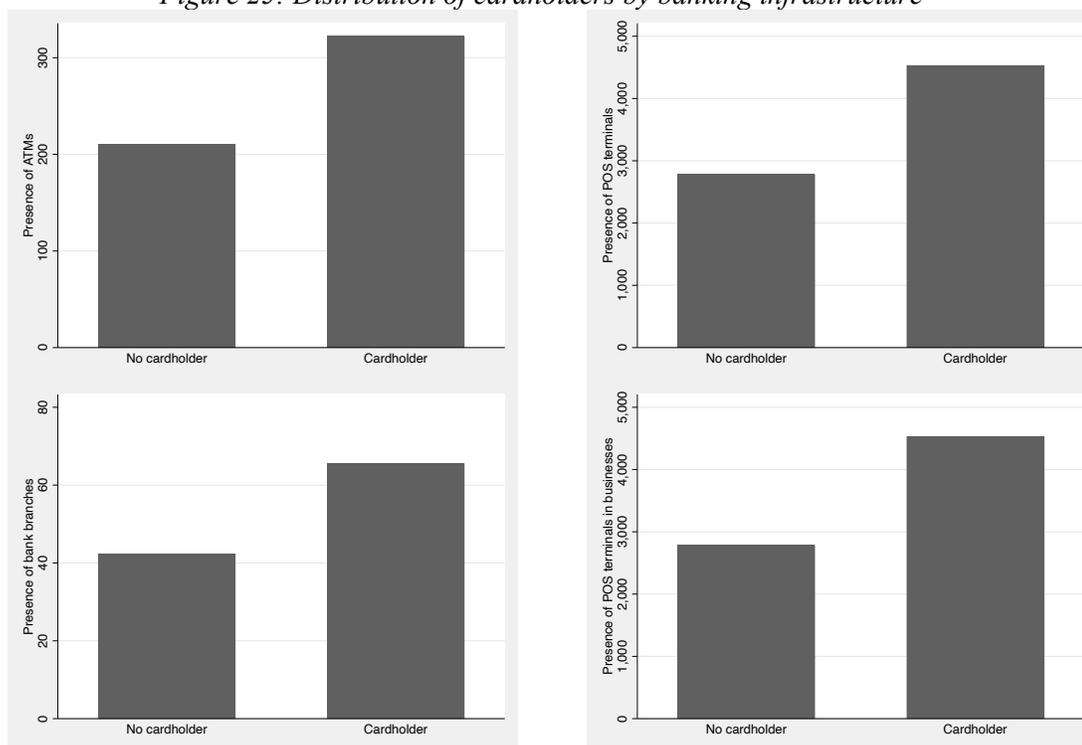
Figure 24: % of cardholders by type of locality



Self-made with data from: Instituto Nacional de Estadística y Geografía, ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’; Comisión Nacional Bancaria y de Valores, ‘Bases de Datos de Inclusión Financiera’.

In reference to banking infrastructure, Figure 25 shows card acquisition is correlated with banking infrastructure of the municipality, such as bank branches, ATMs, POS terminals and POS terminals in businesses.

Figure 25: Distribution of cardholders by banking infrastructure



Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

As a matter of fact, rural areas are negatively correlated to banking infrastructure as shown in Table 3. This is particularly important to note, especially for banking authorities, because without infrastructure people in living in rural areas are almost excluded from financial services and products such as credit cards. In fact, the recently created Bank of Wellbeing (Banco del Bienestar, a government bank) is looking forward to building 2,700 bank branches in 1,877 municipalities (out of 2,458 that exist in the country) that don't have access to this sort of banking infrastructure.²¹ Data of the CNBV in 2016, shows a difference with the claim of the Bank of Wellbeing: 1,221 municipalities didn't have access to bank branches (49.67% of municipalities), 1,038 municipalities didn't have access to ATMs (42.23% of municipalities) and 786 municipalities didn't have access to POS terminals

²¹ Banco del Bienestar and Secretaría del Trabajo y Previsión Social, 'Conferencias sobre Programas del Bienestar'.

(31.98% of municipalities. Additionally, the data shows that in 1,390 municipalities not a single bank account was registered (56.55% of municipalities). This doesn't mean that people living in these areas don't have a bank account, but that they have to go somewhere outside their municipality to get one.²² Regardless of differences in the data, both show that almost half of the municipalities in Mexico have an under-banking problem.

Table 3: Correlation matrix

| | rural | atm | bank | postterminal | busi_postterminal |
|-------------------|-----------|----------|----------|--------------|-------------------|
| rural | 1 | | | | |
| Atm | -0.238*** | 1 | | | |
| Bank | -0.275*** | 0.962*** | 1 | | |
| postterminal | -0.243*** | 0.924*** | 0.932*** | 1 | |
| busi_postterminal | -0.253*** | 0.931*** | 0.949*** | 0.974*** | 1 |

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Lastly, it is intuitive to think that the decision of people comes in two steps: first she decides to acquire a card and then she decides to use it (we could also think that a person would want to get a card because she is planning on using it). However, we can expect two things: first that people that don't own a card cannot purchase goods or services with cards and second, that people with cards decide to use them or not. Table 4 displays the decision of cardholders to use their cards or not. For reference, "cardpay" is a dummy variable that takes value 1 if the person reports to have used their card in the reference period. We see that over 95% of cardholders used their card in the reference period while 2% of cardholders decided not to use it in the reference period. This proportion of card usage should sum 100% and doesn't, which again could be manifesting problems with the data.

Table 4: Card payment of cardholders

| | Mean estimation | Number of obs = 245,853 | | |
|-----------------------|-----------------|-------------------------|----------------------|-----------|
| <i>c.card@cardpay</i> | Mean | Std.Err. | [95% Conf. Interval] | |
| No card payments | 0.2054988 | 0.0008492 | 0.2038344 | 0.2071631 |
| Paid by card | 0.9538533 | 0.0015049 | 0.9509038 | 0.9568028 |

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

²² Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

As mentioned before, we should expect that all card payments are carried out by cardholders, but Table 5 shows otherwise. The table reports that 0.5% of card payments were carried out by no-cardholders and that only 28% of card payments were carried out by cardholders.

Table 5: Card payment of cardholders

| <i>c.cardpay@card</i> | <i>Mean estimation</i> | | <i>Number of obs = 245,853</i> | |
|-----------------------|------------------------|-----------|--------------------------------|-----------|
| | Mean | Std.Err. | [95% Conf. Interval] | |
| <i>No cardholder</i> | 0.0049614 | 0.0001653 | 0.0046378 | 0.0052856 |
| <i>Cardholder</i> | 0.2849437 | 0.0017696 | 0.2814754 | 0.288412 |

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

These results arise great concern about the quality of the data. Especially considering that the data used form ENIGH is the most suitable data for studying the consumer side of credit card market in Mexico. These odd results should be an important indicator for statistic authorities that better data is needed to carry out better research on the topic.

IV. Specification of the empirical model

In this section I will propose an empirical model for estimating the effect that some relevant characteristics of the households described in the previous section would have on the probability that a household will acquire a credit card, as well as the amount spent with it. I assume that the household's decision regarding the amount spent with a credit card can be modelled in two stages in a selection model. In the first stage, the household decides whether or not to acquire a card as a mean of payment and, in the second stage, the household decides how much to spend with it.

I prefer a two-stage selection model over an Ordinary Least Squares (OLS) model since the latter has two problems given the characteristics of the data. First, OLS assumes the dependent variable is continuous. As mentioned before, only a restricted share of the sample is cardholder, providing with plenty of zeros in the card-expenditure variable and ruling out its continuity. Second, OLS assumes homoscedasticity and no correlation between observations, a priori and without any tests, I cannot rule out these assumptions, but it is very likely that they will not hold.²³

Bearing in mind these two aspects of the dataset, a more suitable approach would be that proposed by Heckman, which solves for self-selection problems. This type of model assumes that the discrete decision z and the continuous decision y (again two decisions) have a bivariate distribution with correlation ρ . It is estimated through two stages. In the first stage one needs to estimate a Probit model to model self-selection $Prob(z = 1) = \phi(w'\gamma)$. From this regression we obtain the Inverse Coefficient of Mills: $\hat{\lambda}(wy) = \frac{\varphi(w\hat{\gamma})}{\Phi(w\hat{\gamma})}$ and apply it into the second stage: $E[y|z = 1] = x'\beta + \rho\sigma\hat{\lambda}(w'\gamma)$.²⁴ The assumptions of this model are much more likely to hold since I have a dummy variable “card” to model the decision of households of acquiring a card and a continuous variable (after controlling for selection) of card-expenditure.

More formally, the estimation problem is represented by the following equations:

$$Y_{has\ credit\ card} = \begin{cases} 0 & \text{if } Y_{has\ credit\ card}^* \leq 0 \\ 1 & \text{if } Y_{has\ credit\ card}^* > 0 \end{cases}$$

²³ Cameron and Trivedi, *Microeconometrics Using Stata*.

²⁴ Cameron and Trivedi.

$$Y_{card\ expenditure} = \begin{cases} - & \text{if } Y_{has\ credit\ card}^* \leq 0 \\ 0 & \text{if } Y_{has\ credit\ card}^* > 0 \text{ and } Y_{card\ expenditure}^* \leq 0 \\ A & \text{if } Y_{has\ credit\ card}^* > 0 \text{ and } Y_{card\ expenditure}^* > 0 \end{cases}$$

$$Y_{has\ credit\ card}^* = X\beta_{has\ credit\ card} + \varepsilon_{has\ credit\ card}$$

$$Y_{card\ expenditure}^* = X\beta_{card\ expenditure} + \varepsilon_{card\ expenditure}$$

Note that some of explanatory variables that I will include in the selection and outcome equations overlap to some extent; that is, all variables that appear in the selection equation also appear in the outcome equation but not *vice versa*. The explanatory variables of this model can be found in Table 6. These variables come from either ENIGH or the Financial Inclusion Database. I chose the identificatory of municipality and locality in order to merge these datasets. Therefore, bank, atm and postterminal indicate the number of these establishments in locality of household_i.

The independent variables shown in Table 6 are all the variables that will be included in the first stage of the model, noting that they were chosen after considering correlation between explanatory variables, disregarding multicollinearity, and correlation with the dependent variable *card* considering only the relevant variables. An example of relevant variable that was left out of the model was *labour_contract*, since it was highly correlated with *self_employed*, but with less explanatory power. Correlation matrixes can be found in the appendix.

Table 6: Justification of variables of the model

| Dependent variables | Independent variables | Why? |
|----------------------------------|-----------------------|--|
| <i>card</i> <i>card_expen</i> | Age | To identify possible structural changes |
| | Atm | Control for municipality infrastructure |
| | Bank | Control for municipality infrastructure |
| | current_income | More income, more chances to be given credit |
| | educlevel | More educated people tend to know more about financial instruments such as credit cards |
| | female | To identify possible structural changes |
| | internet | Can be related to family preferences to electronic/modern infrastructure |
| | members | The number of family members can affect consumption patterns and need for liquidity/soften consumption |
| | postterminal | Control for municipality infrastructure |
| | self_employed | Not a very stable job (most often), less likely to be given credit |
| | Married | Gender analysis |
| | Indi | Control for demographic characteristics |
| | rural | Control for locality development |
| | | <i>Self-made</i> |

Additionally, to the correlation analysis, I decided to run a naïve OLS estimation just to make sure that the variables were relevant even without considering the selection problem. As seen in Table 7, the effect of some relevant variables has the expected/intuitive sign regardless of controlling for the selection problem.

In the card acquisition equation, age has a negative coefficient, higher completed education increases the likelihood of acquiring a card and number of family members decreases the chances of acquiring a card. Also, current income has a positive sign and self-employment has a positive sign, which is counter-intuitive due to job security. Additionally, indigenous and rural are negative to card acquisition, which is a very expected relationship due to the socio-economic factors mentioned before in this text. As for the banking infrastructure, almost all variables have the expected sign in this naïve regression, except for number of bank branches. Hopefully the sign of self-employment and bank will be corrected after estimating the proper selection model.

For the card expenditure regression, most coefficients change signs, which is interesting because it could suggest that individuals are acquiring cards, but not using them. This claim is in the line of the descriptive statistics of the previous section, which showed that card expenditure is still very limited. We can also see this in the negative sign of ATM: it is intuitive that card expenditure decreases as the number of ATMs in the municipality increases since they are substitute payment methods. The latter suggests that credit cards are still weak in comparison to other payment methods.

Table 7: Naïve OLS estimations

| VARIABLES | (1) Naive OLS cardholder card | (2) Naive OLS card expenditure Logexpen |
|-------------------|-------------------------------------|---|
| Age | 0.00107*** (1.96e-05) | 0.0183*** (0.000234) |
| Age ² | -7.26e-06*** (2.01e-07) | -0.000144*** (2.44e-06) |
| Female | 0.0212*** (0.000134) | -0.0523*** (0.00116) |
| Married | 0.0365*** (0.000136) | 0.0359*** (0.00123) |
| Basic education | 0.0596*** (0.000212) | -0.351*** (0.00475) |
| Medium education | 0.176*** (0.000236) | -0.125*** (0.00476) |
| Higher education | 0.375*** (0.000242) | 0.0731*** (0.00476) |
| Household members | -0.00156*** (2.80e-05) | -0.0159*** (0.000332) |
| Indigenous | -0.0104*** (9.95e-05) | -0.154*** (0.00114) |
| Rural | -0.0653*** (0.000113) | 0.171*** (0.00180) |
| Income | 8.48e-07*** (5.06e-10) | 8.34e-07*** (1.95e-09) |
| Self-employed | 0.0139*** (0.000110) | 0.193*** (0.00102) |
| POS Terminals | 3.64e-06*** (1.20e-08) | 1.79e-05*** (7.41e-08) |
| ATMs | 0.000121*** (3.56e-07) | -0.000869*** (1.90e-06) |
| Bank | -0.000573*** (2.01e-06) | 0.00318*** (1.29e-05) |
| Constant | 0.0383*** (0.000500) | 6.889*** (0.00691) |
| Observations | 89,503,998 | 9,739,735 |
| R-squared | 0.191 | 0.109 |

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

I additionally ran some relevance tests and endogeneity tests and they show that all variables presented in the naïve OLS are relevant but endogenous, which supports the need for another econometric specification. In the following section I will present the results of the two-stage selection model and further discuss them.

V. Results

In this section I show the results from the estimation of a two-stage selection model that analyses what factors, such as household characteristics, influence the decision of households to carry out transactions with credit cards.

Table 8 displays the results of the first and second stages of the model. We can see that, similarly to the naïve regression estimated in the past section, age, education, household size, income and variables of banking infrastructure such as POS terminals and ATMs have the expected signs. Up to this point, results are coherent with those of Castellanos and Garrido.

Castellanos and Garrido find that females had a negative probability of acquiring a card, but once married this sex-effect was inverted. These results might answer to structural differences that affect women when pursuing financial inclusion. However, in Table 8, the female coefficient is positive, regardless of the marital status, which could imply that gender-equal policies could have attenuated the gender gap over the past twelve years. As a matter of fact, results from the ENIF²⁵ show that for localities under 15,000 inhabitants, the gender gap was reversed for credit card acquisition, therefore, my results are consistent with the data. However, it is also possible that some of the respondents of the survey, especially those who live in localities under 15,000 inhabitants, confuse credit cards with debit cards from social programmes such as “Prospera”. This problem could be mitigated by including information of the bank or institution that issued the credit card, as mentioned in a previous section of the text.

I will now comment on the variables that were not included in Castellanos and Garrido. First, we can see that the internet coefficient is positive and significative. This could be due to the fact that online shopping has become more common in recent years. Second, as expected, indigenous and rural have negative and significant signs. Being an indigenous person in Mexico, decreases your chances of acquiring a credit card by almost 6%, in comparison with non-indigenous people. Also, living in a rural locality decreases your chances of acquiring a credit card by 38%. These results are huge and could imply that, regardless the multiple interventions of financial authorities, there are still structural differences that won't allow all Mexicans the same access to basic financial instruments, such as credit cards.

The theory tells us that when the coefficient on the inverse Mills ratio (denoted as λ) is positive, it is said that “positive selection” has occurred, with “negative selection”

²⁵ Comisión Nacional Bancaria y de Valores, ‘Encuesta Nacional de Inclusión Financiera’.

otherwise. Positive selection means that, without the correction, the estimate of the coefficients would have been upward-biased, while negative selection results in a downward-biased estimate.²⁶ The value of $\text{Ath } \rho$ is negative, which implies that negative selection would happen. This is actually true if we compare the coefficients of Tables 7 and 8, the naïve coefficients are lower than the coefficients in Table 8.

Table 8: Estimation of the selection model

| VARIABLES | (1) | (2) | (3) |
|-------------------|----------------------------|------------------------------|-------------------------|
| | Selection equation card | Outcome equation logexpen | parameters |
| Age | 0.00752*** (0.000110) | | |
| Age ² | -8.10e-05*** (1.15e-06) | | |
| Female | 0.132*** (0.000665) | -0.0712*** (0.00101) | |
| Married | 0.187*** (0.000683) | | |
| Basic education | 0.137*** (0.00161) | | |
| Medium education | 0.417*** (0.00167) | | |
| Higher education | 1.002*** (0.00168) | | |
| Household members | -0.0596*** (0.000162) | -0.0102*** (0.000302) | |
| Indigenous | -0.0638*** (0.000544) | | |
| Rural | -0.372*** (0.000728) | | |
| Income | 7.42e-06*** (4.03e-09) | 5.53e-07*** (2.17e-09) | |
| Self-employed | 0.112*** (0.000584) | | |
| POS Terminals | 1.57e-05*** (4.99e-08) | 1.05e-05*** (7.55e-08) | |
| ATMs | 0.000572*** (1.44e-06) | -0.00100*** (1.87e-06) | |
| Bank | -0.00239*** (8.56e-06) | 0.00366*** (1.31e-05) | |
| Internet | | 0.0625*** (0.00110) | |
| Ath ρ | | | -0.357*** (0.000695) |
| Ln σ | | | 0.263*** (0.000259) |
| Constant | -2.277*** (0.00292) | 7.973*** (0.00203) | |
| Observations | 165,160 | 165,160 | 165,160 |

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

²⁶ Cameron and Trivedi, *Microeconometrics Using Stata*.

Table 9 shows the same selection model but per type of card expenditure. We can see that the outcome equations of type of card expenditure are relatively similar to the outcome equation of Table 8. The coefficient for number of household member changes from negative to positive in the food card expenditure. This agrees with the fact that households would have to increase their food expenditure as the family grows. Also, the POS terminal coefficient of the durable good expenditure and health expenditure equations turn negative. This is not intuitive from an economic perspective. These counterintuitive coefficients could be another manifestation of data limitation for the purpose of this research.

Table 9: Estimation of the selection model per type of expenditure

| VARIABLES | (1) | (2) | (3) |
|-------------------|------------------------------|---------------------------------------|--------------------------------|
| | Outcome equation Log food | Outcome equation Log durable goods | Outcome equation Log health |
| Female | -0.0717*** (0.00282) | -0.0573*** (0.00209) | 0.647*** (0.00691) |
| Household members | 0.166*** (0.000974) | -0.00191*** (0.000575) | -0.187*** (0.00188) |
| Income | 1.06e-07*** (6.99e-09) | 3.31e-07*** (6.11e-09) | 1.15e-06*** (1.15e-08) |
| POS Terminals | 2.78e-06*** (2.53e-07) | -2.20e-05*** (1.68e-07) | -1.40e-05*** (5.87e-07) |
| ATMs | -0.00100*** (7.31e-06) | -0.00143*** (3.67e-06) | 0.00191*** (1.66e-05) |
| Bank | 0.00457*** (4.52e-05) | 0.00731*** (2.60e-05) | -0.00529*** (9.91e-05) |
| Internet | 0.0723*** (0.00357) | -0.188*** (0.00223) | 2.009*** (0.00697) |
| Ath ρ | -0.920*** (0.00325) | -0.496*** (0.00167) | -0.0437*** (0.00496) |
| Ln σ | 0.121*** (0.00167) | 0.313*** (0.000694) | 0.391*** (0.00130) |
| Constant | 8.658*** (0.00875) | 9.435*** (0.00565) | 5.826*** (0.0210) |
| Observations | 150,012 | 153,937 | 149,408 |

Standard errors in parentheses

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

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 10 presents a post estimation relationship between card acquisition and card usage, as a corrected estimation of tables 4 and 5. In table 10 we can see that 13% of card payments are carried out by cardholders and that 0.4% of card payments were carried out by non-cardholders. The latter is smaller than the 0.5% reported in table 5, but still manifests con-

cerns with the quality of the data but suggests that the two-stage estimation partially mitigates some of the issues. We additionally see that 0.05% of cardholders didn't pay by card in the reference period.

Table 10: Post heckman estimation

| | Card payment | No card payment |
|---------|--------------|-----------------|
| Card | 0.1307569 | 0.0005439 |
| No card | 0.0041276 | 0.8645716 |

Number of obs = 165,160

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 16 in the appendix presents a variation of the selection model carried out in Castellanos and Garrido (2010)²⁷, which excludes the number of cars variable and the self-employment variable. I decided these two exclusions because the number of cars is not relevant for this analysis since, as mentioned section II of the text, banks do not ask about collateral for providing consumers with credit cards; and self-employment because this variable is collinear with labour contract. Table 17 of the appendix displays the main results of this article.

There are some minor changes in the coefficient signs. For instance, in Castellanos and Garrido (2010), the age coefficients are not significant in the selection equation, whereas in Table 16 age is negative and very significant, meaning that age has become a more relevant variable when acquiring a credit card. However, these results are contradicting my findings in Table 8 and counterintuitive, which could imply that the specification of the model in Table 16 is not very accurate. This could be also true for the POS-Terminal coefficient of the outcome equation, which turns negative. Additionally, the coefficient for basic education became positive, which means than nowadays, even basic education increases one's chances of acquiring a credit card, in comparison with people with no education. The most impressing change, and which I mentioned in the previous section, is that the female coefficient becomes positive.

Let us remember that Table 16 is partially replicating a methodology carried out with data of twelve years prior to the data I am using. Therefore, it is very surprising to note that, not much has changed, except for the fact that the most recent ENIGH data no longer allows to analyse bank credit cards vis a vis debit cards. As seen in Figure 1, the number of credit

²⁷ Castellanos and Garrido, 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'.

cards in the Mexican market has not changed a lot since 2006. A possible reason why my results are not very different from those in Castellanos and Garrido (2010) could be that the increase in the number of transactions with credit cards and their value is generated by users that already hold a credit card (intensive margin) and not an increase in the number of cardholders (extensive margin). Other possible explanations could have to do with the lack of financial education among the Mexican population or, as mentioned before in the text, the campaigns for the responsible use of credit cards conducted by CONDUSEF, which are often misinterpreted into avoid using a credit card altogether.

Moreover, some of the recommendations established in Castellanos and Garrido (2010) are still applicable today. For instance, we are still in need for more and better data and extending the POS terminals network could incentivise the acquisition and use of credit cards.

Conclusion

Throughout this research I've reviewed the evolution of the credit card market in Mexico with data from the CNBV and empirical research made with data from different versions of ENIGH. I have also described and confirmed the influence of socioeconomic and demographic factors, such as income, schooling, place of residence, ethnicity, formality in employment, as well as access to banking infrastructure such as bank branches, ATMs and POS terminals and internet access, in the acquisition and usage of credit cards.

I find that the credit card is a financial service that is still not accessible to every Mexican today and that factors such as literacy, ethnicity and living in a rural area can affect, if not determine, one's access to credit cards. Therefore, financial inclusion policies should be oriented to facilitating access of financial instruments, such as credit cards, to these marginalised groups. I also find, in accordance to what was found in Castellanos and Garrido (2010) that policies that seek to grow the network of POS terminals can have a positive effect on the number of cardholders and card usage. This might suggest that the Bank of Wellbeing should not only focus on building bank branches, as mentioned before in the text, but also promoting the access and use of financial services such as credit cards to rural localities with high levels of illiteracy and concentration of indigenous people, since these are highly correlated to low access to banking infrastructure.

However, further research that analyses the impact of the establishment of bank branches, POS terminals and other type of banking infrastructure in the usage of credit cards is needed to better understand this phenomenon. On the demand side, further research on why people acquire credit cards, what and where they use it for, would be essential in order to better design financial inclusion policies that answers to the specific needs of people who are typically excluded from the use of financial services.

Finally, I would like to stress the need for better data in order to carry out more and better research on the adoption of cards as a means of payment, particularly, and electronic means of payment, broadly. Although the information on credit cards collected by the ENIGH places this survey as an important source to carry out empirical studies of the possession and use of credit cards, there are still a lot of limitations in the survey. The first possible improvement of the survey that I can suggest is to collect data of each of the owners of a credit card within the household, since banks usually consider individual characteristics when providing consumer credit and not household characteristics. The second is to better identify purchases made with credit cards and other means of payment, since the data presents serious mistakes, at least for the purpose of this research, in this aspect. A possible way

to improve this is by allowing the people surveyed to carry out a shopping diary in which they specify the type of good or service purchased, the amount spent, and the payment instrument used in the transaction. The third possible improvement is to identify the bank or institution that issued the card in not to confuse credit cards with other sort of cards and to perhaps carry out competence analysis. Access to high-quality data is a necessary condition to carry out high-quality research that is helpful to provide policymakers with recommendations that better address today's issues.

Cited References

- Abundis López, Horacio. 'El crédito al consumo en México y sus efectos en el ingreso de los hogares (2000-2010)', 2013. <http://tesis.ipn.mx:8080/xmlui/handle/123456789/12076>.
- Banco de México. 'Indicadores Básicos de Tarjetas de Crédito'. México, 2018. <https://www.banxico.org.mx/publicaciones-y-prensa/rib-tarjetas-de-credito/%7BC58F409E-3116-F8E6-335A-5B4550115020%7D.pdf>.
- Banco del Bienestar, and Secretaría del Trabajo y Previsión Social. 'Conferencias sobre Programas del Bienestar'. gob.mx, 24 May 2020. <http://www.gob.mx/stps/articulos/banco-del-bienestar-conferencias-sobre-programas-del-bienestar>.
- Bank for International Settlements. 'Principios Aplicables a Las Infraestructuras Del Mercado Financiero'. International Organization of Securities Commissions, April 2012. https://www.bis.org/cpmi/publ/d101_es.pdf.
- Bátiz-Lazo, Bernardo. *El Nacimiento de La Tarjeta de Crédito Bancaria En México y España*. Bilbao: BBVA, Archivo Histórico, 2008-2018, 2017.
- Batiz-Lazo, Bernardo, and Gustavo Del Ángel Mobarak. 'The Dawn of the Plastic Jungle: The Introduction of the Credit Card in Europe and North America, 1950-1975'. Text. Hoover Institution. Accessed 28 August 2020. <https://www.hoover.org/research/dawn-plastic-jungle-introduction-credit-card-europe-and-north-america-1950-1975>.
- Cameron, Adrian Colin, and P. K. Trivedi. *Microeconometrics Using Stata*. Revised edition. College Station, Texas: Stata Press, 2010.
- Castellanos, Sara G., and Daniel Garrido. 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'. *Fondo de Cultura Económica*, 2010. <https://www.jstor.org/stable/20857243>.
- Centro de Estudios Espinosa Yglesias. 'Análisis Comparado Sobre La Crisis y Los Rescates Financieros de México (1995) y Los Estados Unidos (2008)'. *El Trimestre Económico*, 2010.
- Comisión Nacional Bancaria y de Valores. 'Bases de Datos de Inclusión Financiera'. gob.mx, 2018. <http://www.gob.mx/cnbv/acciones-y-programas/bases-de-datos-de-inclusion-financiera>.
- . 'Encuesta Nacional de Inclusión Financiera'. gob.mx, 2018. <http://www.gob.mx/cnbv/acciones-y-programas/medicion-de-inclusion-financiera>.

- Estructura de información (SIE, Banco de México). ‘Monto Operado a Través de Tarjetas’, 11 May 2020. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF888&locale=es>.
- . ‘Número de Operaciones Realizadas Con Tarjetas’, 11 May 2020. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF889&locale=es>.
- . ‘Número de Tarjetas de Crédito y Débito’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF256&locale=es>.
- . ‘Operaciones En TPV’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF268&locale=es>.
- . ‘Operaciones En TPV de Comercio Electrónico’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF621&locale=es>.
- Instituto Nacional de Estadística y Geografía. ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’. INEGI, 2019. <https://www.inegi.org.mx/programas/enigh/nc/2018/default.html#Microdatos>.
- Jallath, Eduardo, and José Luis Negrín. ‘Evolución y Estructura de Los Medios de Pago Distintos al Efectivo En México’. *Banco de México, Dirección General de Investigación Económica* Documento de Investigación No.2001-04 (August 2001).
- Negrin, José Luis, and Clara de la Cerda. *Evolucion de la calidad de los usuarios de tarjetas de credito en Mexico: un enfoque microeconomico*. México, DF, 2002.
- Santiago-Ayala, Luis Enrique, and Owen Eli Ceballos-Mina. ‘The Effects of Credit Cards on Consumption Structure and Inequality in Mexican Households | Revista Finanzas y Política Económica’. *Revista Finanzas y Política Económica*, 2019. <https://revfinypolecon.ucatolica.edu.co/article/view/2262>.
- Secretaría de Hacienda y Crédito. ‘Historia de la tarjeta de crédito’. *gob.mx*, 2018. <http://www.gob.mx/shcp/es/articulos/quieres-conocer-la-historia-de-la-tarjeta-de-credito?idiom=es>.

Access to datasets

Comisión Nacional Bancaria y de Valores. ‘Bases de Datos de Inclusión Financiera’. gov.mx, 2018. <http://www.gob.mx/cnbv/acciones-y-programas/bases-de-datos-de-inclusion-financiera>

Estructura de información (SIE, Banco de México). ‘Monto Operado a Través de Tarjetas’, 11 May 2020. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF888&locale=es>

———. ‘Número de Operaciones Realizadas Con Tarjetas’, 11 May 2020. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF889&locale=es>

———. ‘Número de Tarjetas de Crédito y Débito’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF256&locale=es>

———. ‘Operaciones En TPV’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF268&locale=es>

———. ‘Operaciones En TPV de Comercio Electrónico’, December 2019. <https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=21&accion=consultarCuadro&idCuadro=CF621&locale=es>

Instituto Nacional de Estadística y Geografía. ‘Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos’. INEGI, 2019. <https://www.inegi.org.mx/programas/enigh/nc/2018/default.html#Microdatos>.

Consulted References

- Banco de México. ‘Cronología de Los Sistemas de Pago’. Accessed 2 June 2020. <https://www.banxico.org.mx/sistemas-de-pago/cronologia-sistemas-pago-tran.html>.
- . ‘Informe Anual Sobre Las Estructuras de Los Mercados Financieros 2019’, 2020. <https://www.banxico.org.mx/publicaciones-y-prensa/informe-anual-sobre-las-infraestructuras-de-los-me/informes-infraestructuras-mer.html>.
- . ‘Informe Anual Sobre Las Infraestructuras de Los Mercados Financieros’. Banco de México, 2018. <https://www.banxico.org.mx/publicaciones-y-prensa/informe-anual-sobre-las-infraestructuras-de-los-me/%7B47E2C88D-F4B1-1D34-2913-8E25F249E6F1%7D.pdf>.
- . ‘Política y Funciones Del Banco de México Respecto a Las Infraestructuras de Los Mercados Financieros’. Banco de México, August 2016. <https://www.banxico.org.mx/sistemas-de-pago/d/%7B9ACA4DC8-2B96-8EB3-6FF3-F58DDFA3FE51%7D.pdf>.
- Batiz-Lazo, Bernardo, and Gustavo A. Del Angel. ‘The Ascent of Plastic Money: International Adoption of the Bank Credit Card, 1950–1975’. *Business History Review* 92, no. 3 (ed 2018): 509–33. <https://doi.org/10.1017/S0007680518000752>.
- Batiz-Lazo, Bernardo, and Gustavo Del Ángel Mobarak. ‘El Surgimiento de la Tarjeta de Crédito en México y España’. *FUNDEF*, no. 1 (April 2016). <https://www.fundef.mx/el-surgimiento-de-la-tarjeta-de-credito-en-mexico-y-espana/>.
- Batiz-Lazo, Bernardo, and Leonidas Efthymiou, eds. *The Book of Payments: Historical and Contemporary Views on the Cashless Society*. Palgrave Macmillan UK, 2016. <https://doi.org/10.1057/978-1-137-60231-2>.
- Bolt, Wilko, Nicole Jonker, and Corry van Renselaar. ‘Incentives at the Counter: An Empirical Analysis of Surcharging Card Payments and Payment Behaviour in the Netherlands’. *Journal of Banking & Finance*, New Contributions to Retail Payments: Conference at Norges Bank (Central Bank of Norway) 14–15 November 2008, 34, no. 8 (1 August 2010): 1738–44. <https://doi.org/10.1016/j.jbankfin.2009.09.008>.
- Bounie, David, Abel François, and Leo Van Hove. ‘Consumer Payment Preferences, Network Externalities and Merchant Card Acceptance: An Empirical Investigation’. *Springer Science+Business Media*, 2016. <https://doi.org/10.1007/s11151-016-9543-y>.

- . ‘Merchant Acceptance of Payment Cards: “Must Take” or “Wanna Take”?’ *Working Paper*, 14 March 2017.
- Brits, Hans, and Carlo Winder. ‘Payments Are No Free Lunch’. *Working Paper*, August 2005. <http://citescerx.ist.psu.edu/viewdoc/download?doi=10.1.1.477.2604&rep=rep1&type=pdf>.
- Comisión Federal de Competencia Económica. ‘Presentación, Discusión y, En Su Caso Aprobación de La Opinión Sobre La Iniciativa Con Proyecto de Decreto Por El Que Se Adicionan Diversas Disposiciones de La Ley Para La Transparencia y Ordenamiento de Los Servicios Financieros y de La Ley de Instituciones de Crédito En Materia de Comisiones Bancarias’. Comisión Federal de Competencia Económica, 21 November 2018. <https://www.cofece.mx/CFCResoluciones/docs/Opiniones/V90/0/4543419.pdf>.
- CONDUSEF. ‘Campaigns for Responsible Use of Credit Cards’, 2013. <https://www.condusef.gob.mx/Revista/index.php/credito-tarjeta?start=30>.
- Del Ángel Mobarak, Gustavo. ‘50 años de la tarjeta de crédito en México ¿Qué podemos aprender?’ *Arena Pública*, May 2018. <https://www.arenapublica.com/blogs/gustavo-del-angel/2018/05/01/11346/tarjeta-de-credito-en-mexico-historia-de-50-anos>.
- . ‘Cashless Payments and the Persistence of Cash: Open Questions About Mexico’. Text. Hoover Institution. Accessed 28 August 2020. <https://www.hoover.org/research/cashless-payments-and-persistence-cash-open-questions-about-mexico>.
- Instituto Federal de las Telecomunicaciones. ‘USO DE LAS TIC Y ACTIVIDADES POR INTERNET EN MÉXICO: Impacto de Las Características Sociodemográficas de La Población’. Mexico, 2018. <http://www.ift.org.mx/sites/default/files/contenidogeneral/estadisticas/endutih2018.pdf>
- López Wayas, Marco Teddy. ‘Análisis de Los Créditos al Consumo Considerando Los Umbrales de Pobreza’. Universidad de Quintana Roo, 2018. <http://rasisbi.uqroo.mx/bitstream/handle/20.500.12249/1794/HG3755.2018-1794.pdf?sequence=3>.
- Morfín Maciel, Antonio, Naciones Unidas, Comisión Económica para América Latina y el Caribe, Unidad de Estudios del Desarrollo, and División de Desarrollo Económico. *Banca de desarrollo y el apoyo al acceso (México)*. Santiago de Chile: CEPAL, 2009.
- Ponce, Alejandro, Entique Seira, and Guillermo Zamarripa. ‘Borrowing on the Wrong Credit Card: Evidence from Mexico’. *Banco de México*, February 2014. <https://anterior.banxico.org.mx/publicaciones-y-discursos/publicaciones/documentos-de-investigacion/banxico/%7B64AE47DD-FE44-C00A-2444-8BEE0D0A5605%7D.pdf>.

- Seira, Enrique, Sara G. Castellanos, and Diego J. Jiménez Hernández. 'Bancarizing with Credit Cards: Experimental Evidence on Interest Rates and Minimum Payments Elasticities for New Clients'. *Banco de México*, June 2015. <https://anterior.banxico.org.mx/publicaciones-y-discursos/publicaciones/documentos-de-investigacion/banxico/%7B3BFB2BA0-1528-1586-3F46-F0E9ED4FAA38%7D.pdf>.
- Solano Márquez, María del Carmen, Lidia Valera Vega Valencia, and Luis Fernando Cárdenas Alba. 'Determinantes Del Uso de Tarjetas de Crédito En México. Reflexiones Sobre El Papel de La Cultura Financiera'. *Revista RAITES*, 2015. <http://itce-laya.edu.mx/ojs/index.php/raites/article/download/120/118>.
- Vielma Orozco, Edgar. 'La Bancarización En México'. INEGI, 2019. <https://www.telesemana.com/wp-content/uploads/2019/07/PresentacionInegi.pdf>.

Appendix

Table 11: List of variables of dataset

| VARIABLE | DESCRIPTION | TYPE OF VARIABLE |
|---------------------|--|------------------|
| AGE | Age | Categorical |
| AGE2 | Age squared | Continuous |
| ATM | Number of ATMs in municipality | Continuous |
| BANK | Number of Bank branches in municipality | Continuous |
| BUSI_POSTERMINAL | Number of ATMs in municipality | Continuous |
| CARD | Cardholder | Dummy |
| CARD_EXPEN | Amount of expenditure with card | Continuous |
| CARD_EXPEN_DURABLE | Card expenditure on durable goods | Continuous |
| CARD_EXPEN_EDUC | Card expenditure on education | Continuous |
| CARD_EXPEN_FOOD | Card expenditure on food | Continuous |
| CARD_EXPEN_HEALTH | Card expenditure on health | Continuous |
| CARD_EXPEN_OTHER | Card expenditure on other goods | Continuous |
| CARDPAY | Paid by card in last month | Dummy |
| CODE_CARD_EXPEN | Type of card expenditure | Categorical |
| COMPUTER | Owens computer | Dummy |
| CURRENT_EXPENDITURE | Current household expenditure | Continuous |
| CURRENT_INCOME | Current household income | Continuous |
| ECOLEVEL | Socio-economic level | Categorical |
| EDUCLEVEL | Education level | Categorical |
| ELDERLY | Total household members older than 65 | Continuous |
| FACTOR | Expansion factor | Continuous |
| FEMALE | Female | Dummy |
| FOLIOHOG | Household ID | Categorical |
| FOLIOVIV | House ID | Categorical |
| INDI | Indigenous | Dummy |
| INTERNET | Internet connection | Dummy |
| LCONTRACT | Labour contract | Dummy |
| LITERACY | Literacy | Dummy |
| LM_CARD_EXPEN | Last month's card expenditure | Continuous |
| MARRIED | Married indicator | Dummy |
| MEMBERS | Total household members | Continuous |
| MOBILE | Mobile phone | Dummy |
| MUNI | Municipality ID | Categorical |
| PAY_METHOD | Payment method | Categorical |
| PHONE | Telephone line | Dummy |
| PLACE | Shopping place | Categorical |
| POSTERMINAL | Number of Point-of-Sale Terminal in municipality | Continuous |

| | | |
|----------------------|---|------------|
| RURAL | Rural locality | Dummy |
| SELF_EMPLOYED | Self-employment | Dummy |
| STATE | State ID | Categoric |
| TELEVISION | Owens TV | Dummy |
| TOWNSIZE | Size of town | Categoric |
| TYPE_CONTRACT | Type of labour contract | Categoric |
| VEHICLE | Owens vehicle | Dummy |
| YOUNG | Total household members younger than 12 | Continuous |

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

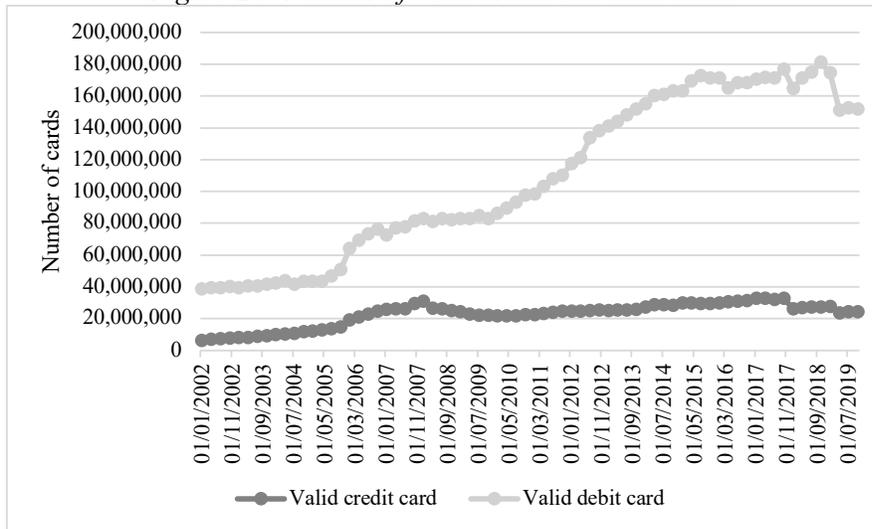
Table 12: Use of variables

| DEPENDENT VARIABLES | INDEPENDENT VARIABLES | WHY? | OTHER VARIABLES | WHY? |
|----------------------------|------------------------------|---|------------------------|-----------------------------------|
| CARD | age | To identify possible structural changes | factor | Factor of expansion of households |
| CARD_EXPEN | age2 | To identify possible structural changes | foliohog | Identification |
| CARD_EXPEN_DURABLE | atm | Control for municipality infrastructure | folioviv | Identification |
| CARD_EXPEN_EDUC | bank | Control for municipality infrastructure | muni | Identification |
| CARD_EXPEN_FOOD | busi_posterminal | Control for municipality infrastructure | state | Identification |
| CARD_EXPEN_GIFTS | computer | Can be related to family preferences to electronic/modern infrastructure | townsize | Identification |
| CARD_EXPEN_HEALTH | current_income | More income, more chances to be given credit | current_expenditure | Descriptive statistics |
| CARD_EXPEN_OTHER | ecolevel | More income, more chances to be given credit | lm_card_expen | Descriptive statistics |
| | educlevel | More educated people tend to know more about financial instruments such as credit cards | pay_method | Descriptive statistics |
| | elderly | The structure of family members can affect consumption patterns and need for liquidity/soften consumption | place | Descriptive statistics |
| | female | To identify possible structural changes | television | Descriptive statistics |
| | internet | Online shopping is mostly carried out by credit card | phone | Descriptive statistics |

| | | | | |
|--|---------------|---|-----------------|------------------------|
| | lcontract | Labour contracts can serve as guarantee that family has stable income to pay off their debts | fridge | Descriptive statistics |
| | members | The number of family members can affect consumption patterns and need for liquidity/soften consumption | electrodomestic | Descriptive statistics |
| | mobile | Can be related to family preferences to electronic/modern infrastructure | vehicle | Descriptive statistics |
| | postterminal | Control for municipality infrastructure | type_contract | Descriptive statistics |
| | rural | Control for municipality infrastructure | indi | Descriptive statistics |
| | self_employed | Not a very stable job (most often), less likely to be given credit | literacy | Descriptive statistics |
| | young | The structure of family members can affect consumption patterns and need for liquidity/soften consumption | cardpay | Descriptive statistics |
| | | | code_card_expen | Descriptive statistics |

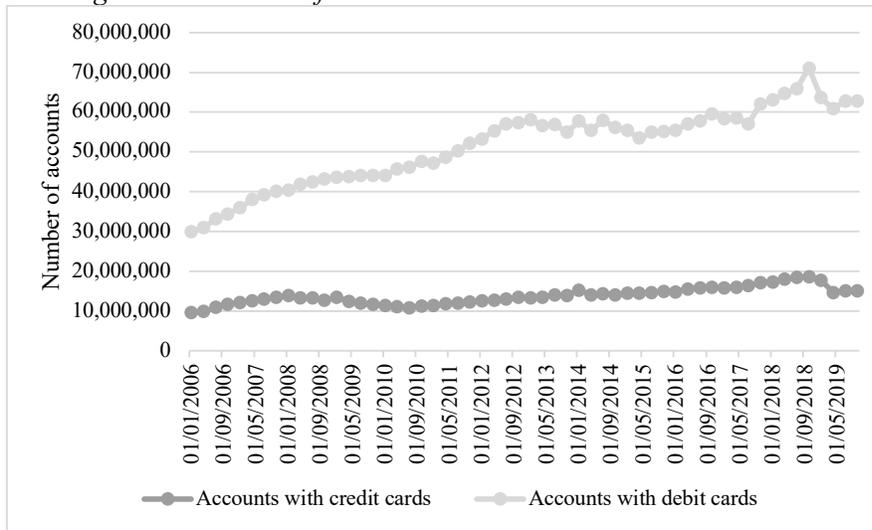
Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Figure 26: Number of valid credit and debit cards



Self-made with data from: Estructura de información (SIE, Banco de México), 'Número de Tarjetas de Crédito y Débito'.

Figure 27: Number of bank accounts with access to credit cards



Self-made with data from: Estructura de información (SIE, Banco de México), 'Número de Tarjetas de Crédito y Débito'.

Table 13: Correlation matrix of variables with card

| | card | age | age2 | female | married | educlevel | members | young | current_incom_e | lcontract | self_employe_d | postterminal | atm | bank | elderly | internet | mobile |
|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|-----------|----------------|--------------|-----------|-----------|-----------|----------|--------|
| card | 1 | | | | | | | | | | | | | | | | |
| age | 0.0574*** | 1 | | | | | | | | | | | | | | | |
| age2 | 0.0679*** | 0.985*** | 1 | | | | | | | | | | | | | | |
| female | 0.0138*** | 0.114*** | 0.115*** | 1 | | | | | | | | | | | | | |
| married | 0.0323*** | -0.202*** | -0.213*** | -0.604*** | 1 | | | | | | | | | | | | |
| educlevel | 0.331*** | -0.291*** | -0.298*** | 0.0385*** | 0.0355*** | 1 | | | | | | | | | | | |
| members | -0.000662 | -0.140*** | -0.167*** | -0.156*** | 0.374*** | 0.0785*** | 1 | | | | | | | | | | |
| young | 0.0373*** | -0.376*** | -0.360*** | 0.0922*** | 0.228*** | 0.0137*** | 0.660*** | 1 | | | | | | | | | |
| current_incom_e | 0.263*** | 0.0121*** | 0.0294*** | 0.0445*** | 0.0698*** | 0.292*** | 0.0986*** | 0.0117*** | 1 | | | | | | | | |
| lcontract | 0.203*** | -0.126*** | -0.142*** | 0.00215 | 0.0188*** | 0.379*** | 0.0473*** | 0.0402*** | 0.188*** | 1 | | | | | | | |
| self_employed | 0.0615*** | 0.323*** | 0.334*** | 0.0527*** | 0.0344*** | -0.178*** | 0.0187*** | 0.0788*** | -0.0304*** | 0 | 1 | | | | | | |
| postterminal | 0.158*** | 0.0502*** | 0.0547*** | 0.0316*** | 0.0490*** | 0.216*** | 0.0489*** | 0.0462*** | 0.151*** | 0.186*** | -0.171*** | 1 | | | | | |
| atm | 0.147*** | 0.0493*** | 0.0546*** | 0.0294*** | 0.0437*** | 0.204*** | 0.0364*** | 0.0326*** | 0.142*** | 0.200*** | -0.186*** | 0.924*** | 1 | | | | |
| bank | 0.157*** | 0.0452*** | 0.0503*** | 0.0377*** | 0.0504*** | 0.223*** | 0.0413*** | 0.0415*** | 0.152*** | 0.197*** | -0.182*** | 0.932*** | 0.962*** | 1 | | | |
| elderly | 0.0687*** | 0.669*** | 0.724*** | 0.0274*** | 0.0626*** | -0.228*** | 0.0928*** | -0.207*** | -0.0469*** | 0.112*** | 0.246*** | 0.0547*** | 0.0540*** | 0.0500*** | 1 | | |
| internet | 0.313*** | 0.0507*** | 0.0711*** | 0.0193*** | 0.0243*** | 0.425*** | 0.0526*** | 0.0634*** | 0.285*** | 0.289*** | -0.0975*** | 0.240*** | 0.235*** | 0.249*** | 0.0806*** | 1 | |
| mobile | 0.172*** | -0.242*** | -0.264*** | 0.0301*** | 0.0992*** | 0.245*** | 0.144*** | 0.0741*** | 0.136*** | 0.138*** | -0.187*** | 0.120*** | 0.117*** | 0.121*** | -0.226*** | 0.205*** | 1 |

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 14: Correlation matrix of variables with card-expenditure

| | card_expen | age | age2 | female | married | educlevel | members | young | current_incom_e | lcontract | self_employe_d | postterminal | atm | bank | elderly | internet | mobile |
|-----------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|-----------|----------------|--------------|-----------|-----------|-----------|----------|--------|
| card_expen | 1 | | | | | | | | | | | | | | | | |
| age | 0.00938 | 1 | | | | | | | | | | | | | | | |
| age2 | 0.00453 | 0.985*** | 1 | | | | | | | | | | | | | | |
| female | -0.0128 | 0.114*** | 0.115*** | 1 | | | | | | | | | | | | | |
| married | -0.0154* | -0.202*** | -0.213*** | -0.604*** | 1 | | | | | | | | | | | | |
| educlevel | 0.0527*** | -0.291*** | -0.298*** | 0.0385*** | 0.0355*** | 1 | | | | | | | | | | | |
| members | 0.00139 | -0.140*** | -0.167*** | -0.156*** | 0.374*** | 0.0785*** | 1 | | | | | | | | | | |
| young | 0.00889 | -0.376*** | -0.360*** | 0.0922*** | 0.228*** | 0.0137*** | 0.660*** | 1 | | | | | | | | | |
| current_incom_e | 0.157*** | 0.0121*** | 0.0294*** | 0.0445*** | 0.0698*** | 0.292*** | 0.0986*** | 0.0117*** | 1 | | | | | | | | |
| lcontract | 0.00472 | -0.126*** | -0.142*** | 0.00215 | 0.0188*** | 0.379*** | 0.0473*** | 0.0402*** | 0.188*** | 1 | | | | | | | |
| self_employed | 0.0275*** | 0.323*** | 0.334*** | 0.0527*** | 0.0344*** | -0.178*** | 0.0187*** | 0.0788*** | -0.0304*** | 0 | 1 | | | | | | |
| postterminal | 0.0505*** | 0.0502*** | 0.0547*** | 0.0316*** | 0.0490*** | 0.216*** | 0.0489*** | 0.0462*** | 0.151*** | 0.186*** | -0.171*** | 1 | | | | | |
| atm | 0.0410*** | 0.0493*** | 0.0546*** | 0.0294*** | 0.0437*** | 0.204*** | 0.0364*** | 0.0326*** | 0.142*** | 0.200*** | -0.186*** | 0.924*** | 1 | | | | |
| bank | 0.0502*** | 0.0452*** | 0.0503*** | 0.0377*** | 0.0504*** | 0.223*** | 0.0413*** | 0.0415*** | 0.152*** | 0.197*** | -0.182*** | 0.932*** | 0.962*** | 1 | | | |
| elderly | -0.0188*** | 0.669*** | 0.724*** | 0.0274*** | 0.0626*** | -0.228*** | 0.0928*** | -0.207*** | -0.0469*** | 0.112*** | 0.246*** | 0.0547*** | 0.0540*** | 0.0500*** | 1 | | |
| internet | 0.0516*** | 0.0507*** | 0.0711*** | 0.0193*** | 0.0243*** | 0.425*** | 0.0526*** | 0.0634*** | 0.285*** | 0.289*** | -0.0975*** | 0.240*** | 0.235*** | 0.249*** | 0.0806*** | 1 | |
| mobile | 0.0209*** | -0.242*** | -0.264*** | 0.0301*** | 0.0992*** | 0.245*** | 0.144*** | 0.0741*** | 0.136*** | 0.138*** | -0.187*** | 0.120*** | 0.117*** | 0.121*** | -0.226*** | 0.205*** | 1 |

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 15: Post Heckman estimation

| Post heckman estimation | | Number of obs = 165,160 | | | |
|-------------------------|-----------------|-------------------------|-----------|-----|------|
| Variable | | Mean | Std. Dev. | Min | Max |
| No card | Card payment | 0.0041276 | 0.064114 | 0 | 1 |
| Card | No card payment | 0.0005439 | 0.0233161 | 0 | 1 |
| Card | Card payment | 0.1307569 | 0.3371343 | 0 | 1 |
| _weight | | 435.4259 | 482.2076 | 9 | 6727 |

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 16: Replica attempt of Castellanos and Garrido (2010)

| VARIABLES | (1) | (2) | (3) |
|-------------------|----------------------------|--------------------------------|-------------------------|
| | Selection equation card | Outcome equation card expen | parameters |
| Income | 9.34e-06*** (5.54e-09) | 0.0124*** (5.13e-05) | |
| POS Terminal | 1.86e-05*** (5.28e-08) | -0.0792*** (0.000493) | |
| Age | -0.00768*** (0.000135) | | |
| Age ² | 7.78e-05*** (1.47e-06) | | |
| Basic education | 0.502*** (0.00321) | | |
| Medium education | 0.721*** (0.00324) | | |
| Higher education | 1.356*** (0.00325) | | |
| Female | 0.223*** (0.000780) | | |
| Married | 0.179*** (0.000759) | | |
| Labour contract | 0.0179*** (0.000591) | | |
| Bank | -1.31e-06 (6.56e-06) | | |
| Household members | | -78.01*** (3.908) | |
| Ath ρ | | | -0.255*** (0.000647) |
| Ln σ | | | 9.676*** (0.000279) |
| Constant | -2.698*** (0.00432) | 8,792*** (23.43) | |
| Observations | 118,009 | 118,009 | 118,009 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Self-made with data from: Instituto Nacional de Estadística y Geografía, 'Encuesta Nacional de Ingresos y Gastos de Los Hogares 2018: Nueva Serie: Descripción de La Base de Datos'; Comisión Nacional Bancaria y de Valores, 'Bases de Datos de Inclusión Financiera'.

Table 17: Results from Castellanos and Garrido (2010)

| VARIABLE | (1) | | VARIABLE | (2) | |
|------------------|-----------------------|----------------------|---------------|---------------------|----------------------|
| | Selection equation | | | Outcome equation | |
| | BANK | COMMERCIAL | | BANK | COMMERCIAL |
| Income | 0.903*** (27.33) | 0.553*** (20.93) | Income | -262 (0.99) | 0.23 (1.58) |
| POS Terminals | 13.211*** (4.61) | 15.430*** (5.71) | POS terminals | 53.063*** (4.11) | 15.057 (1.30) |
| Age | -0.017 (1.36) | 0.009 (0.81) | #Credit card | 0.882*** (6.91) | 0.669*** (5.03) |
| >30 | -0.025 (1.60) | -0.015 (1.08) | Members | -0.138** (2.42) | -0.081* (1.83) |
| >45 | 0.0005 (0.67) | -0.002 (0.23) | Constant | 7.762** (2.44) | 0.113 (0.07) |
| >60 | -0.001 (0.08) | -0.008 (1.03) | | | |
| Basic education | -0.302*** (5.54) | -0.245*** (3.07) | | | |
| Medium education | 0.197*** (3.88) | 0.243*** (5.60) | | | |
| Higher education | 0.465*** (9.32) | -0.023 (0.45) | | | |
| Female | -0.017 (0.32) | -0.161*** (3-23) | | | |
| Married | -0.081 (1.60) | 0.133*** (2.63) | | | |
| Number of cars | 0.345*** (8.28) | 0.229*** (5.98) | | | |
| Labour Contract | 0.159*** (3.98) | 0.253*** (6.42) | | | |
| Self-employed | -0.032 (0.60) | -0.044 (1.00) | | | |
| Bank | 0.316*** (3-97) | 0.415*** (5.72) | | | |
| Constant | -11.081*** (21.96) | -7.338*** (17.85) | PARAMETERS | | |
| | | | Ath ρ | -0.657*** (7.93) | -0.153** (2.43) |
| | | | Ln σ | 1.436*** (54-75) | 1.276*** (132.14) |
| | | | Observations | 20875 | 20875 |

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Copied from: Castellanos and Garrido, 'Tenencia y Uso de Tarjetas de Crédito En México: Un Análisis de Los Datos de La Encuesta Nacional de Ingresos y Gastos de Los Hogares 2006'.