# Towards a cashless economy: The case of Argentina.*

Pedro Elosegui† and Santiago Pinto‡

July 17, 2020

**Abstract**

This paper is part of a broader agenda and constitutes a first step to understanding, both theoretical and empirically, the constraints that several developing economies face in moving towards a cashless economy. We present a simple model of payment methods that includes the main determinants of the adoption of electronic payments in developing economies. The paper focuses in the case of Argentina. We use household data to empirically examine the factors underlying the use and adoption of credit cards in the years 2012 and 2017/18. In line with the model, the results show the importance of informality and network effects in driving such decisions. The model can be further generalized to include the use and adoption of other electronic payments mechanisms. The analysis performed in this paper is particularly useful to understand the impact of the Covid-19 shock, which has triggered the use of alternative electronic payment, challenging the widespread use of cash in the economy.

Keywords: Payment systems, Central Bank Research
JEL Classification: E0, E42.

[PRELIMINARY VERSION]

*We thank the helpful support of Emilio Sáenz.

†Central Bank of Argentina, Research Department. E-mail: pelosegui@bcra.gob.ar.

‡Federal Reserve Bank of Richmond, Research Department, Richmond, VA 23219, USA. E-mail: Santiago.Pinto@rich.frb.org. The views expressed herein are those of the authors and are not necessarily those of the Federal Reserve Bank of Richmond or the Federal Reserve System or the Central Bank of Argentina and its authorities.

# 1 Introduction

While the use of cashless alternatives (credit and debit cards, electronic funds transfers (EFTs), mobile banking (PSP)) has been increasing in Argentina, cash is still the main payment instrument used in everyday transactions. This is also true in most developed and developing economies. However, recent experiences, such as in India, for example, show that countries can move from cash to cashless economies. At least two reasons can explain this trend, the limited access to banking and financial services and the level of shadow or informal economy.

Means of payments are determined by both demand and supply factors. On the supply side, technology, regulation, cost of providing the service and taxes are the main determinants. The demand side determinants include demographic attributes, income, cost of the service, trust on the payment instrument (security) and safety concerns. The literature indicates that network effects may drive both the demand and supply of different payment systems: (i) the costs of providing a specific payment instrument may depend on the number of users; and (ii) at the same time, the benefits of a payment instrument may depend on the size of the network (network externalities). This is a two-side market, where both the merchant or seller and the consumer should be willing to adopt the payment instrument.

Retailers decide the set of payment instruments available to customers. Such decision depends, among other things, on the size of the merchant, the industry or sector where the merchant operates, regulation, taxes, and so on. Households, at the same time, decide which type of payment to use in their transactions. Their choice is driven by a variety of factors, including household income, the cost of each alternative, documentation required to open a bank account, and distance to banks, among others. Moreover, households may use different payment instruments depending on the characteristics of the transaction (see, for example, Bounie D. (2006)). Finally, many firms (usually small) and entrepreneurs from less developed marketplaces operate in the informal sector and have only limited access to financial services. The chances of developing their productive activities is much more limited in such environment.

Indeed, the implementation and adoption of different payments systems have different private and social costs as calculated by several studies (for instance, Schmiedel et al. (2012) and Krüger, Seitz (2014)). Moreover, evidence seems to suggest that the use of different means of payment along with its associated levels of financial inclusion (access to financial services) systematically vary across states and regions. The use of different means of payment also has implications on the ability of state and local governments to collect taxes. The latter is particularly relevant in Argentina, where the collection of the state turnover tax (“Ingresos Brutos" (IIBB)) on the specific payment method used in the transaction.

The present study attempts to examine the determinants of the observed forms of payments used in Argentina in order to quantify and understand the effects of moving towards a cashless economy. In this sense, the idea is to understand why the forms of payments vary across regions, and evaluate the impact of different policies on regional and aggregate economic outcomes.

Considering that the size of the informal sector and the choice of payment system are simultaneously determined, it is relevant to analyze and calibrate the policies that can possibly move the economy from a “bad" equilibrium (large informal sector and high use of cash) to a “good" equilibrium (small informal sector and high use of cashless alternatives). In fact, while incentivizing the use of credit cards, or other electronic means of payments may increase state tax revenue, it might have other negative consequences. For instance, they may end up adversely affecting low income households residing in subsistence (and informal) marketplaces (see Crouzet et al. (2019))

The study is relevant because an efficient payment system facilitates the exchange of goods and services in the economy. It is important to understand evaluate the advantages and disadvantages

of different forms of payments, particularly in developing economies. Argentina is an example of this type of economy, characterized by the presence of a large informal sector. In this environment, the availability and adoption of cashless forms of payments are limited. The outcome of the study is relevant, therefore, for the design of effective policies.

## 2 Literature Review

The literature on the topic has been increasing in the latest years, especially with applications to developing economies. Stavins (2017) summarizes the recent theoretical and empirical literature on consumer payment choice. The paper focuses on major demand and supply factors that drive the decision to adopt a specific payment system.

In the case of Mexico, Del Angel (2016) shows that even though the use of cashless alternatives has been rising, the use of cash still persists. The paper claims that a restricted access to financial services and a large informal economic sector explains such behavior. Jacolin et al. (2019) provides evidence suggesting that the adoption of mobile financial services decreases the size of the informal sector in developing economies in 2.4 to 4.3 percentage points of GDP. Ten Raa, Shestalova (2004) use Dutch payment data and estimate the cost of adopting different payment instruments.

The financial sector dimension of the constraints for going cashless has been extensively analyzed. For instance, Demirgüç-Kunt, Klapper (2013) measure financial inclusion using data from 143 countries. Their study finds that 50 percent of adults have formal bank account. However, "account penetration" varies across countries depending on their level of economic development and income. Barriers to account use are generally explained by the cost of opening and maintaining a bank account, distance to the closest bank, and documentation requirements. When deciding which payment instrument to use (cash, check, debit or credit card, etc.), consumers assess the costs and benefits of each alternative and decide the most beneficial one.

In the case of credit cards, consumers do not completely internalize the fact that paying goods and services by credit card entails merchant fees, higher retail prices, an income transfer from cash to card payers, and, as a result, a transfer from low- to high-income payers. Schuh et al. (2010) develop a simple theoretical framework of consumer payment choice and quantify the impact of using credit cards on consumer welfare. Finally, Bolt, Chakravorti (2008) develop a model that studies how bank and retailers can affect how households decide their payment instruments.

## 3 A Simple Model

The model described below is an extension of Arifovic et al. (2017). Consider an economy populated by a measure one of buyers, $b \in [0, 1]$, and a measure one of sellers, $s \in [0, 1]$. Sellers are endowed with one unit of good, and they don't derive utility from consuming the good. For simplicity, it is assumed that all sellers charge a price equal to one. Buyers are randomly match to sellers and derive a utility $v > 1$ from the consumption of the good.

In principle, two payment systems can be used to pay for the good: cash or credit card. While cash is universally accepted by all sellers, some of them may decide to accept credit cards as well.

At the beginning of the period, buyers decide whether to pay for the good with cash or card. They face a cost of $t_h^b$ per transaction when they pay with cash, and $t_d^b$ wen they with a credit card. It is assumed, however, that a proportion $(1 - \alpha)$ of the consumers are constrained to use cash only. Therefore, only a proportion $\alpha$ of the consumers can freely choose among the two payment

systems.[1]

At the same time, sellers decide whether to accept credit cards as a means of payment. To make the service available, sellers have to incur in a fixed cost $F > 0$. Also, sellers face a cost per transaction given by $t_h^s$ for cash transactions, and $t_d^s$ for credit card transactions. Following Arifovic et al. (2017), we assume that credit card transactions entail a lower cost per transaction than cash for both buyers and sellers: $t_d^b < t_h^b$ and $t_d^s < t_h^s$.[2]

Let $0 \leq m^s \leq 1$ denote the proportion of sellers that accept credit card payments, and $0 \leq m^b \leq \alpha \leq 1$ the proportion of buyers that choose to only carry a credit card to pay for each transaction.

### 3.1 Timing

1. Buyers decide whether to carry cash or a credit card. Sellers decide whether to accept credit cards or not. Cash is always accepted by all sellers.

2. Buyers are randomly matched with sellers. A transaction takes place, if the payment method chosen by buyers and sellers coincide. In this case, buyers receive $v - t_j^b$, where $j \in \{h, d\}$, and sellers $1 - t_h^s$ when buyers pay with cash, and $1 - t_d^s - F$ when buyers pay with a credit card. If payment methods do not coincide, no transaction takes place. In this case, consumers receive zero utility, and sellers receive zero utility if they decided not to adopt credit cards in the first stage, and $-F$ if they have adopted credit cards in the first stage.

### 3.2 Buyers

A proportion $(1 - \alpha)$ of buyers are credit-constrained and can only use cash to pay for the good. Consider, therefore, the decision of a representative buyer in the group of unconstrained buyers, a proportion $\alpha$ of the population. The level of $m^b$ chosen by buyers in this group maximizes the expected utility, which, in turn, depends on $m^s$.

Consider first the decision of buyer when $0 \leq m^s \leq m^b \leq \alpha$. The expected utility is given by

$$u^b = m^s(v - t_d^b) + (1 - m^b)(v - t_h^b). \tag{1}$$

When $m^s$ sellers accept $d$, and $m^b$ buyers choose $d$, only $m^s$ buyers are able to perform the transaction and receive $v - t_d^b$. The rest of the buyers that also hold a credit card, $(m^b - m^s)$ buyers, cannot buy the good, so they receive zero utility. Buyers that hold cash, $(1 - m^b)$ buyers, buy the good and obtain $v - t_h^b$.

Next, suppose that $0 \leq m^b \leq m^s \leq \alpha$. The expected utility is given by

$$u^b = m^b(v - t_d^b) + (1 - m^b)(v - t_h^b). \tag{2}$$

All buyers holding a credit card can The same expected utility holds when $0 \leq m^b \leq \alpha \leq m^s$. In other words,

$$u^b = Min\{m^s, m^b\}(v - t_d^b) + (1 - m^b)(v - t_h^b). \tag{3}$$

The maximum expected value is attained when $m^b = m^s$ for all $m^s$. Note, however, that $m^b \leq \alpha$.

[1] We assume for the moment that $(1 - \alpha)$ is exogenous. We will later relax this assumption and endogeneize the level of informality as well.

[2] We will later modify this assumption and consider different relationships between $t_d^s$ and $t_h^s$.

### 3.3 Sellers

The number of sellers that are willing to accept credit cards will depend on the difference between the expected utility of accepting cards and cash:

$$u_d^s - u_h^s \equiv \Delta(m^s, m^b) = \begin{cases} 1 - t_d^s - F - \frac{(1-m^b)}{(1-m^s)}(1 - t_h^s), & \text{if } m^b \geq m^s; \\ \frac{m^b}{m^s}(t_h^s - t_d^s) - F, & \text{if } m^b < m^s. \end{cases} \tag{4}$$

Note that $(\partial\Delta/\partial m^s) < 0$ (except at $m^s = m^b$, where the derivative is not defined). The number of sellers that accept credit cards, $m^s$ depends on $m^b$, and is implicitly determined by $\Delta(m^s, m^b) = 0$.

### 3.4 Equilibrium

**Definition.** An equilibrium is defined as a pair $\{m^b, m^s\}$ that satisfies:

1. Buyers choose the value of $m^b$ that maximizes the expected utility (3) (in other words, the number of buyers that accept credit cards is given by $m^b = m^s \leq \alpha$);
2. The number of sellers that accept credit cards is given $\Delta(m^s, m^b) = 0$, for a given $m^b$.

### 3.5 Characterization of the equilibrium

The model is characterized by the presence of multiple equilibria. While $\{m^b, m^s\} = \{0, 0\}$ is always an equilibrium, other equilibria will arise depending on the relative values of $t_h^s$, $t_d^s$, and $F$. Intuitively, when sellers decide to accept credit cards or not, they consider, among other things, the savings in transaction costs, determined by $(t_h^s - t_d^s)$, and the additional fixed costs associated with the provision of credit card services, $F$.

**(i)** $F \leq (t_h^s - t_d^s)$**.** When fixed costs are sufficiently low, specifically, when $F \leq \alpha(t_h^s - t_d^s)$, then $\{m^b, m^s\} = \{\alpha, 1\}$. This equilibrium is represented by point $E$ in Figure 1. When $\alpha(t_h^s - t_d^s) < F < (t_h^s - t_d^s)$, the equilibrium is given by $\{m^b, m^s\} = \{\alpha, \alpha(t_h^s - t_d^s)/F\}$. The values $M$ and $M'$ in the figure represent different levels of $F$. Specifically,

$$M = \frac{F}{(t_h^s - t_d^s)} < \frac{F'}{(t_h^s - t_d^s)} = M', \text{ where } F < \alpha(t_h^s - t_d^s) < F' < (t_h^s - t_d^s). \tag{5}$$

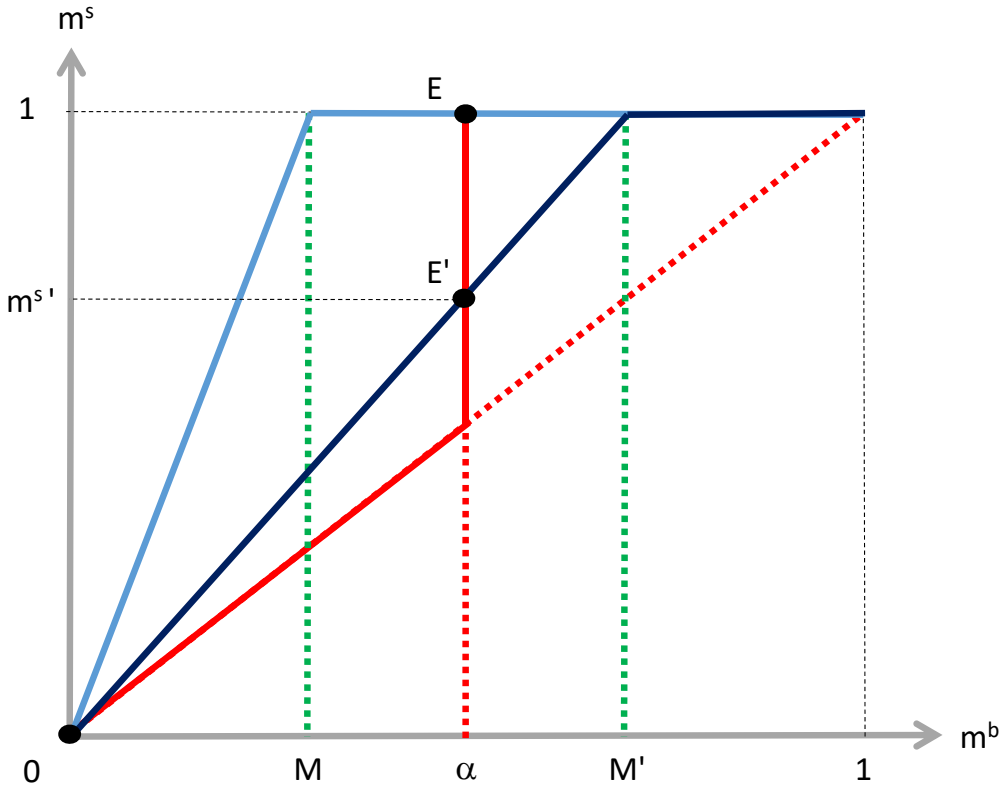


Figure 1: $F \leq (t_h^s - t_d^s)$

**(ii)** $F > (t_h^s - t_d^s)$**.** If $F$ is sufficiently large relative to $t_h^s - t_d^s)$, specifically, when $F > (t_h^s - t_d^s)$, then $\{m^b, m^s\} = \{0, 0\}$ becomes the unique equilibrium. The values of $N$ and $N'$ are given by

$$N = 1 - \frac{(1 - t_d^s) - F}{(1 - t_h^s)} < 1 - \frac{(1 - t_d^s) - F}{(1 - t_h^s)} = N', \text{ where } (t_h^s - t_d^s) < F < F'. \tag{6}$$

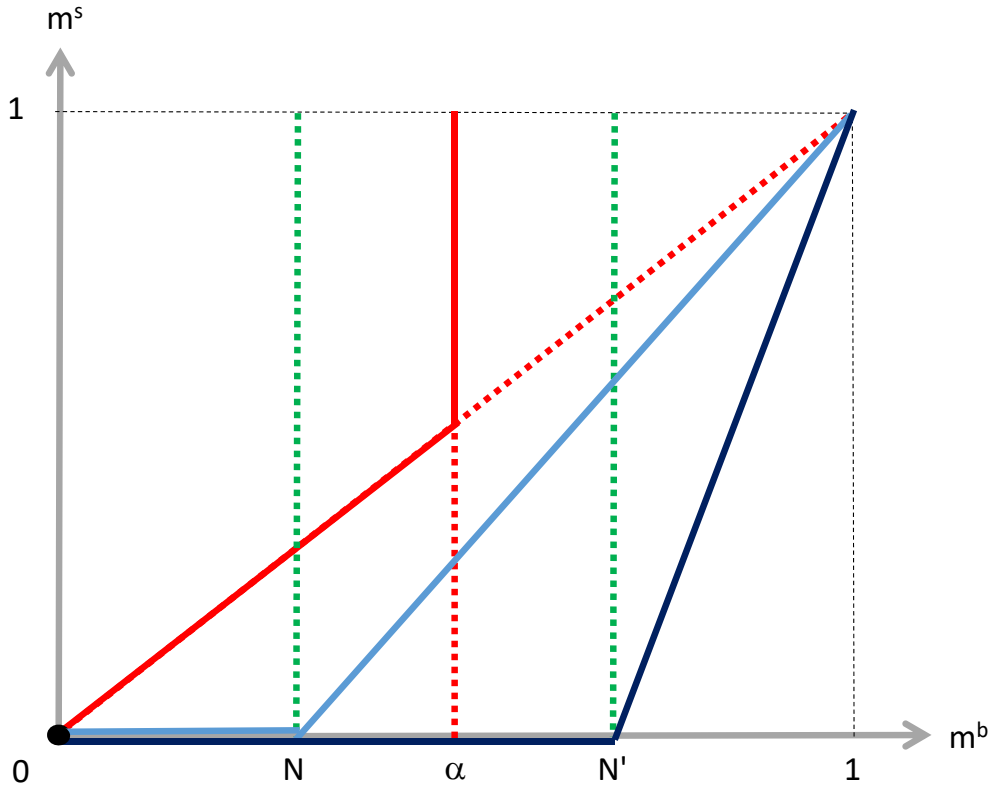


Figure 2: $F > (t_h^s - t_d^s)$

## 4 Proposed Methodology

In order to address the challenge of moving towards a cashless economy we develop a simple theoretical model that attempts to capture the main trade-offs of using different means of payments. The model includes both demand and supply factors as determinants of the use of payment alternatives. The model can be calibrated to the data available in Argentina.

The calibration allows us to examine the implications of different policies. Some of the policies analyzed in the paper include: (i) subsidize electronic payments? (Khan (2019)); (ii) limits on the size of transaction for which cash can be used ("cash thresholds") (Sands et al. (2017)); and (iii) tax rebate for the buyer that keeps the receipts and a tax on cash withdrawals (Immordino et al. (2014)). The model also allows us to evaluate the impact of the policies on different groups of households (low and high income) and merchants, and the impact on local and national tax revenue.

The calibration of the model (and the estimation of the relevant parameters) is based on an empirical analysis that uses data from the National Household Expenditure Survey ("Encuesta Nacional de Gasto de los Hogares" (ENGHO)) conducted by INDEC ("Instituto Nacional de Es-

tadísticas y Censos").[3]

# 5 Empirical Evidence in Argentina

## 5.1 Data: National Household Expenditure Survey

The ENGHO collects national and regional (provincial) information regarding expenditure and income, as well as socioeconomic characteristics of Argentinean households. The 2012 and the (recently published) 2017/18 survey include information regarding the type of payment instruments used by the households. The information on those surveys can be used to analyze the main demographics and economic determinants of the electronic payment's selection patterns.

Despite the fact that availability of banking services has been increasing in the country as shown by several studies analyzing the supply and use of banking services as Anastasi A., M. (2010), Denes, Repetto (2012) among others, still cash is the main payment option both for sellers and buyers. However, there is some regional variation on payments instruments usage patterns. The ENGHO information for 2012 and 2017/18 allow us to analyze the effect of households and consumers characteristics on the use of credit card as payment instrument.

In particular, we can analyze the impact of informality income level, education and other demographic and socioeconomic characteristics of households on the demand of this particular electronic payment instrument. Also, as in Stavins (2002) we analyze the regional variation by including location variables. Finally, following the proposed model, we include fixed costs and network effects.

The information includes household and head of household individual level. In fact, payment choice behaviour is measured at household level. Demographic and socioeconomic variables are measured both at household head and for the household. As mentioned before, the information is representative both at national and regional (provincial (i.e. states) [4]) level.

Table A in the Appendix shows the share of cash (and debit) as well as credit cards in household spending, both for 2012 and 2018, by province. Also, the table indicates the percentage of households with a credit card for each period.

In addition, Figures 7 and 8 summarize the relationship between the proportion of informal employment and the percentage of households using credit card in the provinces. It should be noted the negative correlation between those variables. The negative correlation is related to the adoption cost of electronic payment and it varies between the provinces. In turn, Table A reports the use and percentage of spending made with a credit card by income decile. It should be noted that the use pattern becomes more concentrated at higher income level in 2017/18 comparing with 2012. Also, the cash use decreases for all income levels between 2012 and 2017/18.

## 5.2 Empirical regression models

Following Stavins (2002) we consider a regression model of the form

$$P_{i,d} = \beta_0 + \beta_1\, income_{i,d} + \beta_2\, demographic_{i,j,d} + \beta_3\, employment_j + \beta_3\, network_d + \epsilon_{i,d}, \qquad (7)$$

for household $i$, household head $j$, and province (state) $d$, where $P_{i,d}$ is the credit card use (or the % of expenditure paid with credit cards). The income variables are alternative income measures

[3] The results of the calibration are not included in the present version of the paper.

[4] Argentina is a federal country with 24 states or provinces, each with its own provincial constitution and administration, as well as local laws, regulations and taxes, some of them affecting local payment transactions.

for the household and/or the household head, including income, income decile at national level, expenditure, expenditure decile.[5] The variable $demographic_{i,j}$ variables include control variables as $age$, $education$, $gender$, $homeowner$ both for household $i$ and/or household head $j$. The variable $employment_j$ includes both informal and formal employment variables for the head of the household $j$. Finally, the variable $network_d$ captures the presence of network effects in the use and implementation of an electronic payment system (i.e. credit card network) at the provincial level. In the empirical specification, we use the proportion of household expenditure using electronic (i.e. credit card) payment at the provincial level to proxy for these network effects.

We estimate equation 7 for both 2012 and 2017/18 using logit regressions as in Stavins (2002). One important caveat, clearly stated in our model, is to distinguish between electronic payment access/availability/use at the household or individual level that can be modeled with a binary $0$ or $1$ variable and, the proportion of expenditure paid with this payment method (a continuous variable between $0, 1$. As in Stavins the adoption and use should be modeled simultaneously to avoid sample selection problems. In our cross section regression setup we use a standard Heckman correction model to deal with this issue as in Denes, Repetto.

### 5.3 The use of electronic payments in Argentina

The estimates are reported in in Tables A and A both for the logistic regression and the Heckman correction model.

The results show that households in the highest income bracket, who own their homes, and have a higher level of education (except for 2012) are more likely to use credit card. Also, as the age of the head of the household increases, the probability of using a credit card decreases. Interestingly, being a female household head has a positive impact on the use of credit cards. Furthermore, being a formal worker and a resident in provinces with higher credit card penetration increases the chances of adopting credit cards as a medium of payment.

The results of the Heckman model reinforce the previous analysis. Demographic variables have, in general, the expected signs, especially for 2017.

The selection variables on the first stage regression for the year 2017 show that that the probability of having access to a credit card increases for workers located in the highest spending decile and older than 24 years. On the contrary, the chance of access is reduced for informal workers. For the second stage regression, the sign and significance levels are similar to the logit model. However, the distinction between adoption and use, captures a negative impact on credit card use for informal workers. Finally, the result for the network variable is similar in sign as well as statistical and economic significance. Overall, both models seem to indicate that both informality and network effects play key roles in determining the use of electronic payment systems.

These results, which follow from the latest available information on the use of cashless alternatives (such as credit and debit cards, electronic funds transfers (EFTs), and mobile banking (PSP)) by households in Argentina, can be used to understand the implications of adopting alternative electronic payments currently under consideration.

Recent information from the Central Bank of Argentina indicates that mobile payments increased, from an average of $5\%$ in 2018 to $10\%$ of the electronic transactions made by individuals in June 2020 [6]. In fact, the current context of the Covid-19 pandemia has further highlighted the need to introduce measures and policy reforms aimed at shifting towards a cashless economy.

[5] For the ENGHO 2017/18, information about household income will be available after July 20th, 2020. We use, at this stage, household expenditure to proxy for household income.

[6] Source: author's calculations based on monetary statistics, transaction volume by payments method (BCRA).

This agenda involves considering some of the issues analyzed in the present work, such as network effects (i.e. such as universalizing QR codes to allow Fintech network interactions), as well as the importance of other local issues (such as taxes, withholdings and perceptions), and the big challenge of informality. Our calibrated model will help examine these important issues.

## 6 Conclusions and Next Steps

The Argentine economy faces the important challenge of becoming a cashless economy. Achieving this goal requires an important change in many dimensions that have persisted over time, including the low level of bank penetration, the extent of the informal economy and the pervasive tax evasion. At the same time, tax related constraints are important, especially at the provincial level. In an attempt to contribute to this challenge, we develop a simple model of the determinants of the demand and supply of different payment instruments. The model, calibrated using Argentinean data, is used to examine the impact of different policy options. The main message of the study is that policies that only target either the demand or the supply side will likely fail to accomplish the goal of moving towards a cashless economy. Effective policies should, therefore, consider the constraints that limit the behavior of both sides of the market.

## References


*Anastasi A. Elosegui P. Blanco E., M. Sangiácomo*. La bancarización y los determinantes de la disponibilidad de servicios bancarios en Argentina. Ensayos Económicos 60 - Octubre - Diciembre - BCRA. 2010.

*Arifovic Jasmina, Duffy John Michael, Jiang Janet Hua*. Adoption of a new payment method: theory and experimental evidence. 2017.

*Bolt Wilko, Chakravorti Sujit*. Consumer Choice and Merchant Acceptance of Payment Media. Federal Reserve Bank of Chicago Working Paper No. 2008.

*Bounie D. François A.* Cash, check or bank card? The effects of transaction characteristics on the use of payment instruments. Telecom Paris Economics and Social Sciences Working Paper No. ESS-06-05. March. 2006.

*Crouzet N., Gupta A., Mezzanotti F.* Shocks and Technology Adoption: Evidence from Electronic Payment Systems. Northwestern University Working Paper. 2019.

*Del Angel Gustavo*. Cashless Payments and the Persistence of Cash: Open Questions About Mexico. Hoover Institution, Stanford University. 2016.

*Demirgüç-Kunt Asli, Klapper Leora*. Measuring financial inclusion: Explaining variation in use of financial services across and within countries // Brookings Papers on Economic Activity. 2013. 2013, 1. 279–340.

*Denes A., Repetto G.* Análisis espacial del sistema financiero en aglomerados urbanos: el caso de la Ciudad Autónoma de Buenos Aires. Documentos de trabajo 66 - Estudios BCRA. 2015.

*Denes Blanco E. A., Repetto G.* Mapa económico y financiero de Argentina: Un sistema georeferenciado de indicadores de demanda, oferta y mercado de servicios financieros a nivel de localidad. Documentos de trabajo 59 - Estudios BCRA. 2012.

*Immordino Giovanni, Russo Francesco Flaviano, others* . Taxing Cash to Fight Collaborative Tax Evasion? 2014.

*Jacolin Luc, Massil Joseph Keneck, Noah Alphonse*. Informal Sector and Mobile Financial Services in Developing Countries: Does Financial Innovation Matter? // Banque de France Working Paper. 2019.

*Krüger Malte, Seitz Franz*. Costs and benefits of cash and cashless payment instruments: overview and initial estimates // Study commissioned by the Deutsche Bundesbank. Frankfurt. 2014.

*Sands Peter, Weisman Benjamin, Campbell Haylea, Keatinge Tom*. Limiting the Use of Cash for Big Purchases: Assessing the Case for Uniform Cash Thresholds. 2017.

*Schmiedel Heiko, Kostova Gergana L, Ruttenberg Wiebe*. The social and private costs of retail payment instruments: a European perspective // ECB Occasional paper. 2012. 137.

*Schuh Scott D, Shy Oz, Stavins Joanna*. Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations // Theory and Calibrations (August 31, 2010). FRB of Boston Public Policy Discussion Paper. 2010. 10-3.

*Stavins Joanna*. Effect of Consumer Characteristics on the Use of Payment Instruments // New England Economic Review. 2002.

*Stavins Joanna*. How do consumers make their payment choices? Federal Reserve Bank of Boston. 2017.

*Ten Raa Thijs, Shestalova Victoria*. Empirical evidence on payment media costs and switch points // Journal of Banking & Finance. 2004. 28, 1. 203–213.

# A Appendix

| PROVINCE | % Exp. (Cash + Debit) | | % Exp. CC | | % HH with CC | |
|---|---|---|---|---|---|---|
| | 2012 | 2017 | 2012 | 2017 | 2012 | 2017 |
| CIUDAD DE BS. AS. | 0,910 | 0,736 | 0,082 | 0,133 | 0,493 | 0,682 |
| BUENOS AIRES | 0,915 | 0,858 | 0,072 | 0,077 | 0,513 | 0,492 |
| CATAMARCA | 0,938 | 0,899 | 0,044 | 0,062 | 0,370 | 0,499 |
| CORDOBA | 0,920 | 0,895 | 0,062 | 0,073 | 0,580 | 0,580 |
| CORRIENTES | 0,899 | 0,890 | 0,081 | 0,063 | 0,562 | 0,352 |
| CHACO | 0,948 | 0,922 | 0,047 | 0,052 | 0,367 | 0,270 |
| CHUBUT | 0,874 | 0,866 | 0,120 | 0,062 | 0,569 | 0,420 |
| ENTRE RIOS | 0,874 | 0,880 | 0,100 | 0,095 | 0,576 | 0,519 |
| FORMOSA | 0,906 | 0,924 | 0,079 | 0,065 | 0,655 | 0,451 |
| JUJUY | 0,932 | 0,907 | 0,049 | 0,056 | 0,426 | 0,555 |
| LA PAMPA | 0,921 | 0,876 | 0,062 | 0,077 | 0,397 | 0,557 |
| LA RIOJA | 0,918 | 0,928 | 0,074 | 0,061 | 0,441 | 0,431 |
| MENDOZA | 0,901 | 0,869 | 0,066 | 0,075 | 0,575 | 0,587 |
| MISIONES | 0,916 | 0,876 | 0,064 | 0,081 | 0,357 | 0,486 |
| NEUQUEN | 0,893 | 0,810 | 0,092 | 0,139 | 0,613 | 0,720 |
| RIO NEGRO | 0,897 | 0,891 | 0,095 | 0,062 | 0,469 | 0,381 |
| SALTA | 0,908 | 0,910 | 0,068 | 0,050 | 0,530 | 0,463 |
| SAN JUAN | 0,934 | 0,916 | 0,047 | 0,039 | 0,473 | 0,435 |
| SAN LUIS | 0,909 | 0,910 | 0,072 | 0,062 | 0,554 | 0,558 |
| SANTA CRUZ | 0,834 | 0,911 | 0,159 | 0,068 | 0,639 | 0,387 |
| SANTA FE | 0,886 | 0,857 | 0,086 | 0,085 | 0,539 | 0,621 |
| SGO. DEL ESTERO | 0,947 | 0,919 | 0,049 | 0,058 | 0,630 | 0,514 |
| TUCUMAN | 0,933 | 0,897 | 0,052 | 0,062 | 0,535 | 0,603 |
| TIERRA DEL FUEGO | 0,778 | 0,661 | 0,214 | 0,227 | 0,605 | 0,781 |
| Total Argentina | 0,911 | 0,856 | 0,073 | 0,082 | 0,520 | 0,528 |

Figure 3: Percentage of households with credit card and share of expenditures paid with cash and credit card by province. Years 2012 and 2017.

Source: ENGHO 2012 and 2017.

| Decile | % with CC | | % Exp. CC | | % Exp. Cash | |
|---|---|---|---|---|---|---|
| | 2012 | 2017 | 2012 | 2017 | 2012 | 2017 |
| 1 | 0,3182 | 0,2452 | 0,0693 | 0,0417 | 0,9204 | 0,9118 |
| 2 | 0,3995 | 0,3299 | 0,0760 | 0,0544 | 0,9136 | 0,9148 |
| 3 | 0,4724 | 0,3848 | 0,0925 | 0,0598 | 0,8966 | 0,9125 |
| 4 | 0,5004 | 0,4538 | 0,0960 | 0,0723 | 0,8952 | 0,9020 |
| 5 | 0,5172 | 0,4771 | 0,1047 | 0,0776 | 0,8855 | 0,8967 |
| 6 | 0,5641 | 0,5408 | 0,1151 | 0,0924 | 0,8765 | 0,8867 |
| 7 | 0,5829 | 0,6271 | 0,1238 | 0,1091 | 0,8669 | 0,8689 |
| 8 | 0,6320 | 0,6738 | 0,1344 | 0,1339 | 0,8567 | 0,8475 |
| 9 | 0,6777 | 0,7410 | 0,1643 | 0,1491 | 0,8253 | 0,8323 |
| 10 | 0,7404 | 0,8109 | 0,2051 | 0,2090 | 0,7838 | 0,7696 |

Figure 4: Percentage of households with credit card and share of expenditures paid with cash and credit card by decile. Years 2012 and 2017.

Source: ENGHO 2012 and 2017.

| | Logit: Credit Card Use | | | Heckman | |
|---|---|---|---|---|---|
| | Coef. | dy/dx | ey/ex | % Exp. CC | Use CC |
| Expenditure/Income | 0,000041 | 0,000009 | 0,028857 | 0,000011 | |
| | 0,0000134*** | 0,00000297*** | 0,0092898*** | 0,00000103*** | |
| Expenditure decile | 0,150479 | 0,0334632 | 0,3473573 | | |
| | 0,0081444*** | 0,001754 | 0,0181458*** | | |
| Age group | -0,210051 | -0,0467107 | -0,2553683 | -0,0054226 | |
| | 0,016194*** | 0,0035479*** | 0,0203777*** | 0,001945*** | |
| Education (univ.) | -0,271797 | -0,0604417 | -0,0140178 | -0,0165484 | |
| | 0,0479459*** | 0,0106329*** | 0,0027473*** | 0,0052227*** | |
| Female | 0,034457 | 0,0076625 | 0,0059116 | 0,000286 | |
| | 0,0320886*** | (0,0071351) | (0,0054542) | 0,0037186 | |
| Home ownership | 0,449052 | 0,0998594 | 0,1472488 | 0,0218623 | |
| | 0,034653*** | 0,0075925*** | 0,0054542*** | 0,0039526*** | |
| Formal worker | 0,576481 | 0,1281968 | 0,0794862 | 0,0129226 | |
| | 0,0351691*** | 0,0076333*** | 0,004148*** | 0,0040486** | |
| Informal worker | 0,117836 | 0,0262041 | 0,0092425 | -0,0177324 | |
| | 0,0436797** | 0,009707** | 0,0032984*** | 0,0053173*** | |
| Network | 3,890158 | 0,865086 | 0,9434841 | 0,0766227 | |
| | 0,17676*** | 0,0376021*** | 0,0423342*** | 0,021296*** | |
| Constant | -2,849473 | | | | |
| | 0,1076817*** | | | | |
| Expenditure decile | | | | | 0,1047609 |
| | | | | | 0,0031547*** |
| Age > 24 | | | | | 0,3455149 |
| | | | | | 0,0434373*** |
| Informal worker | | | | | -0,0522639 |
| | | | | | 0,02505** |
| Constant | | | | | -0,8480346 |
| | | | | | 0,0158624 |
| $\rho$ | | | | | -0,0761637 |
| $\sigma$ | | | | | 0,1761298 |
| $\lambda$ | | | | | -0,0134147 |

Figure 5: Logit and Heckman correction models. Year 2012.

Source: ENGHO 2012.

| | Logit: Credit Card Use | | | Heckman | |
|---|---|---|---|---|---|
| | Coef. | dy/dx | ey/ex | % Exp. CC | Use CC |
| Expenditure/income | 0,000015 | 0,000003 | 0,044516 | 0,000001 | |
| | 0,00000488*** | 0,000000102*** | 0,0014061*** | 0,00000002*** | |
| Expenditure decile | 0,165301 | 0,0344261 | 0,3125154 | 0,0078647 | |
| | 0,001479*** | 0,000299*** | 0,002712*** | 0,0001358*** | |
| Age group | -0,158994 | -0,0331127 | -0,2911857 | 0,0017541 | |
| | 0,0024636*** | 0,0005088*** | 0,0045967*** | 0,0002078*** | |
| Education (univ.) | 0,139298 | 0,0290106 | 0,0076075 | 0,0240351 | |
| | 0,0065906*** | 0,0013715*** | 0,0003368*** | 0,0004695*** | |
| Female | 0,012451 | 0,0025932 | 0,0021939 | -0,0107611 | |
| | 0,004827* | 0,0010053* | 0,0008476* | 0,0003881** | |
| Home ownership | 0,329653 | 0,0686548 | 0,0941047 | 0,0182789 | |
| | 0,005547*** | 0,0011471*** | 0,001522*** | 0,0004392*** | |
| Formal worker | 0,565657 | 0,1178057 | 0,0596967 | 0,0272247 | |
| | 0,005678*** | 0,001159*** | 0,0005009*** | 0,0004483*** | |
| Informal worker | 0,079292 | 0,0165136 | 0,0052636 | -0,0044858 | |
| | 0,0067503*** | 0,0014054*** | 0,0004351*** | 0,000576*** | |
| Network | 2,844856 | 0,5924801 | 0,5625437 | 0,1015554 | |
| | 0,0244278*** | 0,0049507*** | 0,0047528*** | 0,00196*** | |
| Constant | -1,887650 | | | -0,0172533 | |
| | 0,0170699*** | | | 0,001869 | |
| Expenditure decile | | | | | 0,1450098 |
| | | | | | 0,0005094*** |
| Age > 24 | | | | | 0,2425687 |
| | | | | | 0,0082231*** |
| Informal worker | | | | | -0,0729265 |
| | | | | | 0,0041322*** |
| Constant | | | | | -0,7905636 |
| | | | | | 0,0087226*** |
| $\rho$ | | | | | -0,1695948 |
| $\sigma$ | | | | | 0,1374251 |
| $\lambda$ | | | | | -0,0233066 |

Figure 6: Logit and Heckman correction models. Year 2017.

Source: ENGHO 2017/18.

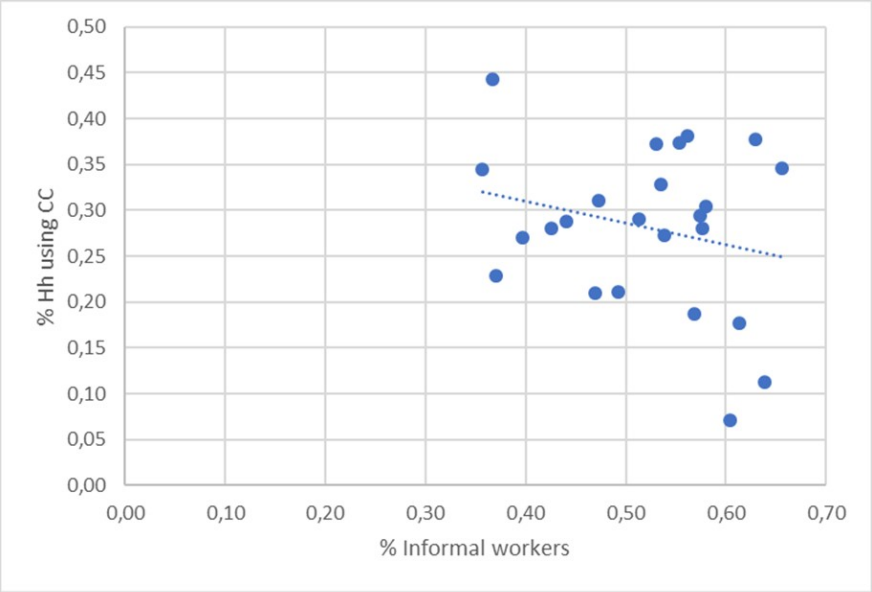


Figure 7: Provincial % informal workers and credit card use in 2012

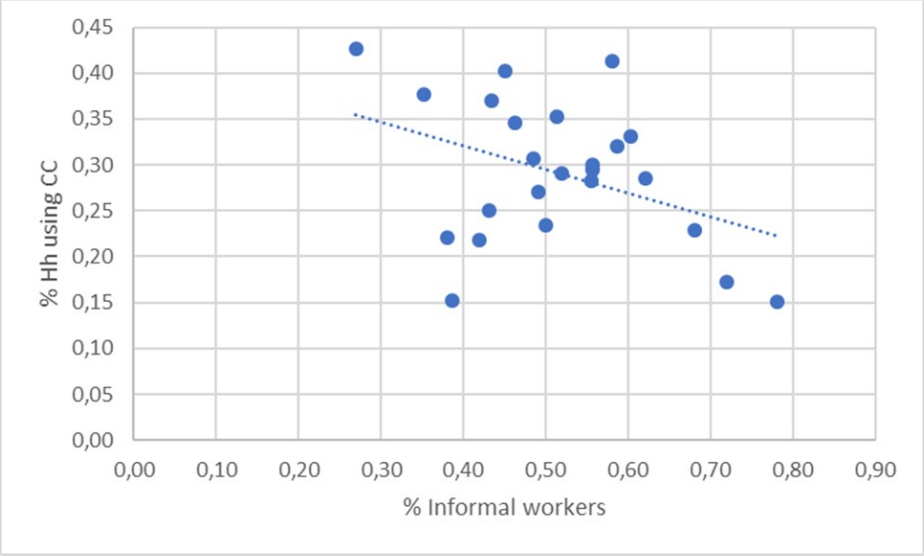


Figure 8: Provincial % informal workers and credit card use in 2017