Secondary Currency:
An Empirical Analysis[*]

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Abstract

Many cases exist of multiple currency usage throughout history. As two leading examples, secondary currencies were widespread during both the Great Depression in the United States and the 2002 recession in Argentina. What are the determinants of multiple currency usage and what is the effect on economic activity? We address these issues here empirically, using individual-level surveys collected by the authors in Argentina during 2002 and 2003. The evidence supports the theoretically predicted determinants of secondary currency acceptability put forth in monetary theory. In particular we find that the acceptability of the secondary currency increases when the supply of national currency is low, the relative transaction cost of the secondary currency is low, and the individual trading technologies are less effective. Moreover we find that the acceptability of the secondary currency has real effects on economic activity. Among those who use the secondary currency the monthly gain is more than 15 percent of the average Argentine's monthly income. This effect aggregates to 0.6 percent of GDP. The estimated semi-elasticity between the proportion of population that accepts the secondary currency and GDP is 0.083.

It becomes more and more clear that, if there were no money, 1933 could invent it all over again; and since Uncle Sam has developed a seeming incapacity to supply enough of it for even that amount of trade which is indispensable to keep his citizens from foraging like animals (or thieves), invention has reached the very threshold of money.

Irving Fisher (1934, pg. 151)

1   Introduction

Until the 1970s, most macroeconomists believed that changes in the money stock affect the real economy. This consensus broke down in the face of both challenging empirical findings and theoretical critiques. Since that time, micro-founded theories and new empirical methods have been developed to asses the effects of money on the economy. Currently, real-business-cycle models predict no real consequences from monetary disturbances, while Keynesian models predict important real effects. While the literature overall agrees on the long-run neutrality of monetary shocks, the short-run effects remain a subject of open debate.[1]

More recently, however, an alternative strand of theoretical work on money as a medium of exchange has formalized the conditions under which currencies circulate. Kiyotaki and Wright's (1989) seminal paper formulates a tractable theory of currency in which commodities or fiat money arise endogenously as a medium of exchange. They build a sequential random matching model of trade, identifying the conditions that enable money to circulate in equilibrium. Kiyotaki and Wright (1993) address the interaction between specialization and monetary exchange and study the conditions of equilibria with multiple currencies.[2] Thus far, this literature has been disconnected from empirical analysis given the difficulty in relating its micro-level considerations to aggregate measures of money and economic activity.[3]

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[1] For an extended review of the literature on money and monetary policy effects on output see Romer (2001) and Walsh (2000).

[2] A good overview of the literature on multiple currencies is presented by Craig and Waller (2000).

[3] There is related experimental literature that tests for the endogenous rise of money as a medium of

1.1 Contribution and Findings

In this paper, we provide a detailed micro-level measurement of the circulation of multiple currencies in Argentina and its effect on real activity. Drawing upon the theoretical money literature, the paper identifies the conditions under which the scarcity of a national currency brings a secondary currency into circulation. We test these conditions and estimate the effect of the use of a secondary currency on economic activity. To perform this novel empirical analysis we use micro-level data, as opposed to the aggregates that the literature previously analyzed. The study is based on surveys conducted by the authors in Argentina during its recent recession and draws parallels with the Great Depression in the United States, during which a similar secondary currency circulated. We present two sets of results regarding the use of money.

First, by exploiting individual and neighborhood level variation in Argentina, we provide empirical evidence that offers overall support to the models of Kiyotaki and Wright. In particular, we find that the acceptability of secondary currency increases when there is a low supply of national currency, low relative transaction cost of the secondary currency, and people are less effective finding trading partners. Second, we employ propensity score matching methods to estimate the gain from accepting a secondary currency in trade. Our findings indicate that users of the secondary currency earn approximately US$ 35 per month more than similar non-users. This amounts to 15% of the average Argentine's monthly income; aggregating over all users the secondary currency adds 0.6% of value to GDP. The estimated semi-elasticity between the proportion of the population that accepts the secondary currency and GDP is 0.083.

1.2 The Use of Multiple Currencies

Developing and transitional economies, either formally or informally, often adopt the currency of a developed country.[4] To a lesser extent, privately issued media of exchange

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exchange. Duffy and Ochs (1999, 2002) and Brown (1996) perform experimental tests of the predictions of Kiyotaki and Wright (1989) with human subjects. Marimon et al. (1990) test these implications with artificially intelligent agents.

[4]Examples include Ukraine and Kazakhstan during the 1990s, when the dollar illegaly circulated alongside the unstable national currency, and Argentina, which adopted the dollar as legal tender along with the

circulate in some countries alongside the national currency. In particular we know that in the United States during the Great Depression and in Argentina during its recent recession, privately issued currencies circulated on a significant scale. Approximately 1% of the U.S. population and 7% of the Argentine population traded with privately issued currencies during these periods.[5]

Secondary currencies circulate for many reasons, which can be broadly grouped into two categories. The first is when the adoption of a secondary currency occurs because of hyperinflation or instability of the national currency. These cases are characterized by a highly volatile money supply and prices that call for an alternative currency to act as a medium of exchange, to store value, and/or to act as a unit of account. Such instances, called currency substitution, are normally found in developing as well as in transitional economies. The second is when the adoption of a secondary currency arises because the national currency is scarce. In this case the national currency performs its role as a unit of account and store of value (for those who have it), but performs poorly as a medium of exchange.

The main determinants of currency substitution include domestic inflation, depreciation, seigniorage, monetary financing of deficits, domestic and foreign interest rates, credibility and time inconsistency of monetary authorities. We refer the reader to Calvo and Vegh (1992) for a comprehensive survey and analysis of this literature.

Our work instead focuses on economies facing scarcity of national currency. In Argentina in 2002 and in the United States in 1933, the national currency suffered from such scarcity problems. The years leading to the acceptance of a secondary currency in both countries are characterized by a large negative growth rate of the money supply (M1) and by a negative but smaller growth rate of the consumer price index.[6] The scarcity of the national currency

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peso to eliminate inflation during the 1990s.

[5]The data sources are Fisher (1934) for the U.S. figure and newspaper *Clarin.com* (July 10, 2002) for the Argentine figure. Examples of other countries with private money circulating on a small scale are France, the Netherlands, Germany, and Russia where the organization LETS (Local Exchange Trading System) is the system used. Japan, Canada, Mexico and the United States have as well, on a very small scale, a similar organization called HOURS. HOURS in the United States is to the best of our knowledge the largest association issuing private money in actuality, and has 5,000 members.

[6]More evidence on the scarcity of the national currency is presented in Section 3, where we explain our theoretical framework.

in the economies under study provides an interesting empirical test of the importance of matching problems or trading frictions. We focus on the use of money as a medium of exchange and the conditions under which a secondary currency arises to fill this role, as well as the real economic value that it provides.

2 Experience in Argentina and the United States

2.1 Exchange Clubs in Argentina

Exchange clubs are private trading organizations where individuals exchange goods and services using the club's private fiat currency: the crédito.[7] Clubs meet between one and three times a week. The locations used for the meetings include social or sports clubs, schools, churches's backyards, public buildings, private garages, and even nightclubs. In July 2002, when the unemployment rate in Argentina soared to over 20%, approximately 7% of the population was participating in exchange clubs and using créditos to trade.[8]

Each club is organized by a coordinator at the neighborhood level and most participants live within the immediate vicinity of the club. In general, clubs belong to either a regional or national network of clubs all of which use the same créditos; however, each coordinator has some degree of discretion in determining the rules used for trading. Rules may stipulate a specific time to start trading, the quality of goods, rationing of high-demand but low-supply goods, or even price controls. The exclusive use of the crédito is rigorously enforced. Nonetheless, some clubs are willing to allow the use of créditos from other clubs within their own club network. Additionally, some coordinators and networks are willing to allow the use of créditos from other networks as well.

Though all clubs call their currency créditos, the physical créditos differ greatly from club to club and from network to network. In some clubs, the créditos are nothing more than photocopies of a bill stating the name of the network and the denomination of the bill, while other clubs used créditos that were printed on check paper and marked with serial numbers. The quality and control over the supply of créditos seems to be a salient

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[7]For an example, see the photo of exchange club in Argentina in 2002, Figure 10, Appendix A.

[8]This measure is equivalent to 9% of the +14-year-old population.

factor distinguishing clubs and networks as well as among coordinators in determining which network's créditos to accept.

When an individual joins an exchange club for the first time she usually pays a two-peso acceptance fee.[9] In return, she gets a one-time crédito loan of around 30 créditos, though the exact amount differs by club.[10] This initial loan has to be repaid in the future or when the member decides to stop participating. However, in reality, there is no enforcement of the repayment, and the loan simply serves as a mechanism to infuse créditos into the economy.

In order to attend a club meeting, individuals are required to bring products or services to sell. Of course, if a participant has accumulated créditos from previous visits, she is encouraged to spend them on the offerings of other participants. While demanding people to bring goods to sell does not force them to sell, in practice few people only buy. Further, since participants are given créditos only when they join the club, there is a dynamic constraint which forces them to sell in order to be able to purchase goods in the future. In the Argentine exchange clubs, many participants came in pairs, with one charged with searching out goods to buy, while the other stayed at a display stand to sell the goods they had brought.[11]

Traded goods and services range from food (bread, baked goods, and vegetables are a popular offering) to clothes, arts and crafts, used books, haircuts, massages, construction, and even dental services. In general, trading lasts for three or four hours before members are content with their exchanges.

2.2   Exchange Clubs in the United States

In their "Great Contraction" chapter, Friedman and Schwartz (1963) acknowledge the existence of similar organizations to the ones just described for Argentina in the United States

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[9]According to the club coordinators, the fees charged are used to pay for printing the créditos, renting the meeting hall, or other assorted expenses.

[10]The 30 créditos received in the initial loan amount to an equivalent value of 15 pesos. This convertion uses the median individual exchange rate that crédito users reported in our surveys.

[11]Lucas (1980) describes an agent as a husband-wife pair, one of whom spends each day shopping (the "shopper") and the other of whom works at the production of a single good (the "worker"). This description is parallel to what we observed in the exchange clubs: one person is the "shopper" and the other is the "seller" of the goods that the couple brought. This is an example of "life imitating theory."

in 1931, at the onset of the Great Depression.[12] They explain, "The severity of the depression stimulated many remedial efforts, governmental and nongovernmental, outside the monetary area... The unemployed in many states formed self-help and barter organizations, with their own systems of scrip... ."[13]

Fisher (1934) and Harper (1948) document that around 400 clubs were organized in 30 states in the United States. As Harper (1948) explains, this movement began in the West and spread to various parts of the country, but by far the greatest number of such organizations were found in California, Washington, Idaho and Utah. The newspaper The Vanguard "...helped launch the Unemployed Citizens League in 1931 and gained considerable influence as thousands joined the UCL's self-help projects..." (Eigner, 2001). It is estimated that one million people, almost 1% of the U.S. population,[14] depended on this system at the end of 1933.[15]

Harper (1948) further details that, out of the estimated 200 to 400 self-help and barter groups that existed in the United States from 1930 to 1936, between 60 and 75 used private currency (called scrip) or instruments of a similar nature. Private money in the U.S. exchange associations (as named by Fisher) arose after a time of direct barter inside the organizations and use of bulletins to advertise desired barter exchanges. Fisher explains, "Finally, since money, however scarce, does still exist, some of the Exchange Associations conceived the idea of printing their certificates in money-denominations. By agreement, a dollar receipt does whatever a dollar would do if you had a dollar... ."[16] The parallel with the Argentine crédito is clear: in both cases private organizations issued a secondary currency to facilitate trade among their members.

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[12]For an example, see the photo of an exchange club in the United States in 1933, Figure 11, Appendix A.

[13]Friedman and Schwartz (1963), Chapter 7, pg. 322.

[14]This measure is equivalent to 1.08% of the +14-year-old population.

[15]Argentina's peak of crédito acceptability occurred at the beginning of 2002, when a reported 7% of the population was involved (equivalent to 9% of the +14-year-old population).

[16]Fisher (1934) pg. 150.

2.3 Comparing the Recessions in Argentina and the United States

Similarly, the macroeconomic situation in the United States during the Great Depression parallels the situation during the Argentine recession of the late 1990s and early 2000s. Figures 1 and 2 illustrate how main macroeconomic variables like the unemployment rate, the growth rate of real GDP per capita, and the growth rate of the money supply followed similar trends over time in the late 1990s and the early 2000s in Argentina and during the Great Depression in the United States.[17]

The acceptability of the secondary currency peaked in Argentina in early 2002, and in the United States in 1933. We observe remarkable similarities between the two economies for the eight-year periods graphed in Figures 1 and 2. Figure 3 illustrates the U.S. experience from 1927 to 1940, which includes the post-recession era as well. We lack data for Argentina's post-recession era, which is still in progress at this time.

Comparing Figures 1 and 2, we observe that both the growth rate of real GDP per capita and the growth rate of the money supply evidence similar contractions for Argentina and the United States prior to the boom in secondary currency. The peak of the contraction in real GDP per capita occurred in the United States one year before the peak in secondary currency use (1932), when it shrank by 15.1%. The peak in Argentina occurred during the same year as the peak in secondary currency use (2002), when it shrank by 14.6%. Similarly, the peak of the contraction of money growth in the United States (falling by 15.2% in 1931) occurred two years before the peak of secondary currency use, and one year before the peak of secondary currency use in Argentina (falling by 17.6% in 2001).[18] Even though the peak

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[17]Argentine data sources: Unemployment rate (May figures, except for July 2003) from INDEC. Growth of real GDP per capita (May figures) from Ministerio de Economia, Argentina. Growth of Money Stock (Circulating plus Pesos and U.S. dollar deposits) from BCRA (December figures). CPI data for GBA from INDEC.

U.S. data sources: Growth of Money Stock and growth of real GDP per capita from Friedman and Schwartz (1963). Population and Unemployment rate from U.S. Department of Commerce-Bureau of the Census. CPI data (for all urban consumers, U.S. city average) from U.S. Department of Labor-Bureau of Labor Statistics.

[18]Note that several states across the country issued their own currency (using it to finance the state budget). These currencies circulated alongside the peso in many cases well before the 2001-2002 peak of the contraction of the Argentine money supply. For example in Tucumán the state currency had been circulating since 1985. Even though an accurate measure of money supply should include the state currencies, their stock did not grow as to compensate for the fall in the peso supply in 2001. The peso money supply contracted by 17.6% in 2001 and the stock of state currencies amounted to less than 4% of the peso money supply in 2001 (Werning 2002). Therefore, even if the state currencies did not exist in 2000, the net contraction in

in secondary currency use occurs one year later in the United States than in Argentina (that is, with respect to the peaks in contraction of the real GDP per capita and money supply), the magnitude of both contractions are remarkably similar.[19]

Although the exact reasons for these drops in the money supply are not universally agreed upon, most economists, in particular Friedman and Schwartz (1963), attribute the fall in the U.S. money stock during the Great Depression to the bank failures of the early 1930s. More than 9,000 banks suspended operations between 1930 and 1933. In response the currency-deposit ratio and the reserve-deposit ratio increased, thus reducing the money supply. On the other hand, throughout 2001, the Argentine public feared that Argentina would abandon the convertibility system and devalue the peso. Peso and dollar deposits were withdraw from banks to be converted into physical dollars. The "corralito," a set of government policies restricting access to bank deposits, was implemented by the end of 2001 and further weakened the already low public confidence in the banking system. In both economies these crises of confidence led to sharp decreases in the money supply.
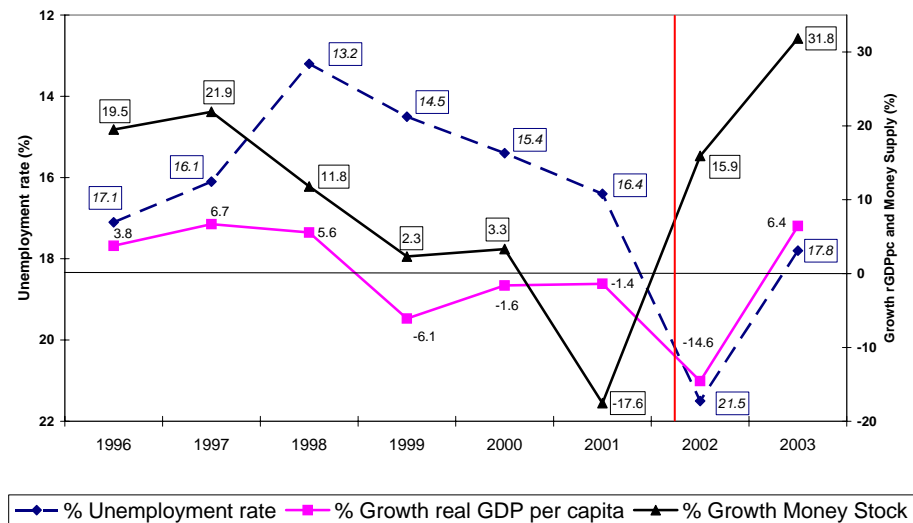

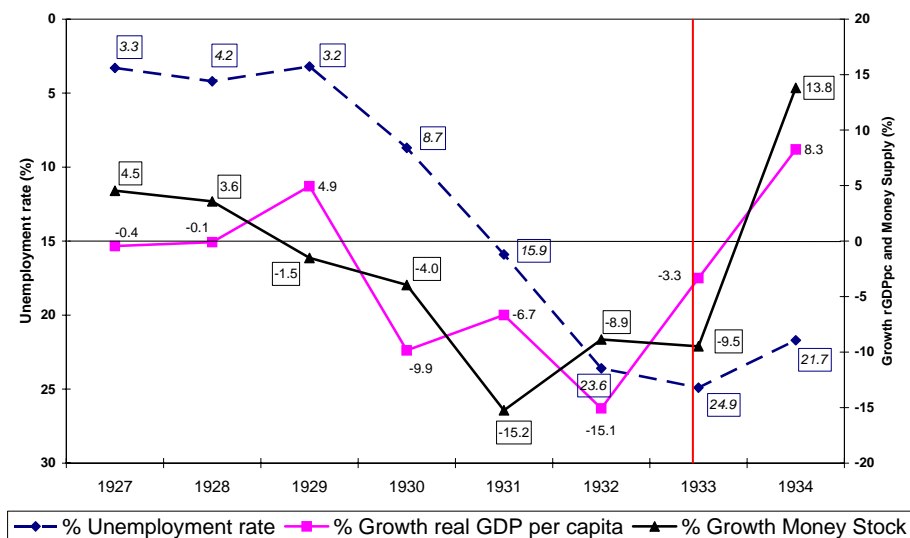Figure 1: The Argentine Experience, 1996-2003

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Figure 2: The U.S. Experience, 1927-1934

The unemployment rate in both countries was at its highest when secondary currency use peaked and showed similar magnitudes (24.9% in the United States and 21.5% in Argentina).[20] However, the evolution of the unemployment rate during the six previous years in Argentina was quite different from that of the United States. Argentina had already had a high unemployment rate (17.1%) six years prior to the secondary currency boom, while the U.S. unemployment rate was low and then increased sharply in the years immediately preceding the peak in secondary currency use. The difference in the evolution of the unemployment rates in the years before their crises might help explain the different magnitudes of secondary currency use, which was approximately eight times larger in Argentina than in the United States.

We can take advantage of time series data on the number of crédito users in Argentina to see how changes in the money supply relate to secondary currency use. Figure 4 shows in detail the evolution of Argentina's crédito users and the (negative of the) growth rate of the money supply for the period from 1996 to 2003. As it is readily apparent, there is a close

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[20]It is likely that the natural rate of unemployment is different in both economies, and if so, the small differences in unemployment rates are not important.
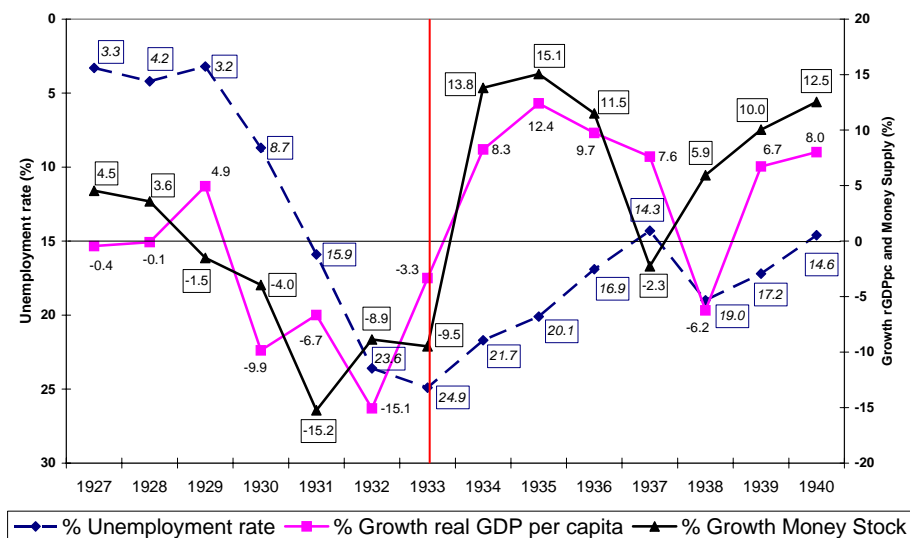
Figure 3: The U.S. Experience, 1927-1940

co-movement of the two variables, providing some anecdotal evidence of the link between the scarcity of the primary currency and the use of the secondary currency.[21]

3   A Framework to Study Secondary Currency

In order to understand the use of a secondary currency and frame our empirical analysis, we employ the theory of multiple currency use that began with Kiyotaki and Wright (1989). The presentation of this theory for now is simple and intuitive; we leave the formal presentation, the specifics of the model, and derivations for Section 7.

We adopt a model in which money scarcity is a key determinant of secondary currency use, since both Argentina and the United States suffered from a scarcity of currency during these periods. Figures 5 and 6 show the growth rates of their money stocks and of prices (measured by the Consumer Price Index).[22] As the money stock falls in both economies,

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[21]Data sources: Time series for club participants cited in *Clarin*. (The plateau on this series for 2002 is mainly due to data limitations). Census population data from INDEC. Money Supply data source as detailed in footnote 17.

[22]Data sources as mentioned in footnote 17.
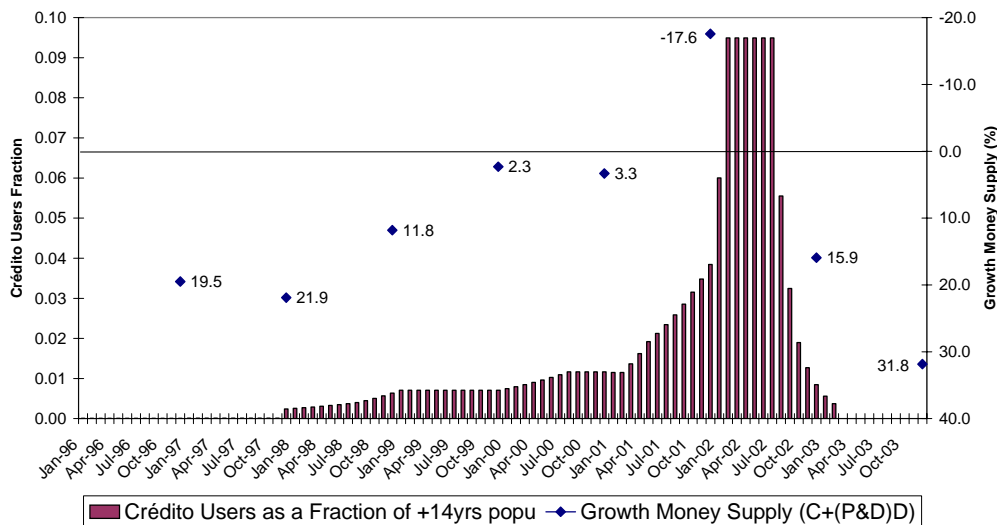
Figure 4: Crédito Users and Growth of Money Supply, Argentina 1996-2003

we observe partial downward movement of prices. Argentina shows a stronger amount of price rigidity than the United States. There are a multitude of potential reasons for this price rigidity offered by the literature (see e.g. Mankiw, 1990). Determining which of these potential reasons played a significant role during these times is not central to our study. The important fact illustrated in the previous section and in Figures 5 and 6 is that there was a decrease in nominal and real money supply in both economies, resulting in a scarcity of money.

To further justify our model of a scarce national currency, we provide survey data from Argentina's crédito users. The vast majority of crédito users, 89%, reported that if they had the choice, they would prefer to be paid for their products with the national currency as opposed to the secondary currency. Also, as will be shown in Section 5.4, receiving peso unemployment insurance more than doubles the chances that a crédito user will stop accepting créditos, which suggests that crédito use is driven by a lack of peso, rather than other factors. Moreover, the crédito holdings in the hands of agents are relatively low when compared to their monthly income. The median crédito user holds only 27 pesos worth of créditos while earning 100 pesos worth of créditos per month. This suggests that crédito users were not using the crédito as a store of value, but instead as a medium of exchange

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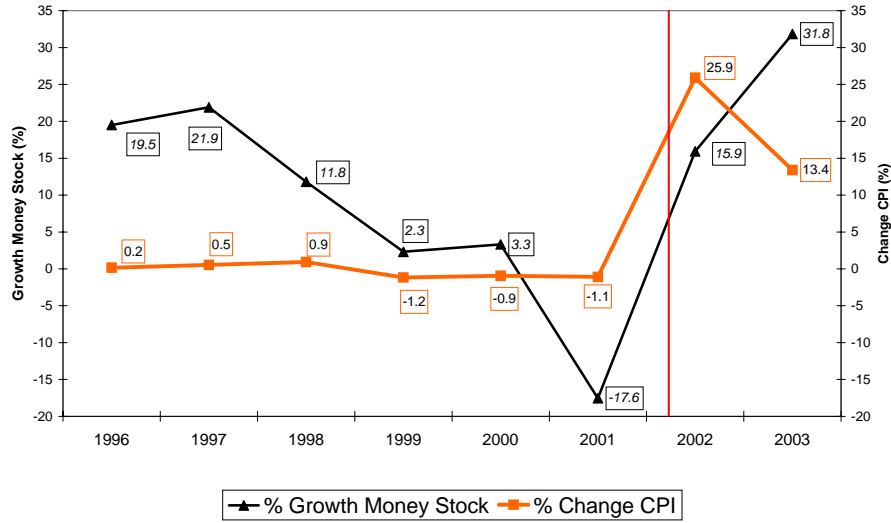
Figure 5: Money Supply and Prices, Argentina 1996-2003

to solve the coincidence-of-wants problem brought about by the scarcity of pesos.

In our theoretical framework individuals are either money holders (some hold pesos while others hold créditos) or goods traders. It is assumed that money is essential to obtain the desired consumption good and that there is no barter in this economy. Therefore money is the medium of exchange that solves the coincidence-of-wants problem. The trading process occurs in pair-wise meetings of individuals, where a successful meeting is one in which money (either pesos or créditos) is exchanged for the desired consumption good. The peso is the national currency, fully accepted in trade by every individual in the economy. The crédito is the secondary currency, which under certain conditions will be accepted in trade by some or all individuals in the economy. Thus the key difference between pesos and créditos is that créditos may be only partially accepted in trade, whereas pesos are sure to be accepted. Sometimes, for exogenous reasons, the national currency becomes scarce, and a secondary currency may arise to relieve this scarcity.

When exactly does scarcity become severe enough to lead to the rise of a secondary currency? To motivate the empirical analysis, we present the relevant factors that determine
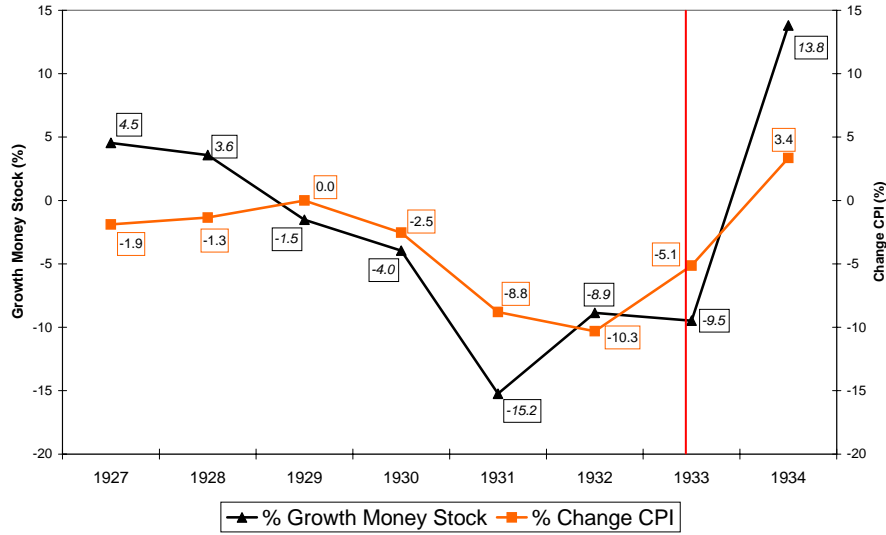
Figure 6: Money Supply and Prices, United States 1927-1934

when both currencies circulate in equilibrium:

1. *The proportion of peso holders.* In order to have both currencies circulating, the proportion of peso holders cannot be too large. In other words, when the national currency is scarce, it is more likely that in equilibrium a second currency will be accepted, given that some currency is needed to obtain a consumption good.

2. *The transaction cost of the currencies.* The higher the transaction cost of the peso relative to the crédito, the more likely the crédito will circulate as well, given that the benefit of accepting the peso is diminished by its transaction cost. Similarly, for a given amount of peso transaction cost, créditos will be more likely to be accepted the lower its transaction cost is.

3. *The matching technology in trade.* The less frequently the pair-wise meetings of traders occur, the more likely the crédito will also be accepted in trade. The intuition of this result is that when the matching technology is less effective and trades happen less often, the wait for a peso trader is longer, and the secondary currency is then more

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valuable because some currency is needed to get a consumption good. Thus, ineffective matching technologies increase the acceptability of the crédito.

4. *The diversification of the economy.* When the economy is more diversified, producing a larger variety of goods, the probability of finding the desired consumption good in a trading match is smaller. Diversification thus increases the value of currency in trade. For a given supply of the national currency, the use of a secondary currency becomes more valuable when the economy is more diversified.

The implications on the proportion of peso holders, on the transaction cost of the currencies, and on the matching technologies will be addressed with our data in Section 5. The implication on the level of diversification in production is not testable in a regression framework and will thus be addressed anecdotally in Section 5.5. Our data also allow us to study in a novel way the actual value (measured in extra income) of the gain to agents who accept créditos in trade, which we do in Section 6.

Next, we describe the formal framework and how it relates to Argentina's recession. Figure 7 provides a simple graphical interpretation of Argentina's monetary experience between 2001 and 2003.
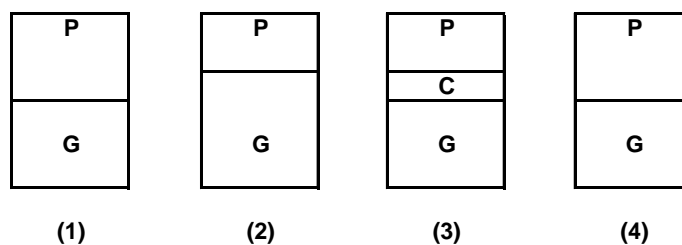
Figure 7: Argentina's Monetary Experience

An exogenous shock to the economy reduced Argentina's money supply in 2001 (see Figure 5), moving the economy from situation (1) to (2) in Figure 7. In terms of the model, the proportion of peso holders (P) diminished and the proportion of goods traders (G) increased. Situation (1) presents an economy in equilibrium using one currency, the peso. We interpret (2) as an out-of-equilibrium situation in which the available money supply is

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too low. Thus, there is room for the introduction of a second currency. A larger model, beyond our framework, predicts that a secondary currency will be introduced as a potential complement to the existing pesos; in this scenario the economy moves to situation (3). Our theory starts at this stage, with the secondary currency already available as an alternative (in a proportion C), and the model studies when it will be accepted in equilibrium. This is the situation in Argentina by the end of 2001. Later, between 2002 and 2003, the Argentine government pursued a massive policy issuing unemployment insurance which infused a large amount of pesos into the areas of the economy where créditos circulated. The resulting larger peso supply in those areas, again an exogenous event, drove the secondary currency out of circulation, and moved the economy from an equilibrium in (3) to situation (4) again. Note that at the same time that the peso supply increased the quality of the secondary currency decreased. It is theoretical and empirically challenging to separate the impact of each of these forces on the end of the secondary currency use.

For the purposes of the present paper our simple model is appropriate because it focuses on when a secondary currency will be accepted in trade, given that it is an option (situation (3) as illustrated in Figure 7) and our data focus on these events. We have information for Argentina in 2002, which is the time during which the crédito was an option available to everybody in the neighborhoods studied. We can thus test for the parameters that determine acceptability of the secondary currency and learn from these findings when an agent, or a local area, or even a country will decide to accept a secondary currency as a medium of exchange.

It is important to note that we could reinterpret our model by saying that a secondary currency is always a latent option to traders, and we only observe it in the data (and the proportion of traders holding it) when it is already accepted by a proportion of individuals. Under this reinterpretation, the entire evolution of Argentina's story above can be explained within the framework of our simple theory.

4 Authors' Collected Data on Secondary Currency Use

The data for this project comes from three surveys that we designed and implemented in two metropolitan areas in Argentina: Tucumán and Buenos Aires. Two surveys were conducted during June of 2002, and the third survey was performed between July and August of 2003. Buenos Aires is the richest state in Argentina, located next to the country's most important port and surrounded by fertile lands, while Tucumán is located in the northwest of Argentina and, even though it has good natural resources, is a relatively poor state. The metropolitan area in Tucumán has a population of approximately 600,000, whereas the population of Buenos Aires is over five million. In Buenos Aires we visited exchange clubs both in the city of Buenos Aires (the capital of the country) and in the surrounding metropolitan area. Tucumán's geographic state gross product per capita is 58% of that of the state of Buenos Aires and 19% of that of the city of Buenos Aires.[23]

4.1 Survey of Exchange Club Participants and Coordinators (SECPC-2002)

This survey covered 919 exchange club participants and coordinators, 299 in Tucumán and 620 in Buenos Aires. The interviews were conducted in twenty-one different clubs, nine in Tucumán and twelve in Buenos Aires, during June 2002.

The sampling process for the SECPC-2002 was a random selection of clubs spread across the two metropolitan areas. A random sample of participants were interviewed during a surprise visit to each club. We visited the clubs during a meeting day, arriving at the club unannounced with a team of five to ten field workers a couple of hours before the meeting started. The survey interviews, which lasted about 15 minutes per participant, were mostly conducted with the participants who were waiting in line to enter the meeting. The waiting time in line could be as long as two hours in some clubs. The coordinator of the club was interviewed on the same day as the surprise visit.

The participants section of SECPC-2002 collected information on club attendance, the

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[23]This information is based on the most recent geographic data available to our knowledge (1996). Data source is INDEC (Offices of the Dirección General de Estadística y Censos).

items sold and bought at the club, their prices, the crédito income and expenditures of participants, the personal peso/crédito exchange rate, the person's preference between receiving pesos or créditos, the number of friends who were members of the club, and the reasons for participating. This section of the survey also collected information on typical control variables such as gender, age, marital status, number of children, educational level, employment status, occupation, income, savings, assets, and sociability.

The coordinators section of SECPC-2002 collected information on the date the club first met, the number of members, the frequency of meetings, the entrance fees, the amount of créditos loaned to a new participant, the most commonly traded items, the club's network, the acceptance of créditos from other nets, the quality of the physical crédito bill, the price control policies, the regulations governing traded items, and the coordinator's perception of what the peso/crédito exchange rate was. This section also collected information on personal characteristics of the coordinator, reasons for coordinating the club, and coordinators' expectations for the clubs.

4.2 Survey of Exchange Clubs' Neighborhoods (SECN-2002 and SECN-2003)

SECN-2002 interviewed 192 neighbors of four clubs, 66 in Tucumán and 126 in Buenos Aires during June 2002. The sampling process for the SECN-2002 was a selection of one out of every five household doors in the neighborhood of each of the four clubs, covering a maximum distance of a ten minute walk from the club. Only household heads (wife, husband, or main supporter of the household) were given the ten-minute interview.

This survey collected information on exchange club membership, opinions about the club, number of friends in the club, expectations concerning the future of the club, if they knew the coordinator of the neighborhood exchange club, and reasons why non-members do not participate. This survey also collected information on the same control variables that SECPC-2002 collected.

SECN-2003 was meant to replicate the SECN-2002 survey on a larger scale and thus interviewed 887 neighbors of the original twenty-one clubs. This survey was done during

July and August of 2003. The sampling process for the SECN-2003 was again a selection of one out of every five household doors in the neighborhood of each of the original twenty-one exchange clubs. Only the household head answered the fifteen-minute interview.

This second neighborhood survey was designed to collect a second round of information from the club neighbors one year after the 2002 surveys. Club membership history was the first set of questions asked. Based on the membership information, the survey collected information either on club experience and participation for ever-members plus all the same control variables, or only information on the control variables for those who never participated.

5 Empirical Evidence on Determinants of Secondary Currency Use

In Section 3, we identified several testable determinants of the acceptability of a secondary currency: the scarcity of national currency, the transaction cost of currencies, and the matching technologies. Here, we introduce the measures designed to capture crédito acceptability and its testable determinants. *Crédito acceptability* will be measured using two criteria: the individual decision to join a local club and the proportion of agents who joined a local club. By mid-2003 the proportion of individuals interviewed who had participated in a local exchange club was 19%, based on retrospective data from the SECN-2003. The fraction of ever-participants for the Buenos Aires clubs is 15% and for those in Tucumán 25%, with neighborhoods ranging from 4% to 61%. These figures indicate a significant level and variability of secondary currency use in Argentina's neighborhoods in 2002, which allows for the study of what determines crédito acceptability. Sections 5.1 and 5.2 examine crédito acceptability at the individual and neighborhood level respectively.

We define the *proportion of peso holders* in a neighborhood to be the fraction of individuals in the neighborhood who earned more than 150 pesos per month (equivalent to 25% of the average Argentine monthly income) in 2002.[24] An exact analog of the model's

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[24]Results are robust to alternative cutoffs.

percentage of peso holders is not empirically feasible, because in reality everyone holds at least some small amount of pesos. Using this definition provides a sense of the scarcity of pesos within a neighborhood and thus the likelihood of meeting a trading partner willing to trade pesos for goods. In the data, the neighborhood-level proportion of peso holders ranges from 28% to 100%.

We simplify the measurement of *transaction cost* of the peso and crédito currencies by measuring solely the transaction cost of the créditos. In our cross-club analysis as well as throughout the country, the peso has a common transaction cost for all clubs, while crédito transaction cost varies across clubs. Since the common peso transaction cost would cancel out across clubs, we lose nothing by focusing only on crédito transaction cost.

We use information collected in the SECPC-2002 to measure crédito transaction cost at the club level. The measures that we use are the quality of the crédito bill,[25] the network level of the club,[26] the acceptance of other club's créditos,[27] and the educational level of the club's coordinator. These variables measure specific club and coordinator characteristics that determine how well the club and the crédito function to serve their users. Low-quality crédito bills are easily falsifiable and the costs generated by this are paid by the crédito user in the same way he pays typical seigniorage when extra bills are printed by the club. Network integration of the club at the local level is associated with better monitoring of club activities, and translates into better functioning clubs with lower costs for crédito users. The acceptance of créditos issued by other clubs increases the cost that club members bear. This is because acceptance of any bill increases the opportunities to circulate counterfeit bills from other clubs in a given club, and because the actual seigniorage generated by the extra printing of créditos comes from multiple clubs. Lastly, the educational level of the coordinator determines also how well organized the club is, which benefits club members in

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[25] Créditos printed on stamped paper or simple photocopies are coded as Low Quality. Créditos printed on special paper without serial numbers are coded as Medium Quality. Créditos printed on special paper with serial numbers are coded as High Quality. Due to the small number of clubs in the data, we only include one out of the three categories.

[26] Clubs that belong to a national net of clubs are coded as National Net. Clubs integrated into regional or local nets are coded as Local Net.

[27] Clubs are coded as either exclusively using their own créditos in trade, or accepting other créditos printed by other clubs.

Table 1: Correlation Matrix for Club Level Characteristics

	1	2	3	4	5
1 Peso Holders	1				
2 Low-Quality Crédito	-0.16	1			
3 National Net	0.36	-0.21	1		
4 Use Some/Any other Crédito	0.67	-0.19	0.29	1	
5 Coord with some College (obs=20)	-0.08	-0.17	0.18	-0.17	1

turn.[28]

Table 1 presents the correlation matrix for the club level variables used to analyze the twenty neighborhoods with complete data. In general, the correlations between the five variables discussed above are low, except for the correlation between the proportion of peso holders in the area and the use in trade of some or any other crédito inside the club. The weak correlations are evidence that there is true variability across clubs in the source of crédito transaction cost and that the results are not driven by a small subset of clubs. Furthermore, if club and crédito characteristics are uncorrelated across observable measures, there is less concern about correlation with unobserved measures.

The *matching technology* parameter captures the difficulty or ease with which a trader is matched with another trader. To capture this effect, we use a number of measures of a trader's ability to find trading partners. In particular, we use an indicator of car ownership, which speaks to the mobility of the agent and the potential to travel longer distances to find new matches. We also consider a measure of sociability which presumably affects the trader's predisposition and ability to find new matches. Sociability is a dummy variable that indicates if the individual is actively involved in social organizations (e.g., social or sports clubs, political parties, or religious organizations).[29]

Complementarily we utilize education and occupation as measures of matching technology. Education is measured as a set of dummy variables, categorized as some college (for individuals with complete or incomplete college education), some high school (for individ-

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[28] We impute the measures of education of the coordinator and use of other créditos for Club 21 based on our assesment of this club.

[29] Unfortunately, the number of pre-club-participation friends who belong to the neighborhood club is not available to us in the 2002 data on crédito users employed in the test in section 5.1. This measure would have captured some social network-specific matching advantages of friends. We do have this measure for a different sample, and it is used in the analysis in section 6.

uals with complete or incomplete high school education), and no high school. We argue that more educated individuals either developed better matching technologies with their education, or already have this better technology in their set of higher abilities. Occupation is also measured as a set of dummy variables. The categories include independent worker (e.g., business owner, independent professional, or technician), dependent manual worker (e.g., dependent technician or dependent house cleaner), dependent administrative (e.g., top- or middle-level executive, teacher, or clerk), and other (including housewife and full-time student). Occupation proxies for individual matching technologies through skills and human capital formation. For example, we expect that dependent manual workers are mainly unskilled workers with low human capital and skill formation, and therefore have lower abilities to find trading partners.

Our database is rich in other individual-level measures. We employ them throughout the empirical analysis to control for their potential effects on the results. As discussed in Section 4, examples of these include individual income, gender, age, and marital status.

5.1 Individual Measure of Crédito Acceptability

We first consider the individual decision to accept créditos in trade (i.e., individual participation in the local exchange club). We estimate probit regressions at the individual level where the dependent variable is the choice to participate in the local club. The individual data used is retrospective 2002 data from SECN-2003 and the club data is from SECPC-2002.[30]

In Table 2 we present five specifications to test the importance of the three theoretically predicted determinants of crédito acceptability. In the first three specifications we separately include each of the three determinants (the proportion of peso holders, crédito transaction cost, and individual matching technologies). In column (4) we combine the three determinants, and in column (5) we run the same specification that we run in (4) but drop the variables that have no significant effect on the individual probability of accepting

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[30]For the variables measuring car ownership, occupation, education, and sociability we use the 2003 information as a proxy for their 2002 values.

créditos in trade. Control variables include income, gender, and region among others.[31] See Table 3 for summary statistics of the variables in Table 2.

We observe that our measure of the *proportion of peso holders* has the predicted effect on crédito acceptability. Specifically, the higher the proportion of individuals with pesos in a given area, the less likely that an individual in the area will accept créditos in trade. For instance, the specification in Table 2, column (5) states that an increase of 10 percentage points in the proportion of peso holders decreases by 2% the probability that an individual in the area will accept créditos in trade. An increase of one standard deviation in the proportion of peso holders in a neighborhood translates into a 21% decrease of the individual probability relative to the mean probability of accepting créditos in trade.

The data also confirm the predicted effects of the *transaction cost* measures. In particular the network level of the club, the use of other créditos in trade, and the educational level of the coordinator show significant effects in columns (4) and (5). On the other hand, the quality of the crédito is significant only in column (5) but has its predicted effect in columns (4) and (5). Interpreting results from column (5) in Table 2, we find that low-quality créditos significantly decrease the individual probability of joining the club by 4.5%, which amounts to 24% of the mean probability of accepting créditos. When the club belongs to a national network, the individual probability of accepting créditos significantly decreases by 8.1%, representing 43% of the mean probability. The club policy of accepting crédito bills printed by a different club significantly decreases the individual probability of accepting créditos by 13.1%, or 69% of the mean probability. Highly educated club coordinators increase the individual probability of accepting créditos by 11.9%, which is 62% of the mean probability.

Finally, concerning *matching technologies*, we observe in Table 2 that car ownership and education of the individual show the predicted effects. Owning a car significantly decreases the individual probability of accepting créditos by 11.3-11.7%, or 59-62% of the mean probability. A higher educational level, which we argue measures skills for matching technologies, shows the expected but not statistically significant result of decreasing the

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[31]Every specification controls for Gender, Individual Income, Age, Age Squared, Marital Status, Has Children, and Geographic Region. Only Gender, Has Children, and Region have some significant coefficients.

Table 2: Determinants of Crédito Acceptability: Individual Level (Marginal Effects)

| | Individual Level Probit on Club Participation | | | | |
	Col (1)	Col (2)	Col (3)	Col (4)	Col (5)
Peso Holders	-0.3113***			-0.1547*	-0.2038***
	[.0863]			[.0863]	[.0652]
Low-Quality Crédito		-0.0518		-0.0271	-0.0451*
		[.0362]		[.0288]	[.0260]
National Net		-0.0698		-0.0728*	-0.0812*
		[.0504]		[.0426]	[.0443]
Use Some/Any other Crédito		-0.1999***		-0.1190***	-0.1308***
		[.0361]		[.0221]	[.0269]
Coord with some College		0.1168*		0.1083**	0.1194**
		[.0639]		[.0536]	[.0553]
Own Car			-0.1130***	-0.1154***	-0.1172***
			[.0280]	[.0301]	[.0291]
Some College			-0.0429	-0.0198	
			[.0327]	[.0353]	
Sociable			0.1162**	0.1120***	0.1129***
			[.0455]	[.0427]	[.0421]
Independent Occupation			0.0609	0.0469	
			[.0441]	[.0451]	
Dep Manual Occupation			0.1549**	0.1212*	0.0929**
			[.0686]	[.0655]	[.0441]
Other Occupation			0.0519	0.0289	
			[.0401]	[.0393]	
Observations	688	688	688	688	688

1. Clustered Standard errors by Club and Region in brackets
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Included Controls are Gender, Individual Income, Age, Age Squared, Marital Status, Has Children, and Geographic Region.
4. The base case for the marginal effect is every variable evaluated at the mean.
5. Other Occupation includes Housewife or Full-time Student. Dependent Administrative Occupation is the excluded category.

acceptability of a secondary currency in trade by 2-4.3%, or 11-23% of the mean local acceptability. Sociability, though, is shown to have a strong and significant effect contrary to what theory predicted; being classified as sociable increases the probability of accepting créditos by 11.2-11.6%, or 59-61% of the mean local acceptability. One interpretation of this seemingly puzzling result is that sociability is measuring a political or social preference that does not improve matching abilities.

Last, occupation of the individual, which again relates to skills and human capital accumulation, shows a significant and positive effect on the individual probability of accepting créditos, but only for dependent manual workers who see a 9.3-15.5% increase in probability of crédito acceptability (49-82% of the mean local acceptability). This finding goes along with our prediction that individuals with occupations that do not enhance skill formation

Table 3: 2002 Club and Neighbors' Characteristics: Summary Statistics

	Mean	SD	Obs	Range
Participation Rate (Individual)	0.19	0.39	688	0-1
Buenos Aires	0.13	0.33	357	0-1
Tucumán	0.25	0.43	331	0-1
Participation Rate (Club Level)	0.19	0.14	20	0.04-0.61
Buenos Aires	0.15	0.11	11	0.04-0.36
Tucumán	0.25	0.16	9	0.05-0.61
Peso Holders '02 (>$150)	0.78	0.20	20	0.28-1
Buenos Aires	0.91	0.13	11	0.53-1
Tucumán	0.63	0.17	9	0.28-.89
Low-Quality Crédito	0.05	0.22	20	0-1
National Net	0.45	0.51	20	0-1
Use Some/Any other Crédito	0.40	0.50	20	0-1
Coord with some College	0.35	0.49	20	0-1
Own Car	0.28	0.45	688	0-1
Some College	0.20	0.40	688	0-1
Sociable	0.13	0.34	688	0-1
Independent Occupation	0.27	0.45	688	0-1
Dep Manual Occupation	0.16	0.37	688	0-1
Dep Administrative Occupation	0.20	0.40	688	0-1
Other Occupation	0.36	0.48	688	0-1
High Income	0.14	0.35	688	0-1
Medium Income	0.35	0.48	688	0-1
Low Income	0.28	0.45	688	0-1
Missing Income	0.23	0.42	688	0-1
Male	0.26	0.44	688	0-1
Age	47.88	15.71	688	19-87
Married	0.65	0.48	688	0-1
Has Children	0.85	0.36	688	0-1
Buenos Aires Region	0.52	0.50	688	0-1

or human capital may have less matching abilities, which explains their higher acceptability of créditos.[32]

Alternatively, other interpretations could arguably be attached to our findings, especially concerning the measures of matching technologies. Car ownership could rather capture a wealth effect as opposed to an increased ability to find matches. This seems unlikely though, given that in the analysis we include individual income and other individual controls that capture wealth. The findings on education and occupation could be capturing a social stratification effect as opposed to a matching technology effect. Under this interpretation, individuals in the same social stratum trade easily with each other but not with individuals

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[32] Even though gender is not directly motivated by the theoretical framework under consideration, we consider it interesting that it has a very significant effect on the acceptability of créditos in trade. The evidence indicates that men are significantly less likely to accept créditos in trade. This fact, combined with the fact that 75% of the club participants are women, will be further studied in future research.

from other strata. This would predict that strata of all types of education or occupation should form clubs. The fact that we observe low education and dependent manual workers in all clubs rejects this alternative interpretation, instead suggesting that low education and dependent manual workers have worse matching technologies than others.

5.2   Local Measure of Crédito Acceptability

An alternative way to measure crédito acceptability is to use the proportion of neighbors who accept créditos in the local area. This measure captures the local scale of crédito acceptability for the neighborhood and complements the individual measure used previously. One disadvantage of this measure, however, is the power limitation in the regression analysis when using twenty observations, one for each neighborhood in which we conducted interviews and have full data. The data for this analysis come from SECPC-2002 and SECN-2003 retrospective 2002 data. Table 4 presents three specifications, one in which we include the peso holders variable and transaction cost measures combined, and the others in which we include each of these two determinants of crédito acceptability separately.[33]

The evidence in Table 4 indicates that the *proportion of peso holders* in the area affects the acceptability of the crédito measured at the local level, but the result in column (1) is not significant. An one standard deviation increase in the proportion of peso holders in the area decreases the local acceptability of créditos by 5.5-7.3%, or 29-38% of its mean value.

All *transaction cost* measures demonstrate the predicted effect. Low-quality créditos decrease local crédito acceptability by 6.3-7%, or 33-37% of the mean probability of accepting créditos, but the standard errors are large. Club networking at the national level, as opposed to the local level, decreases neighborhood crédito acceptability by 7.2-7.7%, or 38-41% of the mean acceptability, again with large standard errors. The club policy of accepting crédito bills printed by a different club significantly decreases the local acceptability of créditos by 17.9-21.7%, or approximately 100% of the mean local acceptability. Finally, highly educated club coordinators significantly increase the local acceptability of créditos by 10.8-11.7%, or around 60% of the mean local acceptability. Overall, two of the four

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[33]In all regressions we control for the club region.

Table 4: Determinants of Crédito Acceptability: Local Level

Dependent Var is Proportion of Crédito Users in each Club

	Col (1)	Col (2)	Col (3)
Peso Holders	-0.277	**-0.367***	
	[0.177]	[0.193]	
Low-Quality Crédito	-0.063		-0.07
	[0.116]		[0.122]
National Net	-0.077		-0.072
	[0.069]		[0.073]
Use Some/Any other Crédito	**-0.179****		**-0.217****
	[0.080]		[0.080]
Coord with some College	**0.117***		**0.108***
	[0.056]		[0.059]
Observations	20	20	20
R-squared	0.61	0.3	0.53

1. Standard errors in brackets
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. All regressions include Regional dummy and constant term.
4. Peso Holders is defined as the proportion of neighbors who earn
>$150 per month.

club and coordinator measures support, with statistical significance, the prediction that a secondary currency is more accepted when it bears a smaller transaction cost. The other two measures show the predicted effect but are not statistically significant.

5.3 Results So Far

The results presented so far support the empirical implications drawn from monetary theory concerning secondary currency acceptability. We now quickly integrate the results from the individual and neighborhood level analyses.

As predicted by Kiyotaki and Wright (1993), the *proportion of peso holders* has a significantly negative effect on the individual acceptability of the secondary currency. It also shows the predicted effect on club-level acceptability of the crédito, but loses statistical significance when including transaction cost measures as well.

The *transaction cost* measures have the expected effect on crédito acceptability both at the individual and the neighborhood level. The use of créditos printed by other clubs and having a highly educated coordinator demonstrate significant effects both at the individual and neighborhood level; however, low quality crédito bills and the club belong to a national network of clubs only have significant effects at the individual level.

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Finally, three of the four measures of *matching technologies* show the predicted effects on individual crédito acceptability. Owning a car and being a dependent manual worker both have significant predicted effects, but the education level of the individual is not significant. Sociability shows an effect on the individual acceptability of secondary currency that is unexpected and statistically significant.

5.4 Determinants of Ending Crédito Acceptability

Having looked at the factors behind the decision to start accepting créditos, we now examine the factors behind the decision to stop accepting créditos. If we find that individuals stop accepting créditos when they receive "free pesos" from the government, it would be an indication that peso scarcity was a driving force behind the emergence of the créditos. This evidence, though not a direct empirical implication of the theory that frames this paper, would complement our previous study of the determinants of crédito acceptability.

To perform this test we exploit the fact that the Argentine government significantly increased the coverage of unemployment insurance benefits by the end of 2002 and the beginning of 2003. In Argentina near the beginning of 2002, there were approximately 200,000 individuals receiving unemployment insurance. This number increased to 2,500,000 by the beginning of 2003.[34] Crédito acceptability peaked during the first half of 2002, right before the government increased its unemployment insurance coverage. Thus, we investigate to what extent receiving these benefits affect the crédito acceptability decision.

We estimate a semiparametric model for survival time, following Cox's (1972) proportional hazard model. The intuition behind the model is to measure if receiving the peso transfer from the government affects when the crédito user stops accepting créditos. We expect to find that crédito users are more likely to stop accepting créditos upon receiving pesos from the government, compared with similar crédito users who did not receive these transfers. This evidence would support the hypothesis that the national currency was suf-

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[34]This data comes from a private conversation with an Argentine government official. Most of the subsidies are under the category of "Plan Trabajar." These target the unemployed population, and the beneficiaries get the subsidy in exchange for a few hours of work per week (which in theory are around 20, but in reality 0). Other subsidies such as "Plan Jefe de Hogar" target unemployed parents.

fering from problems of scarcity which led individuals to trade with créditos in the first place.

Formally, the Cox proportional hazard model that we estimate assumes the hazard function h as follows:

$$h(t) = h_0(t)e^{\beta_1 x_1 + \ldots + \beta_k x_k}$$

The hazard function approximates the probability of ending crédito acceptability within a short interval, conditional on having accepted créditos up to the starting time of the interval.[35] The Cox model is estimated by maximum-likelihood and delivers estimates of the hazard ratios $e^{\beta_1}, \ldots, e^{\beta_k}$. These ratios measure the proportional increase in the individual probability of ending crédito acceptability corresponding to one unit increases in the explanatory variables $x_1, \ldots x_k$. The advantage of using Cox's model over parametric estimations is the freedom allowed in the structure of the hazard function– in particular, we do not need to estimate $h_0(t)$ to estimate the hazard ratios. In the estimation, $h_0(t)$ represents an individual specific baseline hazard or individual heterogeneity. In our case we are not interested in estimating the actual hazard function; instead, we want to study if a particular variable shifts the hazard function.

To run this estimation we use our sample of crédito users from the neighborhood survey SECN-2003. We have retrospective information on the dates crédito users joined and left the exchange clubs, and the date they received unemployment insurance, if ever. We measure the duration of club participation in days. To test for the effect of receiving the peso transfer on ending crédito acceptability we estimate the model and calculate the hazard ratio for receiving unemployment insurance. We also include the previously studied determinants of crédito acceptability: the proportion of peso holders in the neighborhood,[36] transaction

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[35] See Wooldridge (2002), chapter 20 for more details.
[36] We use the 2003 values. Using the 2002 proportion of peso holders delivers similar results.

Table 5: Determinants of Ending Crédito Acceptability (Hazard Ratios)

Timing of Unempl Insurance	**2.208****
	0.720
Peso Holders	1.102
	0.989
High-Quality Crédito	**0.480****
	0.173
National Net	**1.742***
	0.547
Use Some/Any other Crédito	1.396
	0.557
Coord with some College	0.801
	0.241
Own Car	1.102
	0.437
Some College	**0.297***
	0.188
Sociable	0.836
	0.203
Independent Occupation	1.280
	0.471
Dep Manual Occupation	1.299
	0.299
Other Occupation	1.053
	0.262
Observations	131

1. Italicized clustered standard errors by club.
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Included Controls are Gender, Individual Income, and Region.

cost measures for the club,[37] and individual matching technology measures.[38]

Table 5 presents the estimated hazard ratios.[39] As expected, we find that when a crédito user receives unemployment insurance, she is 2.2 times more likely to quit the club than a crédito user who did not receive unemployment insurance. Additionally, some of the studied crédito acceptability determinants show a significant effect on ending crédito acceptability. In particular, if the crédito user participated in a high-quality crédito club (which proxies for low crédito transaction cost), she is half as likely to end her crédito acceptability than

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[37]Note that all transaction cost measures are cross-club measures in 2002. In a way, we are proxying the evolution of their transaction cost over time according to what we observed in the 2002 cross-section between clubs. Even if peso transaction cost changed over this time frame, it did not change differentially across clubs. Given that it is still much smaller than the crédito transaction cost measures, we do not include it in the analysis.

[38]These measures are the 2002 values, or its proxies.

[39]The estimation assumes no correlation between the date of entering the club and either duration or unobserved heterogeneity, conditional on covariates. Wooldridge (2002) suggests adding dummies for different entering times to control for this potential issue. Adding a dummy to indicate joining the club before or after the peak of crédito acceptability partially diminishes the significance of the unemployment insurance result, but it always maintains the expected sign.

a crédito user in a lower-quality crédito club.[40] If the crédito user participated in a club coordinated at the national level (which proxies for high crédito transaction cost) she is 1.7 times more likely to stop accepting créditos compared with crédito users involved in clubs coordinated at the regional or local level. The proportion of peso holders in the area shows no significant effect on ending crédito acceptability. No significant effects are found for the two other crédito transaction cost measures, whose point estimates show the expected signs. Education is the only individual matching technology variable that shows a significant effect, but its coefficient seems to go against our previous results concerning crédito acceptability.

To verify the validity of the assumed proportionality of the hazard ratios specified by Cox, we perform a global test based on Grambsch and Therneau (1994) and find no evidence that the proportional hazards assumption is violated. Thus, the evidence supports the importance of scarcity of the national currency to the use of the secondary currency, as we find that individuals are more than twice as likely to end crédito acceptability when they receive unemployment insurance, compared to crédito users who do not receive such benefits.

5.5   Anecdotal Evidence on Diversification

So far we have empirically addressed three determinants of crédito acceptability motivated by our theoretical framework: the proportion of peso holders, the transaction cost of the currencies, and the individual matching technology. We also consider it important to address, even if only anecdotally, another determinant of crédito acceptability motivated by our framework, namely the diversification of the economy.

A common question regarding secondary currency use is why we do not observe it more in other countries that have gone through the sort of deep recessions and money shortages as Argentina and the United States did. We strongly believe, even if we can support this belief only anecdotally and theoretically, that the answer resides in the level of economic

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[40]Now, the excluded categories of crédito quality are Low and Medium. Low-quality créditos do not have significant effects relative to Medium- and High-quality créditos.

Table 6: Argentine National Income by Industrial Origin, 2002

	(%)
Agriculture, forestry, and fisheries	6.3
Mining	2.1
Contract Construction	3.6
Manufacturing	15.4
Wholesale and Retail Trade	14.2
Finance Intermediation and Real Estate	23.2
Transportation, Storage and Communications	8.8
Public Utilities (Electricity, Gas, Water)	3.1
Education, Social Services, Health, and Other Ss	15.5
Government Administration and Defense	6.0

Table 7: United States National Income by Industrial Origin, 1933

	(%)
Agriculture, forestry, and fisheries	9.2
Mining	1.5
Contract Construction	2.0
Manufacturing	18.9
Wholesale and Retail Trade	13.7
Finance, Insurance, and Real Estate	14.2
Transportation	7.5
Communication and Public Utilities	5.0
Services	13.9
Government and Government Enterprises	13.2

diversification when the crisis occurs. Argentina and the United States were both highly industrialized and diverse countries at the time of the onset of exchange clubs and the use of the secondary currency. Argentina's GDP per capita was $6,405 in 2001 (measured in 1995 dollars).[41] The comparable measure for the United States in 1933 was $4,478.[42] While Argentina's GDP per capita was higher than the U.S. value, both show the same order of magnitude, indicating a similar level of development, which proxies for diversification. Tables 6 and 7 show the income composition by industrial origin for both countries at the time of the crises.[43]

Tables 6 and 7 show a similar composition of national income in both economies, further evidencing a similar degree of diversification. Monetary theory predicts that diversification increases the benefits from using currency to trade because the coincidence-of-wants problem

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[41] Data source: World Development Indicators, The World Bank; Bureau of Labor Statistics for CPI price correction data.

[42] Data source: U.S. Department of Commerce-Bureau of Economic Analysis; Bureau of Labor Statistics for CPI price correction data.

[43] Data source for Table 6 is INDEC. Data source for Table 7 is the U.S. Department of Commerce-Bureau of the Census.

becomes extremely difficult for very diverse economies. The same mechanism applies to the benefits accrued from using a secondary currency. For countries in which the number of goods produced and consumed is small, the coincidence-of-wants problem is not large, because with a relatively small number of matches the probability of a successful trade is much larger than in a more diversified country. In an agrarian economy, since production and consumption is based on a small set of goods, the exchange process is not difficult even when the money supply is low. Finding the desired consumption good between a few options is a much more likely event than finding it in an economy where thousands of different goods are produced. In a diversified economy, like Argentina in 2002 and the United States in 1933, the trade-facilitating role of a currency takes on added importance in the face of money shocks and is thus an environment in which a secondary currency would be likely to arise.

And, in fact, the transactions performed with secondary currency involved a large variety of products both in Argentina and in the United States. For example, in Argentina créditos bought and sold items as diverse as homemade food, repair services, dental services, electronics, and office supplies.[44] In the United States, we are aware that trade with scrip involved food, clothes, medical services, and musical instruments.[45]

For further anecdotal evidence on the importance of diversification, Table 8 presents episodes in countries around the world in which similar crises occurred. Defining a monetary crisis as one in which the real money supply decreased by 10% or more, with a maximum of 2% inflation, we find twenty-four country-year crises in our sample.[46] We use the 2% cut-off for inflation to isolate cases in which real money supply shrinks mainly because of

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[44]The items that we observed being traded in clubs in Argentina broadly fall into four categories: homemade food and other self-production (e.g. homemade bread, clothes, pillows, vegetables, and flowers); services (e.g. bike and car repair services, painting services, English lessons, sewing lessons, medical services, taxi rides, laundry services, babysitting, publicity services, cell phone activation, cleaning services, massages, astrological services, plumbing services, electricity services, computer services, printing services, and haircuts); new not-homemade goods (e.g. notebooks, books, pens, trays, dolls, cleaning products, CDs, VCRs, candy, wood, car parts, sugar, rice, salt, houses, windows, and faucets); and used goods (e.g. clothes).

[45]Other items that Fisher (1934) mentions and the photos from "Library of Congress, Prints & Photographs Division, FSA-OWI Collection" show are haircuts, shoe repair services, printing services, radio loudspeakers, auto mirrors, snow plows, gasoline, oil, and houses.

[46]The considered sample, from World Development Indicators 2001, covers the period 1975 to 1999. It includes a varying number of countries per year that ranges from 76 in 1975 to 140 countries in 1996, with complete data on money supply (M1), consumer price index, and GDP per capita (measured in 1995 dollars).

nominal money supply shrinkage, as opposed to inflation being the main channel.[47] Note from Figures 5 and 6 that inflation rates in Argentina and the United States during the crises under consideration were negative, which motivates our inflation cut-off choice.

To proxy for the diversification of the country at the time of the crisis, we use the GDP per capita at the time of the crisis to indicate its development level; we also compute the relative GDP per capita of the country with respect to the United States. Twenty-two out of the twenty-four countries experiencing crises have a lower GDP per capita than the United States did in 1933.[48] These same twenty-two cases have less than 25% of the GDP per capita of the United States. This evidence supports our view regarding the importance of a country's development in accepting a secondary currency in trade when facing such a monetary crisis. To the best of our knowledge none of the listed countries under monetary crises accepted in trade a secondary currency on a significant scale.

It is worth noting that Kuwait in 1984 and Barbados in 1995, even though relatively wealthy compared to the United States, were not highly diversified economies. In Kuwait petroleum accounts for nearly half of GDP, and Barbados mostly depends on sugarcane cultivation and related activities.[49] Similar cases are Gabon, where the oil sector accounts for 50% of GDP, Saint Kitts and Nevis, which concentrates on sugar and tourism, and Dominica, which concentrates on bananas.[50] Again we are not surprised that a secondary currency was not largely used in trade in the cases presented in Table 8, given the low development and diversification of the countries that suffered such crises. This anecdotal evidence supports the theoretical prediction that a secondary currency is more likely to be accepted in diversified economies.

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[47] As mentioned in the Introduction, money supply crises driven by inflation are associated with a different set of issues than money supply crises driven by nominal money shortages. We focus on the issues and consequences of crises driven by nominal money supply shrinkage.

[48] Remember, the U.S. GDP per capita for 1933 was $4,478 (measured in 1995 dollars). This value for 2001 in Argentina was $6,405.

[49] From "The World Factbook," 2004, CIA.

[50] From "The World Factbook," 2004, CIA.

Table 8: Money Supply Crises

Country	Year	Annual Change in M1	Annual Change in CPI	GDP pc (1995 dollars)	GDP pc/GDP pc US
Azerbaijan	1998	-25.56	-0.69	431	0.01
Barbados	1995	-17.01	1.88	7,037	0.25
Benin	1993	-13.16	0.44	355	0.01
Cameroon	1992	-27.58	-0.02	674	0.03
Cameroon	1993	-14.09	-3.21	634	0.02
Central African Republic	1998	-18.29	-1.89	341	0.01
Chad	1993	-27.67	-7.07	207	0.01
Cote d'Ivoire	1989	-11.55	1.05	815	0.03
Dominica	1993	-12.08	1.57	3,005	0.11
Gabon	1987	-12.24	-0.95	3,797	0.15
Gabon	1992	-27.16	-9.54	4,295	0.16
Gambia, The	1994	-11.67	1.71	352	0.01
Kuwait	1984	-18.26	1.18	11,157	0.49
Mali	1990	-10.83	0.61	252	0.01
Niger	1990	-11.71	-0.81	235	0.01
Panama	1988	-31.28	0.36	2,393	0.09
Rwanda	1989	-12.52	1.01	306	0.01
Senegal	1990	-11.54	0.33	566	0.02
St. Kitts and Nevis	1988	-12.26	0.23	4,109	0.16
Togo	1988	-29.29	-0.15	380	0.01
Togo	1992	-27.23	1.39	332	0.01
Togo	1993	-18.46	-1.01	273	0.01
Tonga	1995	-13.86	1.44	1,695	0.06
Vanuatu	1985	-12.70	1.07	1,672	0.07

6 Empirical Evidence on the Value of Accepting Secondary Currency

While theory predicts that créditos will be accepted in trade when doing so makes people better off, it does not indicate what the size of the gain is empirically. In this section, we take advantage of the detailed micro-level data we have collected to estimate the gain obtained by accepting créditos, both at the individual and aggregate levels.

To perform this estimation, we would ideally compare the market outcome of an agent accepting créditos with the corresponding outcome for a comparable agent who does not accept créditos. Of course, simple theory under symmetric equilibrium predicts that comparable agents facing the same circumstances behave equally. Therefore, if simple theory holds, we would be unable to measure the gain from accepting créditos.

A more sophisticated theory, in which individuals face informational asymmetries, would allow us to exploit these differences in order to estimate the gain from accepting créditos. This asymmetry may take the form of some people either ignoring the existence of the crédito or simply miscalculating its benefits– ideally in a way such that the informational asymmetries are not correlated with economic performance of the individuals. We argue,

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and support with evidence, that such asymmetries are present in our data. We therefore proceed to estimate the gain from crédito use to be the extra income that crédito users earn over similar uninformed or misinformed non-crédito users.

To measure the discounted expected payoff that theory proposes we use the monthly income of the agent. Income in a given month has been shown to predict future income well and thus captures our theoretical interest.[51] The main advantage of using monthly income for this measure is that we have good information for it in our data, both for agents who do not accept créditos and agents who do.

The income measure for agents who do not trade with créditos is relatively straightforward. We use the individual monthly income (in pesos) that agents who never participated in a club declared for 2002 in our SECN-2003 survey. The average income in pesos for non-participants in our sample is 401 pesos, with a median of 313 pesos for the 429 agents interviewed for whom we have complete data.

The slightly more challenging income measure is the one for agents who accept créditos in trade. To calculate this measure we start with the crédito income earned in the club in the agent's most recent visit prior to the survey. We then multiply this by the number of weekly visits to the club the agent made during the week prior to the survey.[52] This gives an estimate of weekly club income in créditos that when multiplied by four provides an estimate of a monthly club income in créditos. Finally we multiply this value by the club median exchange rate (pesos per crédito) to get an estimate of the monthly crédito income measured in pesos.[53] Figure 8 plots a kernel density estimation of the reported individual exchange rates. This last transformation makes it directly comparable to the monthly peso income from the non-club activities, as well as allowing us to compare crédito incomes across clubs that use créditos with potentially different values. The crédito income

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[51]MaCurdy (1982) shows with Michigan Panel Study of Income Dynamics (PSID) data that the change in income is approximately well described as a random walk plus a moving average term.

[52]If the club participant did not attend the club the previous week, we assign him a weekly number of visits of 0.5. Given that he is present at the moment of our survey, he has visited the club at least once in the last two weeks.

[53]Because clubs "outlawed" the trade of créditos for pesos, there is no data on actual exchange rates. Our SECPC-2002 collected individual information on the subjective individual exchange rate between pesos and créditos. We construct the club median exchange rate to convert the individual crédito income from the club to the equivalent peso income.

measured in pesos described above has a mean of 272 pesos and a median of 100 pesos for the 639 interviewed participants in 2002 for whom we have complete data. The peso income from non-club activities for these individuals who accept créditos has a mean of 206 pesos and a median of 138 pesos in 2002. These data come from our survey of club participants (SECPC-2002).[54],[55]
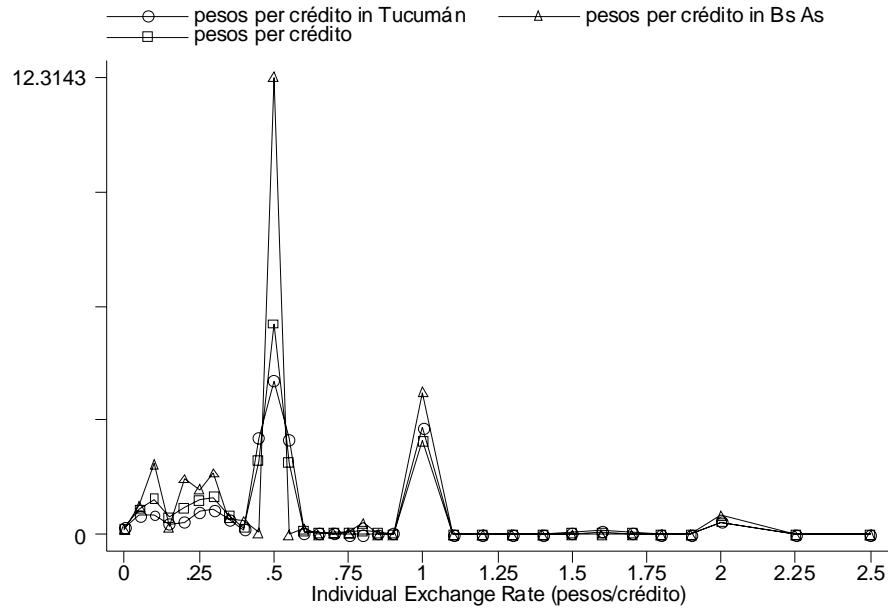

Figure 8: Individual Exchange Rate Distribution (Pesos per Crédito)

For a first look at the income data by crédito acceptability status, we plot the kernel density estimations of the income distribution for crédito users and non users.[56]

From Figure 9 note that both income distributions lie close to each other, suggesting that total income is distributed similarly for crédito users and non users. Of course, this graph does not account for differences between agents, which we proceed to do next.

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[54]Data on income are reported for the 639 crédito users and 429 non-users with complete data in twenty exchange clubs.

[55]Note that the presented means and medians for crédito users are weighted by the potential over/undesampling of certain clubs, as described in Appendix B.

[56]The following are Epanechnikov kernel density estimations with a specified width of the density window around each point of 50 pesos. The kernels are weighted by the potential over/undesampling of certain clubs, as described in Appendix B.
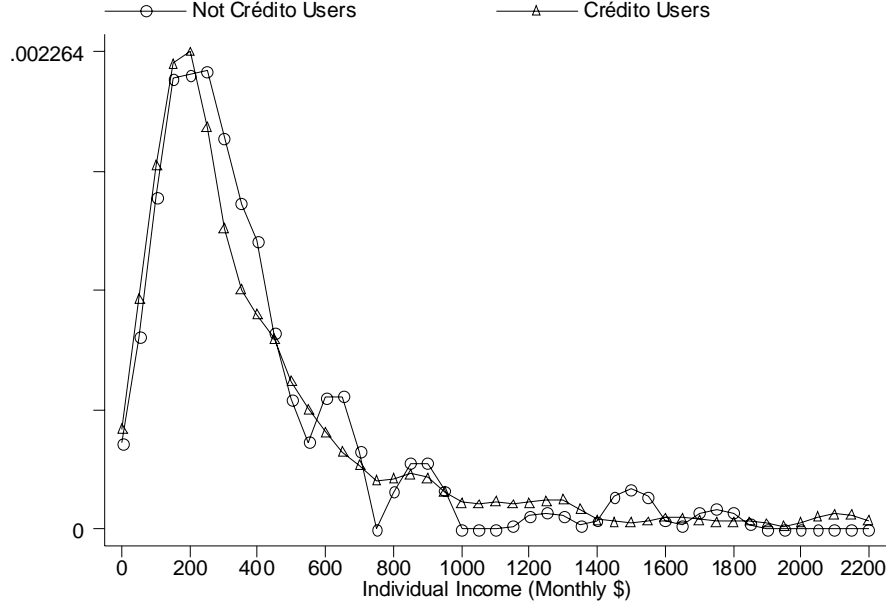
Figure 9: Income Distribution for Crédito Users and Non Users

6.1 Estimation of the Value of Accepting Créditos

To perform this estimation we borrow methodology from the applied-micro empirical literature.[57] In particular, we use the matching method by propensity score to estimate the average treatment on the treated (ATT) effect on total income that an individual perceives when she accepts créditos in trade.[58]

The propensity score $p(X)$ is defined by Rosenbaum and Rubin (1983) as the conditional probability of being treated given pre-treatment characteristics. Treatment in our context is defined as accepting créditos in trade. Formally, the propensity score is:

$$p(X) \equiv \Pr\{D = 1|X\} = E\{D|X\}$$

where $D = \{0, 1\}$ is the indicator of accepting créditos and X is the vector of pre-treatment characteristics. From now on, we will use the notation T to indicate the situation $D = 1$,

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[57]Angrist and Krueger (1999) present in detail existing empirical methods and applications to labor economics. Duflo (2000) concisely describes the evaluation problem and commonly used empirical methods applied in empirical development, labor and public finance fields.

[58]Rosenbaum and Rubin (1983) first introduced this methodology. See also Heckman, Ichimura, and Todd (1997,1998), and Dehejia and Wahba (1999, 2002).

and C to indicate the situation $D = 0$. Rosenbaum and Rubin (1983) show that if treatment is random within cells defined by X, it is also random within cells defined by the values $p(X)$. Then, if $p(X)$ is known, the ATT effect is defined as the average increase in income upon treatment:

$$ATT \equiv E\{Y_{T,i} - Y_{C,i}|T, p(X_i)\}$$

We can estimate ATT as:

$$
\begin{aligned}
ATT &= E\{Y_{T,i}|T, p(X_i)\} - E\{Y_{C,i}|C, p(X_i)\} - [E\{Y_{C,i}|T, p(X_i)\} - E\{Y_{C,i}|C, p(X_i)\}] \\
&= E\{Y_{T,i}|T, p(X_i)\} - E\{Y_{C,i}|C, p(X_i)\}
\end{aligned}
$$

under the assumption that:

$$[E\{Y_{C,i}|T, p(X_i)\} - E\{Y_{C,i}|C, p(X_i)\}] = 0$$

This assumption says that after conditioning on the $p(X_i)$ there are no systematic differences between the crédito users and non-crédito users. We will present evidence below as to why we think this assumption is appropriate in our estimation. The intuition we offer is that the non-crédito users, who have the same characteristics as the crédito users, do not use créditos because of informational asymmetry issues unrelated to their income-generating capabilities.

A main advantage of using matching by propensity score over exact matching is that exact matching is not practical when there are many conditioning variables or when such variables are continuous. By aggregating all conditioning variables into one propensity score, we are able to bypass the problem of not having a large number of observations for the comparison agents (in this case, the non-crédito users) in all categories of the conditioning variables. Moreover, the propensity score allows us to work easily with continuous variables. As has already been mentioned, the literature shows that full control for the observed

covariates can be obtained by simply controlling for the function $p(X)$.

We implement a matching method instead of other empirical methods for the following reasons. The non-parametric structure of the propensity score allows us to better compare treated and control observations than regression analysis and it allows for a choice of appropriate control observations. We choose matching over difference-in-difference (DD) estimations because in our case DD could be biased given the structure of our data. We have "during" and "after" treatment data (instead of "before" and "after" data). This feature of our data can potentially amplify the problems associated with the assumptions that DD imposes on shocks. Another reason not to use DD is that our data includes a panel only for non-crédito users, and two cross-sections for crédito users. Potentially important factors assumed constant over time at the individual level with DD may not hold for this sample. Lastly, we have not implemented the instrumental variable approach simply because we do not have an instrument for crédito acceptability for the individuals in our sample.

Weights in the estimation of the propensity score are introduced to avoid sampling biases.[59] We also impose the balancing condition and the common support condition because of the debate in the literature over potential biases coming from small samples and appropriate choice of control observations.[60] The particular balancing condition that we test for imposes that after breaking the sample into ordered groups, such as quartiles, based on propensity score estimates, the means of the propensity score estimates and the control variables do not differ between treated and control groups of the same quartiles (at the 1% level). We perform multiple matching methods using the propensity score (Stratification, Radius, Kernel, and Nearest Neighbor) to show that our results are not sensitive to the choice of method.[61]

The Stratification method involves dividing the treatment and control groups into strata by ranges of propensity scores, as has been done for verification of the balancing property.

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[59] Appendix B details the weights incorporated in the estimations.

[60] The common support condition restricts the tests performed of the balancing property only to use the observations whose propensity scores belong to the intersection of the supports (or ranges) of the propensity score of treated and control observations.

[61] Becker and Ichino (2002) present an overview of these methods and provide STATA code to implement them. We modified this code to allow for correct weighting of the ATTs.

It calculates the ATT as the weighted average of each stratum's ATT, weighting each by the weighted number of treated observations in the stratum. The Radius method calculates the ATT as the weighted average of the individual ATTs obtained by comparing a treated observation with all control observations whose propensity score is within a fixed radius of the propensity score of the treated individual. The Kernel method mirrors the Radius method, but the individual ATTs are constructed by matching each treated observation with all weighted controls, where weights are generated by kernel density and are inversely proportional to the differences in propensity scores.[62] The Nearest Neighbor method again computes ATT as the weighted average of the individual ATTs estimated with the comparison between each treated observation and the control observation that has the propensity score closest to that of the treated observation.[63]

Standard errors use the bootstrap method, following Agodini and Dynarski's (2004) recommendations. This method replicates the complete process used to compute the ATTs, including the probit and the choice of control observations. However, as Agodini and Dynarski do, we assume in all the bootstraps that the probit specification that balances for the whole sample is appropriate. Bootstrapped standard errors are based on 1,000 replications.

We pursue the propensity score matching to best eliminate the chance that we compare agents who are different in non-random ways. The differences between the two groups of individuals after we control for the relevant covariates are argued to be uncorrelated with their income-generating capabilities. In particular, we control for the variables that determine crédito acceptability such as the proportion of peso holders in the neighborhood, club transaction cost measures, education, occupation, car ownership, and sociability, including as well measures of age, marital status, children, gender and geographic region of the individual.[64] After performing several checks, which are presented in the next section, we are

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[62] Gaussian kernels are estimated with a bandwidth of 0.06.

[63] If equally good nearest neighbors are found in the data for a treatment observation (in the "forward" and "backward" search for neighbors), we randomly pick either forward or backward match.

[64] All of these variables fulfill the balancing property for the ATT estimations. Low percentage of peso holders is an indicator variable that equals one when the neighborhood's proportion is lower than the median proportion. High transaction cost is defined as an indicator variable that equals one when the neighborhood's club has either low quality bills, uses some/any other créditos, national networking, or has a coordinator with no college education. A dummy for HS education captures individual education. A dummy for housewife or full-time student captures occupation. A dummy that equals one for individuals younger than 35 years old

Table 9: Value of Accepting Créditos: Estimation of Average Treatment on the Treated Effects (ATT) on Total Income by Propensity Score Matching

	Stratification Method (7 blocks)	Radius Method (radius 0.1)	Kernel Method	Nearest Neighbor Method
ATT	101.6	102.0	101.2	106.9
St Dev (1,000 B)	36.1	33.6	35.3	41.1
t-stat	2.8	3.0	2.9	2.6
# Participants	633	637	639	639
# Controls	425	425	425	346

1. We match participants and non-participants on the balanced covariates: Low %Peso Holders, Club Seigniorage, Education, Owns Car, Sociability, Occupation, Young dummy, Married, Has Children, Gender and Region.

2. Propensity scores range from 0.02 to 0.69, and have a mean of 0.23.

3. Observations are weighted considering the correct population proportions of participants and non-participants, and the potential over/under sampling of clubs.

confident the variables that we cannot control for (and thus the errors) are uncorrelated with income-generating capabilities.

Table 9 presents our estimates for the four matching methods used to compute the gain that an agent receives when she decided to accept créditos in trade. The estimation shows a significant effect of around 100 pesos per month (approximately US$ 35) for crédito users, and remains similar for all matching methods. This crédito effect represents 17% of the average monthly income in Argentina for 2001 according to per capita GDP. Thus accepting créditos in trade generates a non-trivial amount of income for those who choose to accept them.

To put this effect into perspective we perform several back of the envelope calculations. We estimate that the acceptability of créditos in Argentina at the time of our surveys in mid-2002 (which discussions with multiple crédito users lead us to believe to be a couple of months after its peak) added a value of 1.17% to national GDP. We obtain the aggregate income generated by the clubs by multiplying the proportion of the population participating in the clubs (7% reported in mid-2002), times the total population of the country, the estimated club effect of 100 pesos, and a twelve-month annual period. This amount is then 1.17% of Argentine GDP. To get to a more accurate measure of added value generated by

captures age. Note that this age group represents the bottom third of the age distribution of the surveyed population. Marital status is measured as a dummy for married individuals. Children is a dummy variable equal to one when the individual has one or more children. Including the full set of controls used in Section 5 does not change the results, although the balancing property is not satisfied for every strata and every variable.

the club we should only include the transactions that involved the trading of home produced goods or services. Approximately half of the club participants sold home produced goods or services at the clubs, therefore a more accurate estimation of the added value generated by the acceptability of créditos is around *0.6% of the national GDP.*[65]

6.2 Robustness Checks of the Estimated Value of Accepting Créditos

In this section we examine how appropriate our comparison group is for the estimation. We also address issues of potential overvaluation of the crédito, the quality of retrospective data, crédito gains for home producers versus not-home producers, and crédito gains for experienced versus not-experienced crédito users. Last, we look at crédito holdings to study the size of the capital losses when the crédito goes out of circulation, while also checking if specific groups of crédito users face higher loses than others.

We start by examining the descriptive statistics of the relevant variables in the analysis. Table **??** shows means and standard deviations of the main individual-level variables considered in the empirical analysis in Table 9. It also includes a test of the significant differences of the means between crédito users and non-users.

Potential biases in our estimated ATTs could arise when a variable not included in the propensity score (to satisfy the balancing property) shows a significant difference between crédito users and non-users. We note in Table **??** that this happens only for one variable in the study, pre-club friends who participate or participated in the club. Adding this variable into the estimation does not affect the estimated ATTs.

Next, we evaluate the assumption that the differences between income generating abilities of crédito users and non-users, after controlling for relevant covariates, are random. We use data from SECN-2003 in which we interviewed ever-users and never-users of créditos. Even though these clubs attracted huge numbers of people in mid-2002, they had almost disappeared at the time of our follow-up survey in 2003. We use the 2003 income information to calculate the income differences between crédito ever- and never-users after the clubs

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[65]For this simple calculation we assume that crédito users who sold in the club not-home produced goods would have sold those same goods if they were to trade for pesos. Those trades would not have been added into GDP. This is the justification for excluding them from the previous calculation.

Table 10: Comparison of Club Participants and Non Participants in 2002

2002 Data

VARIABLE	Participants (2002s)			Non Paricipants (2003s)					P-Value [test: mean(partic) =mean(non-p)]
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean Diff.	Std. Error	
Low % Peso Holders 2002 dummy	0.40	0.12	639	0.47	0.09	429	-0.07	0.11	0.513
High Club Transaction Cost 2002 dummy	0.89	0.07	639	0.88	0.07	429	0.01	0.06	0.873
Buenos Aires dummy	0.64	0.08	639	0.50	0.05	429	0.14	0.11	0.214
Age in 2002	41.96	1.24	639	46.86	1.10	429	-4.90	1.76	0.012**
Young 2002 dummy	0.33	0.04	639	0.25	0.02	429	0.08	0.05	0.129
Male dummy	0.18	0.03	639	0.28	0.03	429	-0.10	0.05	0.039**
Married 2002 dummy	0.67	0.02	639	0.63	0.04	429	0.04	0.04	0.342
Has Children 2002 dummy	0.86	0.01	639	0.81	0.03	429	0.05	0.03	0.128
Low Education dummy (02, 03)	0.40	0.06	639	0.35	0.04	429	0.05	0.05	0.401
Medium Education dummy (02, 03)	0.40	0.02	639	0.44	0.02	429	-0.04	0.03	0.214
High Education dummy (02, 03)	0.21	0.05	639	0.21	0.03	429	0.00	0.04	0.828
Occupation Indep dummy (02, 03)	0.30	0.03	639	0.30	0.02	429	0.00	0.04	0.939
Occ Dep Administrative dummy (02, 03)	0.23	0.02	639	0.23	0.02	429	0.00	0.02	0.777
Occ Dep Manual dummy (02, 03)	0.17	0.02	639	0.14	0.02	429	0.03	0.03	0.278
Occ Housewife or Full-time Stud (02, 03)	0.29	0.03	639	0.34	0.02	429	-0.05	0.04	0.292
Sociability dummy (02, 03)	0.17	0.02	639	0.12	0.02	429	0.05	0.03	0.060*
Own Car dummy (02, 03)	0.15	0.02	639	0.30	0.03	429	-0.15	0.02	0.000***
Friends from before in the club (02, 03)	18.60	2.15	639	4.30	1.11	429	14.30	2.11	0.000***
Low Friends dummy (02, 03)	0.36	0.03	639	0.78	0.04	429	-0.42	0.04	0.000***

1.Weighting 2002 participants data by sampling weights.
2.Clustering standard errors by club and region.
3.Tests assume that the two samples have equal variances.
4. * significant at 10%; ** significant at 5%; *** significant at 1%

had closed. If our assumption of random differences between the two groups is true, then there should be no difference in their 2003 income when créditos are no longer accepted in trade. To check, we perform the same propensity score matching that we performed with the 2002 data, instead using the 2003 data. As expected, we find no significant differences in income between the crédito ever-users and never-users, which supports the validity of our crédito-gain estimation. In other words, the crédito users and non-crédito users, after controls, are two groups of very similar individuals in their income-generating abilities. The estimation is presented in Table 11. All 2003 available control variables were balanced for the ATT estimations.[66]

Even though we find evidence supporting no differences in the peso income-generating capabilities of crédito users and not-users, we remain concerned about potential differences in *crédito* income-generating capabilities. Consider the income of "new" and "old" crédito users. We define "new" crédito users as those who started to accept créditos a month before our survey in 2002, and "old" users as all other of crédito users. Of the surveyed crédito

[66]We performed this same test but excluding three neighborhoods that by the time of our survey in 2003 seemed to have little club activity. Results look very similar to the ones included in Table 11.

Table 11: Value of Accepting Créditos: Robustness Check Using 2003 Income

	Stratification Method (3 blocks)	Radius Method (radius 0.1)	Kernel Method	Nearest Neighbor Method
ATT	**-22.3**	**-60.6**	**-19.9**	**-33.0**
St Dev (1,000 B)	40.6	42.9	40.6	47.2
t-stat	-0.5	-1.4	-0.5	-0.7
# Participants	104	105	105	105
# Controls	386	386	386	85

1. We match participants and non-participants on 2003 balanced covariates: Low %Peso Holders, Education, Owns Car, Sociability, Occupation, Age, Married, Has Children, Gender, Region, and Age squared, Extra Edu Variable, Extra Occup Variables, Homeowner, Owns Computer, Has Savings, Owns TV.

2. Propensity scores range from 0.03 to 0.64, and have a mean of 0.21.

users, 12% are "new" (75 out of 639 crédito users). We find no significant difference between the crédito market income (or the crédito and peso market incomes combined) between the two groups of crédito users.[67] This evidence indicates that "new" crédito users have the same crédito generating capabilities that "old" crédito users have.

Moreover, if we performed the surveys one month before, these "new" crédito users would have been part of our control group of non-users. We therefore argue that there are likely other individuals in our current control group who have the same crédito generating abilities, but have not yet joined. (It is difficult to believe that we surveyed the clubs the exact day on which everybody who was ever going to join had already joined.) This evidence suggests that there are no differences in crédito generating capabilities between crédito users and non-users, further lending confidence to our estimated crédito-use gain.

Alternatively, we can take advantage of self-reported evidence in the SECN-2003 survey to address the potential unobserved differences between individuals who accepted créditos versus individuals who did not accept them. In particular, in this survey we asked the non-crédito users their reasons for not accepting créditos in trade. Of the non-crédito users, 45% said that they either never knew that the clubs existed (12%), or knew about them but did not trust them (10%), or just did not like the clubs (23%). Arguably these reasons are not related to income-generating abilities, and therefore we expect these agents to perform

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[67] The estimated coefficient for the "new" variable is 15.8 with a standard error of 30.3. We include controls for individual education, occupation, car ownership, sociability, age, gender, marital status, children, region, club transaction cost, and proportion of peso holders in the area. (Adding experience in the club and type of production good does not change the result).

Table 12: Value of Accepting Créditos: Robustness Check Using Non-Crédito Users Who Did Not Know About the Club

	Stratification Method (5 blocks)	Radius Method (radius 0.1)	Kernel Method	Nearest Neighbor Method
ATT	135.8	128.6	126.1	161.9
St Dev (1,000 B)	68.9	64.7	59.2	95.8
t-stat	2.0	2.0	2.1	1.7
# Participants	419	548	639	639
# Controls	52	52	52	45

1. We match participants and non-participants on the balanced covariates: Low %Peso Holders, Club Transaction Cost, Education, Owns Car, Sociability, Occupation, Young dummy, Married, Has Children, Gender, and Region.
2. Propensity scores range from 0.09 to 0.99, and have a mean of 0.75.
3. Observations are weighted considering the correct population proportions of participants and non-participants, and the potential over/under sampling of clubs.

as a good control set of observations in our propensity score estimation. On the other hand, we may be concerned about the 35% who declared that they had not participated because they did not need to (25%) or because they did not have the time to (10%). The remaining 20% declared not having participated because the clubs did not interested them (10%) or for other reasons (10%). To ensure that no bias is affecting our estimation we re-run the propensity score estimation including as a control group only the individuals who reported in 2003 that they never went to their neighborhood club because they never knew about it. Table 12 shows the estimated effects, and the club effect is positive and of similar magnitude to the main estimates in Table 9.

Next, we address the potential bias introduced by individuals who could be overvaluing the income that they earned with créditos. Note that we did observe a large dispersion of individual exchange rates (pesos per créditos) for crédito users, as shown in Figure 8. The dispersion speaks to both the variability of the value of the crédito between clubs and inside each club. This robustness check estimates by how much crédito users must be overvaluing créditos in order to turn the estimated crédito gain insignificant or nil.[68] To run this check we introduce an overvaluation term in our calculation of the total monthly individual income for the crédito users:

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[68] Even if the crédito effect was all due to a perceived overvaluation by the crédito users, it is not clear that it would make the crédito effect less relevant. It is a philosophical question for economists whether to be more concerned about the income of the individual or the perceived income of the individual. This discussion is beyond the scope of this paper.

Table 13: Value of Accepting Créditos: Robustness Check on the Accuracy of Retrospective Income Data

	2002 Survey			2003 Survey			
	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean Diff.
2002 Monthly Individual Non-Club Income for Non Participants (4 Clubs '02 & 20 Clubs '03)	304.1	41.2	105	401.1	37.8	429	97.0
2002 Monthly Individual Non-Club Income for Non Participants (ONLY 3 Clubs for both '02 & '03)	305.3	68.1	75	411.3	89.9	61	106.0

1.Clustering standard errors by club and region.

$$Total\ Income(\$) = Peso\ Income(\$) + Crédito\ Income * E * (1/(1+O))$$

E represents the club median exchange rate (pesos/créditos) and O is the new overvaluation parameter. We find that overvaluation has to be as high as 40% to make our estimated crédito effect insignificant. And only overvaluation of 65% or more renders the point estimate below zero.[69] We believe that the distortions needed to wash out the estimated crédito effect are too large to be taken seriously.

The next robustness check addresses the quality of the retrospective data used in the crédito gain estimation. In the ATTs estimation we used retrospective data for non-crédito users (from SECN-2003) and contemporaneous data for crédito users. Table 13 presents the mean differences between retrospective data about 2002 income (from SECN-2003) and contemporaneous data about 2002 income (from SECN-2002) for non-crédito users.

To perform this check we take advantage of our small SECN-2002 survey of four neighborhoods. From Table 13 we find that recollections of 2002 income are significantly larger than the data collected contemporaneously. If this over-reporting of income of non-crédito users were true for all 20 neighborhoods, then our crédito effect would be underestimated. (This is because income data for crédito users was collected contemporaneously, and thus not over-reported.) Therefore, if anything, more accurate non-crédito users income data for 2002 would strengthen the results. If we wanted to implement a simple correction for this

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[69]The mentioned overvaluation checks were done for the Radius matching method using the specification of Table 9.

Table 14: Value of Accepting Créditos: By Production Good

Matching Method		Home Producer	Not Home Producer
Stratification	ATT	134.1	78.7
	SE (1,000 B)	53.2	43.5
	t stat	2.5	1.8
Radius	ATT	128.9	83.7
	SE (1,000 B)	55.1	41.7
	t stat	2.3	2.0
Kernel	ATT	128.8	82.4
	SE (1,000 B)	55.9	40.2
	t stat	2.3	2.1
Nearest Neighbor	ATT	134.8	91.4
	SE (1,000 B)	60.8	48.8
	t stat	2.2	1.9

1. We match participants and non-participants on the balanced covariates: Low %Peso Holders, Club Transaction Cost, Education, Owns Car, Sociability, Occupation, Young dummy, Married, Has Children, Gender, and Region.
2. Propensity scores range from 0.02 to 0.69, and have a mean of 0.23.
3. Observations are weighted considering the correct population proportions of participants and non-participants, and the potential over/under sampling of clubs.
4. 43% of crédito-users sell home-produced goods or services.

over-reporting of income of non-crédito users in 2003, we could re-scale their reported 2002 income using the information presented in Table 13. Doing so would increase our estimate of the gain from using créditos.

To better understand the estimated value of the acceptability of créditos we disaggregate the estimated effect by the type of good sold in exchange for créditos. In particular we want to know how much gain is accomplished by trading for créditos home produced versus not-home produced goods. As shown in Table 14 both groups, home producers and not-home producers, experienced a significantly positive gain in income when trading with créditos. Home producers, which account for 43% of our sampled crédito-users, gain approximately 130 pesos per month when accepting créditos in trade. Not-home producers gain approximately 80 pesos per month. This calculation shows that there is actual value generated from trade with créditos, contrary to the view that traders who decide to accept créditos are desperate individuals selling their belongings. Note that even though home producers gain more than not-home producers, both groups experience gains from accepting the secondary currency in trade.

On a related note, we could be concerned that our sampled crédito-users might over represent very experienced crédito traders who presumably perform much better than first-

Table 15: Value of Accepting Créditos: By Experience of the Trader

Matching Method		Low Experience	High Experience
Stratification	ATT	**68.6**	**142.6**
	SE (1,000 B)	39.4	58.0
	t stat	1.74	2.5
Radius	ATT	**70.4**	**141.8**
	SE (1,000 B)	37.8	56.6
	t stat	1.9	2.5
Kernel	ATT	**69.6**	**141.1**
	SE (1,000 B)	39.2	57.5
	t stat	1.8	2.5
Nearest Neighbor	ATT	**87.6**	**131.0**
	SE (1,000 B)	45.1	62.5
	t stat	1.9	2.1

1. We match participants and non-participants on the balanced covariates: Low %Peso Holders, Club Transaction Cost, Education, Owns Car, Sociability, Occupation, Young dummy, Married, Has Children, Gender, and Region.
2. Propensity scores range from 0.02 to 0.69, and have a mean of 0.23.
3. Observations are weighted considering the correct population proportions of participants and non-participants, and the potential over/under sampling of clubs.
4. 57% of crédito-users have low experience in trading with créditos.
5. Low experience is defined as being a member of the local crédito club for less or equal number of days than the median number of days of participaton in the local club.

time traders. In our search for a real average effect, we re-estimated the crédito acceptability effect by experience of crédito-users.[70] Table 15 presents these results, which indicate that high-experienced traders seem to perform better than low-experienced trades as expected (doubling the gain from the use of créditos), but both of these groups experience a positive and significant income gain from crédito acceptability.

6.2.1 A Check on Crédito Holding Levels and Patterns

Our estimate of the monthly gain from accepting crédito users is based on data from mid-2002. From our research and numerous interviews with club participants, we believe that our surveys took place slightly after the peak of crédito acceptability; this seemed to be especially true for clubs located in Buenos Aires. We heard a number of complaints from club participants who could no longer find products that they liked during the meetings that we sampled. This observation leads us to believe that our crédito effect estimation is

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[70] We define high-experienced crédito users as those who have participated in the local club for more days than the median number of days of participation in their local club.

not measuring the peak of the club's activities but instead the beginning of their decline.

Still, when measuring the crédito effect we may be interested in the overall club effect over the life cycle of the club, or over the participation period for a given participant. In particular, we would like to know if there are major losses for crédito users when the clubs disappear, as those left with large amounts of crédito holdings when clubs close would sustain a potentially large loss. To address this question we would ideally measure the crédito holdings of the crédito users the day that the club closed, and we would consider the amount of créditos that the participant did not have a chance to spend, minus the initial crédito loan, as capital losses.

However, these data are not available to us, and instead we look at crédito holdings when the individual came to the club meeting just prior to the sampled club meeting in 2002. We would be concerned about these potential losses if it appeared that crédito holdings were large and focused on a small subgroup of participants. However, if the losses are thinly spread across all crédito users, these losses would likely be small in nature and unable to completely wipe out the benefits of participating in the clubs when they were thriving.

The median crédito holding for the 2002 crédito users is 50 créditos, and the mean is 152 créditos. Expressing these measures in peso equivalent units using the club median subjective exchange rate, the median crédito holding is 27 pesos and the mean is 72 pesos worth of créditos. Moreover, if we net out from the crédito holdings the initial crédito loan that participants received (approximately 15 pesos, with a 2 peso fee), the net median holding is 14 and the net mean is 59 pesos. Only the top 21% of the net holding distribution holds more than 100 pesos worth of créditos, and thus only 21% of participants are holding enough net créditos to wipe out their average monthly income gain from accepting créditos. SECPC-2002 allows us to estimate that the average participation in the club at the time of our survey was 7 months, the median was 3.3 months, and 10% of the participants had been using créditos for a month or less.[71] These data confirm that 90% of crédito users were earning the $100 gain multiple months,[72] which confirms that the capital loses when

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[71] The crédito holding estimations and participation in the club incorporate weights for the over/under sampling of clubs for the 639 crédito users, as described in Appendix B.

[72] Note that the clubs continued to operate for around six months after our survey.

the clubs closed would have been small relative to the income generated in the clubs.

We have often heard concerns that the exchange clubs may serve as a sort of Ponzi game in which members who joined early push crédito holdings onto new members and take their physical goods. While we find this view extremely unlikely given the large amount of home production and trade that took place during months of activity, we can look at the relationship between crédito holdings and certain relevant personal characteristics. The correlation between crédito holdings and high experience as a club member is -0.03 and the correlation with equivalent peso holdings is -0.02. These correlations indicate no strong pattern of holdings and club experience. The correlation of crédito holdings with high frequency of visits to the same club is 0.03 and with equivalent peso holdings is 0.05. Again, these correlations show no evidence that those who trade more often or those who have traded with créditos for a longer period of time are passing crédito holdings onto new or less experienced members.

Another meaningful correlation to check is between crédito holdings and education. It is possible that more educated participants are pushing the crédito holdings onto less educated members to take physical goods from them. The value of the correlation between the peso measure of crédito holdings and having education beyond high school is 0.12, the correlation with having some high school is 0.05, and the correlation for having no high school is -0.15. Therefore, if anything, the pattern we observe is that less educated participants hold less créditos instead of more. Still, these correlations are not strong.[73]

We conclude that the one-time capital losses suffered by crédito users when the club closes and créditos go out of circulation, approximated by the net crédito holdings of participants in mid-year 2002, do not seem sizable when compared with the monthly crédito acceptability gain that we calculated. The net losses for the median participant are approximately a one-time loss of 14 pesos which is small compared with the monthly club

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[73]As a complementary test for the mentioned correlations we performed a regression analysis. We regressed the peso value of the crédito holdings on experience in the club, weekly visits, education, personal controls and club fixed effects, with appropriate weights. We find that experience and education have no significant effect on crédito holdings. High frequency of visits to the club has a significantly positive effect on crédito holdings. This result confirms our previous findings using the simple correlations, showing no evidence in favor of a Ponzi scheme going on in the clubs (créditos going from more expierenced members to less experienced members) or redistribution of créditos by education level.

effect of 100 pesos earned for 3.3 months. Moreover the capital losses are not larger for low-experience, low-frequency of participation, or less educated crédito users. Thus, we are not concerned that the monthly crédito acceptability effect previously estimated would be strongly diminished by the closure of the clubs (for either the median participant or for those with less experience, involvement, or education), and thus our previous estimation is a good approximation of the true crédito acceptability effect.

7   Detailed Theoretical Framework to Study Secondary Currency

We adopt the model presented in Kiyotaki and Wright (1993) on dual currency regimes.[74] We choose this formulation because it captures the main feature that describes the economies under study here, namely, the scarcity of money. The model does not allow prices to respond to money shortages. Therefore the theory allows us to study negative shocks to real money balances by simply diminishing the proportion of peso holders.[75]

The main difference between our formulation and Kiyotaki and Wright's (1993) formulation is that we allow for individual level differences in the matching technologies.[76] This allows us to derive heterogeneous individual level conditions for secondary currency acceptability, which can be tested with our individual level data.[77]

Even when Argentina had the peso, the crédito, the U.S. dollar, and a few state's currencies circulating at the same time, this simple framework with dual currency regime applies. We reinterpret the duality of currencies to compare the crédito with the other currencies. All government-printed currencies circulating in Argentina can be grouped together because

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[74]Curtis and Waller (2000) work on a similar model for legal and illegal currency.

[75]Trejos and Wright (1995) introduce endogenous prices with bilateral bargaining.

[76]Shevchenko and Wright (2004) use individual level differences in other parameters to model heterogeneous agents.

[77]Alternatively we could have focused on a model with separation of agents (by neighborhoods, or by social classes) in which inside money arises to overcome trading frictions. And we could have modeled the trading frictions coming from the separation of the groups of agents (like in Matsuyama et al. 1993) and/or frictions coming from scarcity of outside money (like in Wallace and Zhou, 1997). We think that such formalization would not have added to the flavor of our current study, where basic trading frictions are already central to the theory.

they all suffered the same problem of scarcity in the Argentine economy.[78]

7.1 Production and Consumption

This is a fixed-price model, where time is continuous and there is one economy populated by a continuum of infinitely-lived agents. The population is normalized to one. Each agent is capable of producing one type of perishable consumption good and has the desire to consume only one particular consumption good. Her production good and consumption preferences are the only difference, for now, with other agents. The production cost of the first unit for each agent is zero and normalized to one after that.

Agent i (where i symbolizes the production good of the agent) wants to consume the good $i + 1$, therefore she has to search to obtain her consumption good.[79] k, fixed by assumption, symbolizes the number of goods produced in the economy and also symbolizes the number of types of agents in the economy where $i \in 1,...k$. We assume that $k \geq 3$.[80] Therefore there is a fraction $1/k$ of each type of agent in the economy.

When each agent consumes her consumption good, she receives utility $U > 0$ for the first unit, and zero for extra units. Combining this utility scheme and the production cost described above, we know that trades for more than one unit do not happen in this model.

7.2 Trading in the Economy

Agents are pair-wise randomly matched in this economy in order to trade, following a Poisson process with a constant arrival rate of a match γ ($\gamma > 0$). The probability that a single coincidence of wants occurs in a match is defined as x, where $x = 1/k$. In order to trade, agents need to use a medium of exchange, and in this model the medium of exchange is fiat currency.[81] Now, given that we want to model an economy endogenously accepting

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[78] In a related advance in the literature, the study of known histories of the agents and credit are considered with their role to create inside or private money, which is shown to circulate simultaneously with government or outside money in equilibrium. See Cavalcanti and Wallace (1999), Smith and Weber (1999) and Azariadis et. al (2001).

[79] The last type of agent wants to consume the first good.

[80] We assume there exists at least three goods in the economy, to rule out double coincidence of wants in pairwise meetings (barter) and make the model much simpler.

[81] We assume that credit histories are private information, therefore trade based on credit histories is not possible.

two currencies in trade, we introduce the peso and the crédito. Both are indivisible, can buy the same goods, and an agent can carry only one of them at a time. A difference between them is the exogenous utility cost that the trader pays when she buys a good with a given currency. We can interpret this cost as the transaction cost associated with the currency, and S_P will represent the transaction cost for a peso holder and S_C will represent the transaction cost for a crédito holder. We will assume that both transaction costs are smaller than the utility that the agent receives when she obtains her consumption good, U. To make the model simpler we will ignore S_P, and interpret S_C as the transaction cost of the crédito relative to the transaction cost of the peso.[82]

There are three possible trading states for each agent in this model at any time: to be a peso trader (P), a crédito trader (C), or a goods trader (G). A monetary equilibrium is described as one where a G meets a money trader (either a P or C) and if there is a single coincidence of wants, trade occurs; if there is no single coincidence of wants or if the currency is not accepted by the G, no trade occurs and they separate and continue to search.[83] If a trade occurs, this trade delivers gross utility U for the money trader, and zero utility for the G; after the trade, the G becomes a money trader and vice versa.[84]

At any point in time the total of agents is equal to the fraction of goods traders (m_G), plus the fraction holding pesos (m_P), and the fraction holding créditos (m_C), where $m_G + m_P + m_C = 1$. A stationary steady-state distribution of individuals imposes that these fractions are constant over time. These fractions are assumed exogenous and given in the model. The effects of changes of these fractions will be considered in the comparative statics

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[82]It is easy to show that the results of this simpler model are the same as if we included S_P in the model as well and rescaled the S_C (substracting from it the S_P), and rescaled the utility U (also substracting S_P). Again, the interpretation of the net S_C is the relative transaction cost of the crédito with respect to the peso.

[83]Direct exchange of both currencies does not happen in any equilibria in this model by construction. In general when a P and a C meet they will not trade currencies because trading can not make both traders better off. There is though one particular situation in which trade between P and C could occur leaving both traders indifferent, implying an exchange rate of one. But this exchange rate is artificially derived from the assumption of indivisibility of the currencies in the model. Therefore the model does not speak to the exchange rate between currencies.

[84]For simplicity we assume that gift exchanges do not occur in meetings. A gift exchange would be one in which a money trader is matched with a G where the production good of G is not the desired good of the money trader, but the production good of the money trader is the consumption good of the G. In this situation a gift exchange is one in which the money trader produces one unit of the good (at zero cost) for free for the G.

later.

7.3   Endogenous Currency Acceptability and Returns to Search

The most important feature of this model is that acceptability in trade of each currency is endogenously determined and depends on the expected payoffs from holding each currency and producing a good. π and θ represent the probability that an individual G will accept créditos or pesos in trade respectively (capturing the best response of the individual). Π and Θ represent the probability that a random G will accept créditos or pesos in trade respectively. These four measures are bounded between zero and one. In a symmetric equilibrium with homogenous agents the best response for an individual G is the same for every G, therefore in symmetric equilibrium $\pi = \Pi$ and $\theta = \Theta$.

In what follows we focus on steady-state equilibria. V_G denotes the expected value function for agent G (goods trader), V_P denotes the expected value function for agent P (peso holder), and V_C denotes the expected value function for agent C (crédito holder). r denotes the rate of time preference ($r > 0$). And the expressions for the expected returns to search for G, P, and C respectively are:

(1) $rV_G = \gamma x m_P \max_\theta \theta[V_P - V_G] + \gamma x m_C \max_\pi \pi[V_C - V_G]$

(2) $rV_P = \gamma x(1 - m_P - m_C)\Theta[U + V_G - V_P]$

(3) $rV_C = \gamma x(1 - m_P - m_C)\Pi[U + V_G - V_C - S_C]$

The three above equations show the expected flow returns for each type of trader in the model. Remember that γ is the constant arrival rate of a match, and x is the probability that a single coincidence of wants occurs in a match. Equation (1) shows that the expected flow return for a goods trader has two parts. First, the net returns to trading with a peso trader, that successfully occurs with the probability $\gamma x m_P$. Second, the net returns to trading with a crédito trader, that successfully occurs with probability $\gamma x m_C$. Once a goods trader is matched with a peso trader whose consumption good is the one produced by the goods trader, the goods trader will decide whether to trade or not solving a maximization

problem. A parallel situation is faced by the goods trader when she faces a successful match with a crédito trader. Note that the choice of θ and π are endogenous to the goods trader, who maximizes her expected net gain from trading with a P and with a C. Under this specification θ and π depend on all the parameters of the model.

Equation (2) shows the expected flow return for a peso trader, and equation (3) shows the expected flow return for a crédito trader. Note that these two equations include the aggregate probability of currency acceptability, Θ and Π, because they are given parameters for the peso and crédito traders. Crédito transaction cost enters the expected flow return of the crédito trader because at the time of buying her consumption good her utility is diminished by this cost.

To find symmetric Nash equilibria of the dynamic program above we first provide some extra characterization. For that purpose we assume that the expected value of holding a peso is higher than the expected value of being a goods trader ($V_P > V_G$), which implies $\theta = \Theta = 1$. Therefore in all equilibria that we consider, pesos are always fully accepted. This is a realistic description of the economies that we study. Under this characterization we have three possible types of equilibria: ones with no acceptability, partial acceptability, and full acceptability of créditos. In all the equilibria the optimization problem regarding the choice of whether or not to accept a crédito is the same, and we proceed from this optimization problem. The intuition is simple: a crédito is accepted by G when the return to holding the crédito is higher than the return to continuing to search for a later match which may provide a peso instead. Pesos and créditos differ now not only in their relative transaction cost but also in their acceptabilities.

7.4 Equilibria

To obtain the sufficient conditions that apply to the cited equilibria, we have to do some algebra with the three equations in the dynamic program. In particular calculating (3)-(1) and (2)-(1) with the equations above, and combining the two obtained equations, we obtain the following sufficient conditions for crédito acceptability:

1. $\Pi(U - S_C) > \phi U$ is the sufficient condition for $V_G < V_C$, which implies $\Pi = \pi = 1$ (Full acceptability of crédito and peso)

2. $\Pi(U - S_C) = \phi U$ is the sufficient condition for $V_G = V_C$, which implies $0 < \pi < 1$ and $0 < \Pi < 1$, where $\Pi = \pi$ (Partial acceptability of crédito and full acceptability of peso)

3. $\Pi(U - S_C) < \phi U$ is the sufficient condition for $V_G > V_C$, which implies $\Pi = \pi = 0$ (No acceptability of crédito and full acceptability of peso)

where $\phi = \frac{\gamma x m_P}{r + \gamma x (m_P + m_G)}$. We can focus now on the conditions under which both currencies are accepted and circulate in equilibrium that motivate our empirical analysis.

The calculated sufficient condition (1), $\Pi(U - S_C) > \phi U$, is the individual condition to accept créditos in trade and is also the condition for full acceptability of créditos in a world of homogeneous agents, like the one we have presented up to now in the modelling. Under this individual decision the agent takes as given the Π, and equilibrium arises when the Π that every individual agent took as given is the same as the aggregation of the individual choices π.

An extension to the presented simple model allows for *heterogeneity* among agents with respect to the personal matching technology, γ_i. In this context an agent chooses to accept créditos if and only if $\Pi(U - S_C) > \phi_i U$, where $\phi_i = \frac{\gamma_i x m_P}{r + \gamma_i x (m_P + m_G)}$. That is, the same decision rule applies as in the homogeneous agents case, but now with differences among agents. Now a symmetric Nash equilibrium is defined as a function $\pi(i)$ and an aggregate acceptability Π, where $\pi(i) = 1$ iff $\Pi(U - S_C) > \phi_i U$ and $\Pi = \int \pi(i) di$. Note that in this heterogeneous agents case the individual decision does not necessarily equal the aggregate decision. In the heterogeneous agent case no acceptability, partial acceptability, and full acceptability of the crédito refer to the aggregate decision. It can be shown that no acceptability, partial acceptability and full acceptability of crédito exist under certain parameter values.[85] Nevertheless the equilibrium condition for crédito acceptability at the individual

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[85] The equilibrium observed in Argentina in 2002 is a partial acceptability one. Define $F(\phi_i)$ as the CDF of ϕ_i that arises from the distribution of γ_i. For a partial acceptability equilibrium to exist, the solution to $G(\widetilde{\phi}) = 0$, where $G(\widetilde{\phi}) = F(\widetilde{\phi})(U - S_C) - \widetilde{\phi} U$, must lie in the interior of the support of ϕ_i.

level, $\Pi(U - S_C) > \phi_i U$, always applies and therefore can be taken to the data. This is precisely what we did in the empirical analysis of this paper.

7.5   Comparative Statics

In this simple model, $\Pi(U - S_C) > \phi_i U$ is the individual rule for crédito acceptability in all equilibria, therefore independent of which equilibrium the economy is at, the comparative statics are qualitatively the same. Thus we can analyze how changes in the parameters of the model affect this rule for crédito acceptability. Taking the following derivatives we obtain the empirical implications studied in this paper, whose intuition was explained in Section 3:

1. $\frac{\partial}{\partial m_P}[\Pi(U - S_C) - \phi_i U] = -U\frac{\phi_i - \phi_i^2}{m_P} < 0$: A lower proportion of peso holders increases the acceptability of the crédito.

2. $\frac{\partial}{\partial m_G}[\Pi(U - S_C) - \phi_i U] = U\frac{\phi_i^2}{m_P} > 0$: A higher proportion of goods traders increases the acceptability of the crédito.[86]

3. $\frac{\partial}{\partial S_C}[\Pi(U - S_C) - \phi_i U] = -\Pi < 0$: A lower crédito transaction cost (with respect to the peso transaction cost) increases the acceptability of the crédito.

4. $\frac{\partial}{\partial \gamma_i}[\Pi(U - S_C) - \phi_i U] = -U\frac{\phi_i^2 r}{\gamma_i^2 x m_P} < 0$: A slower matching technology increases the acceptability of the crédito.

5. $\frac{\partial}{\partial x}[\Pi(U - S_C) - \phi_i U] = -U\frac{\phi_i^2 r}{\gamma_i x^2 m_P} < 0$: A higher diversity of the economy (or lower probability that a single coincidence of wants occurs when two traders are randomly matched) increases the acceptability of the crédito.

6. $\frac{\partial}{\partial r}[\Pi(U - S_C) - \phi_i U] = U\frac{\phi_i^2}{\gamma_i x m_P} > 0$: A higher rate of time preference increases the acceptability of the crédito.[87]

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[86] Note that 1 and 2 speak to the same issue: if the proportion of peso holders is too low, the individual is willing to try other monies. Empirically we can not distinguish between the two propotions, and therefore we focused the empirics on m_P only.

[87] We do not discuss the effect of changes in the rate of time preference in our empirical study as this parameter has no variation.

Therefore this framework predicts that créditos are more likely to be accepted in trade when the proportion of peso holders in the economy is low, the proportion of goods traders in the economy is high, the relative transaction cost of the crédito with respect to the peso is low, the individual matching technology is less effective, the rate of time preference is high, or when the economy is more diverse. On the other hand, this framework predicts that créditos are less likely to be accepted in trade when the proportion of peso holders in the economy is high, the proportion of goods traders in the economy is low, the relative transaction cost of the crédito with respect to the peso is high, the individual matching technology is more effective, the rate of time preference is low, or when the economy is less diverse.

8 Conclusion

In 1934 Irving Fisher wrote:

> It becomes more and more clear that, if there were no money, 1933 could invent it all over again; and since Uncle Sam has developed a seeming incapacity to supply enough of it for even that amount of trade which is indispensable to keep his citizens from foraging like animals (or thieves), invention has reached the very threshold of money.[88]

The U.S. monetary situation described by Fisher during the Great Depression repeated itself in the Argentine crisis of 2002. Both economies saw the acceptance of a secondary currency in trade. This paper provides detailed micro-level data on the Argentine experience, which allow us to test the theoretical conditions for the circulation of multiple currencies intuited by Fisher and laid out by Kiyotaki and Wright. Moreover we are able to measure the magnitude of the gain of the acceptability of the secondary currency in trade.

By exploiting individual and neighborhood level variation in Argentina, we offer empirical evidence that gives overall support to the Kiyotaki and Wright style models of multiple currency circulation. Local supply of the national currency, relative transaction cost of the

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[88]Fisher (1934) pg. 151.

currencies, and individual matching technologies are shown to affect the acceptability of secondary currency as predicted by the models. In particular, a standard deviation decrease in the neighborhood level peso supply shows a significant increase of 21% in the individual probability of accepting créditos in trade relative to the mean. This proportion shows a similar but not always significant effect on the neighborhood level acceptability of créditos (29-39%).

Crédito transaction cost measures show expected effects on the individual and local level analyses. The use of créditos from other clubs, which increases inflation in the club, and the educational level of the crédito coordinator show significant effects on the individual and local level acceptability of secondary currency. Additionally, the quality of the physical crédito bill and the monitoring level of the crédito show significant effects on individual level acceptability and expected but insignificant effects at the local level.

With respect to individual matching technologies, mobility and occupation show significant and expected effects on the individual acceptability of the crédito. Education shows an expected but insignificant effect, and sociability shows an unexpected significant effect on crédito acceptability. We discuss as well anecdotal evidence on the importance of the economy's diversification on the acceptability of a secondary currency in trade.

Additionally, using micro-level data we estimate the gain from accepting the secondary currency in trade in Argentina. This gain speaks to the effect of money on real activity, long studied by macro and monetary economists, who have used macro aggregates to estimate this relationship. We calculate that those who accept créditos in trade earn 100 pesos (US$ 35) per month more than those who do not, roughly 15% of the average monthly income in Argentina for 2001. Aggregating those benefits we estimate an added value to Argentina's GDP of 0.6%. Last, we estimate a semi-elasticity between the proportion of population that accepts the secondary currency and GDP of 0.083.

These results provide insight into the monetary literature, shedding light on the applicability and power of models of currency use. We find support for the importance of some of the determinants of currency use, as predicted by the monetary theory literature. Finally, we demonstrate that money affects real activity. The empirical success of the micro-

founded monetary literature suggests that further development of these models to analyze macroeconomic phenomenon would be fruitful.

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9 Appendix A: Photos

Figure 10: Shopping in Alderetes Exchange Club, Tucumán, Argentina, 2002

Figure 11: Self-Help Client Buying Suit With Scrip, Washington, D.C.

10   Appendix B: Weighting Methodology

Data collection methods can introduce biases in estimations. To take into account these potential biases weights are built and used throughout the empirical analysis.

First, when considering the representation of crédito users in the sample, we correct for the fact that the survey unit of observation was the club. Clubs were sampled randomly, and the sampling inside each club was implemented randomly, but the number of observations surveyed per club varied. Clubs vary in size and in multiple characteristics, and these correlate with crédito income performance of the participants. Therefore to have an accurate representation of crédito users and their performance, we correct for over/under representation of a given club in the sample. Each observation is weighted by the inverse of the probability of having surveyed that observation, where the probability is the number of surveys collected in a given club over the number of participants in the club. For example, for the ATT estimations, these weights intervene in the propensity scores and in the ATT calculation as well.

Second, when considering the overall population of the neighborhoods, which include crédito users and non users, we need to accurately reflect their respective proportions to obtain correct estimates. This particular problem arises because the data collection had different sampling structures during the two years the project was conducted. This consideration matters because we use crédito users data from one survey and non users data from the other survey. In particular, crédito users data were collected in 2002 inside the clubs by the survey SECPC-2002. Non crédito users data for 2002 were collected in the neighborhoods by SECN-2003. SECN-2003 interviewed a random sample of club neighbors, therefore this survey accounts for the correct proportions of crédito users and non-users in the population. But if we attempt to compare crédito users interviewed in 2002 and non-users interviewed in 2003 (about 2002) we need to weight both populations to represent their correct proportions. For example, we face this problem when we estimate propensity scores and ATTs for the crédito gain. SECN-2003 indicates that 19% of the neighbors ever attended the neighborhood club. Therefore we re-scale the data of crédito users and

non-users to add up to these correct proportions. Note that we use the 2002 data for crédito users instead of the retrospective 2002 data about them collected in SECN-2003 because SECN-2003 did not collect as detailed information on club activities as SECPC-2002 did (like crédito income). The need for extra information on crédito users motivates the combination of crédito users data from one survey with non users data from another survey.

Let us look at the weights to estimate unbiased ATTs more formally. Use i to represent each individual, where crédito users are represented by u and non-users are represented by n, and use b to represent each surveyed club. I is the set of surveyed individuals, U is the set of crédito users, and N is the set of non-users, such that $U + N = I$. First, the weights to correct for the proportions of crédito users and non-users affect the estimation through w_{1i}, such that $\sum_{u \in U} w_{1u} = w_1 = 0.19$ for crédito users and $\sum_{n \in N} w_{1n} = w_1 = 0.81$ for non-crédito users. Second, to correct for the over/under sampling of clubs we introduce w_{2ub} such that $\sum_{u \in I_b} w_{2ub} = w_{2b} = N_b/n_b$ where I_b is the set of surveyed individuals in club b, N_b is the number of club members of club b, and n_b is the number of surveys in club b. w_{1i} (or w_{1u} and w_{1n}) and w_{2ib} (or w_{2ub}) are independent, and therefore enter multiplicatively into the estimation of the weighted propensity scores. Implicitly, the weighted propensity scores are estimated by:

$$p(X) \equiv \Pr\{D = 1|X\} = E_{w_{1i},w_{2ib}}\{D|X\}$$

For the estimation of the ATT, again, w_{1i} and w_{2ib} enter multiplicatively. Let us look into the ATT estimated by the Stratification method. q represents each stratum defined, as explained, such that covariates balance, B is the number of clubs surveyed, and Q is the number of strata:[89]

$$ATT_S = \sum_{q=1}^{q=Q} [\frac{\sum_{u \in I_q} \sum_{b=1}^{b=B} \sum_{u \in I_b} Y_u * w_{1u} * w_{2ub}}{\sum_{u \in I_q} \sum_{b=1}^{b=B} \sum_{u \in I_b} w_{1u} * w_{2ub}} - \frac{\sum_{n \in I_q} Y_n * w_{1n}}{\sum_{n \in I_q} w_{1n}}] \frac{\sum_{u \in I_q} \sum_{b=1}^{b=B} \sum_{u \in I_b} w_{1u} * w_{2ub}}{\sum_{u \in I} \sum_{b=1}^{b=B} \sum_{u \in I_b} w_{1u} * w_{2ub}}$$

where I_q is the set of crédito users and non-users in stratum q. Y_u is the total income (crédito

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[89] We follow Becker and Ichino (2002), and we add the weights to insure an unbiased estimation.

plus peso income) of crédito users and Y_n is the total income (peso income) of non-crédito users. $\sum_{u \in I_q} \sum_{b=1}^{b=B} \sum_{u \in I_b} w_{1u} * w_{2ub}$ is the weighted number of crédito users in stratum q, $\sum_{n \in I_q} w_{1n}$ is the weighted number of non-users in stratum q, and $\sum_{u \in I} \sum_{b=1}^{b=B} \sum_{u \in I_b} w_{1u} * w_{2ub}$ is the weighted number of crédito users in the surveyed population.

Similar modifications were applied to the Radius, Kernel, and Nearest Neighbor matching methods.