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**Cashless Payments and the Persistence of Cash:
Open Questions About Mexico**

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This essay analyzes the trends in payments in Mexico since 2002 and argues that there has been an important growth in the use of cashless digital payment instruments, namely the use of credit and debit cards, electronic funds transfers (EFTs) and mobile banking. However, the use of cash widely persists in the Mexican economy. The essay discusses the factors behind the persistence of the use of cash, and argues that low financial inclusion and informal economic activity are considered the main causes. Equally relevant is the fact that digital instruments are not a perfect substitute for cash as money yet, as it is the need to adequate payments services to the convenience and trust of segments of users, mainly population that still has little use or no access to financial services.

JEL classification: E42, G20, G21, O32, E49

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1. Introduction

In recent years, Mexico has undergone strong growth in the use of cashless payment instruments, namely the use of credit and debit cards, electronic funds transfers (EFTs) and mobile banking. Although these payment instruments have been available in the country for some time (the bank credit card was introduced in the sixties), their rate of adoption was not remarkably fast, except over the last 15 years. The recent acceleration is due to the drive of the financial industry to adopt digital innovations in payments and penetrate into new market segments, mainly low income earners with little or no access to financial services, as well as growing interest from the government to encourage digital payment methods. But despite the large increase in the use of these instruments over the last decade, the use of cash still persists in the Mexican economy. This essay seeks to document this phenomenon and discuss some hypotheses on why things have happened that way.

In Mexico the growth of cashless payment instruments, combined with the persistent use of cash, presents us with an interesting environment to discuss the coexistence of several forms to carry out transactions.[1] Such coexistence, alongside with the rapid pace of innovation in payments and digital financial services, is transforming the ecosystem of payments in Mexico. A particular country case might contribute to better understand developments witnessed in other nations.

There are several reasons why cash persists. This essay shows the trends in payments since 2002 and argues that there are three groups of causes. The first group relates to low financial inclusion, which hinders the use of digital financial services. Low financial inclusion is related at least to two underlying factors; one is the structure and scope of the networks of payments, and the other is the presence of a large informal economy. The second group is the extent to which digital payments work as money, and consequently can substitute cash. I argue that so far, there is no full substitute for cash as money. The third is that the design of payment services still requires to

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[1] This text refers to cashless payment instruments primarily as cards, electronic funds transfers and mobile banking that nowadays are associated to digital technology. However, cashless payments can take many forms, for instance payments with vouchers, checks (also discussed in this paper) and local monies. Cash, for the sake of clarity, is coins and banknotes issued by a central bank and function as legal tender.

prove convenience and reliability to various segments of the population, particularly those with low financial inclusion.

Moreover, we cannot expect an instantaneous and even transformation of payment practices of all individuals. A change in habits will take more time. Some authors suggest that these habits evolve slowly (Maurer 2015; Conolly and Stavins 2015; Bátiz-Lazo, Haigh and Stearns 2014). Change of habits also differ among distinct segments of population.

New instruments, product of innovation, provide more efficient and secure means for transactions, at least this is believed for certain contexts. Consequently, the persistence of cash puzzles advocates of digital payments. Mazzota and Chakravorti (2014) argue that "Mexicans are reluctant to adopt new payment methods. For everyday purchases and for important bills, Mexicans trust cash." These authors explain that the preference for cash in Mexico bears significant costs, and they estimate that the costs of cash access represent 2.3 billion of Mexican Pesos and 48 million hours of time annually. But the coexistence of several payment methods is a rule rather than an exception, across cultures and along history. Maurer (2015) and Maurer and Nelms (2014) discuss how people in the world use diverse types of monies and forms of payment; money is embedded in culture, social interactions and hence payments are decisions that contain an inherent complexity. A recent study by Sanford (2016), using the information of the *financial diaries*, shows that the poor in Mexico use a mixture of financial services that include formal intermediaries as well as informal mechanisms; this includes transactional accounts in banks and savings cooperatives.

I emphasize in this paper that more research is needed to analyze this issue. However, no single discipline can provide a complete answer, because the problems at stake are at the intersection of financial inclusion, financial development, technological innovation and cultural change. There is no need to clarify to the reader that the expansion of the digital world has been a central factor in the growth of cashless payments and its blooming wave of innovation. And as Villasenor, West and Lewis (2015) show in a multi-country study, financial inclusion is increasingly related to digital inclusion.

Industry studies stresses the role of technology-driven innovation. PwC assessment of the future of the financial sector (2016 and 2014) points out that technological change is re-shaping financial services, creating new competitive pressures and transforming the way financial intermediaries engage with their customers. The Fintech surge has had a particular impact,

modifying the ways in which the financial industry is approaching to innovation. However, new preferences and needs are also result of social and demographic changes in both, emerging and developed economies. Thus financial services need to adapt to a transforming culture of how people pays.[2]

The paper is organized as follows. Next section argues that the expansion of digital payments and the persistence in the use of cash is a question observed globally. Section 3 provides a brief account of some key components in the formation of the payment system in Mexico which will help us to understand its current set-up. The following section explains how innovations are transforming payment services. Section 5 explains the trends in the use of payment instruments, both cashless and cash. Section 6 discusses some hypotheses concerning the persistent use of cash and the limitations of cashless instruments. Lastly, concluding remarks are provided.

2. Two sides of the same coin

According to the World Payments Report, global non-cash transactions volumes reached 357.9 billion in 2013, a 7.6 percent annual growth. The fastest rate of growth was 37.7 percent in emerging Asia, led by China. In Latin America, they grew 8.6 percent, a decrease considering the 11 percent of the previous year. This was due to a reduction in non-cash payments in Mexico and a slowdown in Argentina and Brazil. That report shows that Latin America accounted for 23.8 billion dollars in 2009 and 35.3 billion in 2013. In the region, Brazil was the leader and it is one of the world top ten markets in 2013, with 26 billion USD that year. The growth of non-cash transactions is led by card instruments; its share in 2013 was 62.8 percent.[3] But even though cashless payments are growing rapidly across the world, the use of cash remains resilient. Global demand for cash grew 8.9% between 2009 and 2013.[4]

Hence, there are two sides of the same coin in this process. On the one hand, cashless payment methods have been rising. On the other, cash remains central in payments. And this is equally valid for both, developed and developing economies. In a multi-country study, Amromin and Chakravorti (2009) observe that despite the strong growth in the adoption of electronic payments

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[2] For changing trends in the industry see PwC (2016) and (2014).
[3] World Payments Report (2015), pp. 6-10.
[4] According to data from Retail Banking Research, see Bátiz-Lazo, Efthymiou and Michael (2015), "Around the world in 80 payments – global moves to a cashless economy", in The Conversation: http://theconversation.com.

throughout the 1990s and the early part of the twenty-first century, cash usage remains significant in most OECD countries. They find that greater consolidation in the retail industry also contributes to lower transactional demand for cash, suggesting that larger merchants may be better able to absorb the fixed costs of accepting electronic payments.

The prevalence of cash is also observed in financial systems that have led the innovation in payments. According to Bennett, Conover, O'Brien, and Advincula (2014), in the United States, cash makes up the single largest share of consumer transaction activity, 40 percent, followed by debit cards, 25 percent, and credit cards, 17 percent. This is because consumers have a large number of low-value transactions and use cash for these payments. About one-third of the average consumer's monthly payments involve transactions less than 10 USD, and the average consumer uses cash for two-thirds of these transactions. Using data from the 2012 Diary of Consumer Payment Choice, Briglevics and Schuh (2014) estimate payment instrument choice for U.S. consumers and find that checks have virtually disappeared from purchase transactions, while still play a role in bill payments; cash, however, still plays a relevant role for low-value transactions. Conolly and Stavins (2015) show that age, education and income are strongly correlated with the choice of payments methods; they also argue that payment behavior evolves slowly over time.

In most nations, but particularly in developing economies, the use of digital payment methods has been linked to financial inclusion. Their use is commonly attributed to levels of inclusion; and vice versa, their greater use is considered a factor for increasing inclusion. The understanding of this relationship has defined an important part of the policy debate (Villasenor, West and Lewis 2015).[5] This is the case of Mexico; although it is considered an upper middle income developing economy (it is the 15th largest world economy) which also happens to have a sophisticated financial system and well-developed telecommunications sector, the level of financial inclusion is low.

Another important cause is the presence of what is called the informal economy. It is argued that the informal economic activity incentives the use of cash to avoid reporting or surveillance from authorities, mostly tax compliance. Informal activities include the underground economy, which refers to illegal trades and criminal activity. However, most of the informal economy is not

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[5] See Villasenor, West and Lewis (2015); and the National Survey on Financial Inclusion (Encuesta Nacional de Inclusión Financiera) by the National Banking and Securities Commission (Comisión Nacional Bancaria y de Valores, CNBV).

underground, illegal, but mostly unregistered. In this view, advocates of cashless instruments display an implicit discourse of control, which runs against the individual privacy that cash allows in transactions. Transactions in cash after all, are private.

As it will be discussed in this paper, acceptance also depends on the attributes of cashless instruments to function as money. These attributes depend on how people use different types of money for distinct purposes, depending on the size or type of transactions, cultural norms and multi-level decision making (Briglevics and Schuh 2014; Maurer 2015).

3. Foundations

This story of the modern payments system in Mexico started with the computerization process of banks, which took off during the sixties.[6] The introduction of the bank credit card in 1968 proved to be a milestone; its acceptance was rapid, despite its relatively limited scope which, up until the nineties, only reached medium and high income segments.[7] The development of private platforms in the financial system paved the way for the necessary infrastructure to distribute financial services; in other words, the "roads and pipelines" that would allow the distribution and use of instruments such as cards.

Compared to other economies, the adoption of cashless payments in Mexico progressed slowly. This was due in part to the somewhat turbulent recent history of the financial system. The government expropriated the banks in 1982 in response to a severe and prolonged financial crisis (the Latin American sovereign debt crisis which lasted the entire decade). The re-privatization of the banks between 1990 and 1992 led to a process of re-adaption of the business strategies of intermediaries. Just a couple of years later, towards the end of 1994, a new financial and banking crisis erupted, seriously damaging the banks. The process to rescue the financial institutions implied bankruptcies, mergers and acquisitions. This altered the strategies of the banks, causing the long-term strategies and adoption of innovation to take longer and move forward at a slower

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[6] Del Angel (2011).
[7] Bátiz-Lazo and Del Angel (2016); the debit card was introduced in 1986, although the form we know it today did not arrive until 1994.

pace than they otherwise would have in more stable times. That process lasted until the early 2000s, specifically until 2003, which the heralded the beginning of the reactivation of credit. [8]

As for the financial authorities, during the eighties and nineties, they focused their attention on the problems of the government finances and on the crises of the banking system. But in 1994, the Bank of Mexico (Banco de México), the country's central bank, undertook a reform of the payments system, motivated in part by the re-privatization of the banks and by its condition of independence, which was new at that time. The objective of the reform was to assess the exposure to risk of the different participants in the system.[9] Under this reform, a high-value payment system was designed which started to operate in March 1995. For a while, the central bank focused on high-value payments.

The financial authority maintained an arms-length position in respect to the system of payments for quite some time. The regulatory capacity of the Bank of Mexico on the system of payments was defined with greater precision until December 2002, with the enactment of the System of Payments Law (*Ley de Sistemas de Pagos*). Under this law, each year the central bank would designate the systems of payments it considered "systematically important".

Later, the central bank became more involved in payments. The next important change in the regulatory attributes of the central bank on payments system was brought about with the enactment of the Financial Services Transparency Law (*Ley de Transparencia y Ordenamiento de los Servicios Financieros*) in January 2004. In November 2004, it also created the Electronic Payment Methods Infrastructure Fund (*Fondo de Infraestructura de Medios de Pago Electrónicos*), a trust set up by financial intermediaries and with a tax incentive from the federal government to encourage the use of electronic payment methods. And in August 2004, a new platform of the central bank, the SPEI, started operations. This was a system designed and operated by the central bank which would apply for high- and low-value transactions. To date, SPEI is the most important platform for EFTs.[10]

Castellanos, Garrido and Mendoza (2008) point out that during the first half of the 2000s, credit and debit cards were not used in Mexico as ubiquitously as in other countries, while the number of cheques held steady. This contrasted with the fact that the banks had already spent the last few

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[8] Regarding mergers, see Castellanos, Del Angel and Garza-García (2016); for the evolution of the system, Del Angel (2010 and 2011).
[9] Bank of Mexico, 1994 Annual Report, Annex 8.
[10] For details, see the country report on payments by the BIS (2011); and Castellanos, Garrido and Mendoza (2008).

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decades developing telecommunication and ATM networks, point of sale terminals, as well as a growing issuance of credit and debit cards. These authors argue that the fees the customers paid could have played a role. The fees for the use of electronic methods were greater than for using cheques, despite their higher processing costs for the bank; moreover, the average processing costs of cheques were higher than those of the industry in developed countries.[11]

Concern arose in different segments of the public sector about the slow adoption of payment methods other than cash and their relationship with financial inclusion, primarily regarding the role of card's fees and interest rates charged by commercial banks. That discussion to identify the reasons for bank prices and rates was probably not well-documented. But it created political pressure, mainly from the Mexican Congress, for the central bank to step in and play a more active role in the regulation of these markets and their prices (particularly personal loans, as well as debit and credit cards). The regulatory framework has been modified since 2004 to strengthen the role of the central bank and include several reforms to promote the dissemination of cashless payment methods. For example, from 2009, development started on regulations for mobile banking. A particular interest of the authority has been to limit the growth of the informal economy and promote financial inclusion. As Villasenor, West and Lewis (2015) point out, the Mexican authorities –at least up until 2012– showed awareness in the topic with the creation of a Council on Financial Inclusion (*Consejo de Inclusión Financiera*) in 2011.

4. Disruption

Besides the banking instruments that are accessed through traditional means (with the opening of an account), multiple initiatives have arisen over the last decade that are transforming our understanding of the market. The initiatives range from small pilot programs to larger platforms involving several channels, including mobile banking. Others include platforms that involve "non-traditional" actors; in other words, from non-financial areas of the government to non-intermediary companies.

For example, one of the larger platforms is called *Transfer*, which was created 2011. Transfer is an association between two banks, Banamex and Inbursa, and the main telephone company, which provides multi-channel means. The service allows the transfer of money via mobile

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[11] See Castellanos, Garrido and Mendoza (2008).

telephone, from telephone to telephone and from telephone to bank accounts; in fact, the telephone number is used as a bank account number. The service also incorporates access to correspondent banking through large chains of retailers (particularly with small stores that are ubiquitous in urban zones).[12] It is reckoned that this platform gives Banamex above 70 percent of the clients in the bank mobile payments market, a lion share if compared with its follower, Bancomer that has above 20 percent.

An important step forward was the G2P (government-to-person) initiatives used by the government as a means to distribute subsidies and make cash transfers for poverty alleviation programs. G2P channels to transfer subsidies aimed for poverty alleviation have been a promise for financial inclusion: they use government distribution networks and cover large portions of the population. In addition to more efficient funds transfer (and better monitoring), the government sought to promote financial inclusion and the use of digital payments. These initiatives involve bank accounts that include the use of a card. Despite the praise they have received, these projects still need to prove their success regarding financial inclusion, given some failed attempts and other relatively successful ones.[13] The first attempts involved a traditional bank account with a debit card. These projects failed because the product (bank accounts) did not suit the needs of the target population. The bank accounts have slowly been tailored; for example, they no longer require minimum activity and the commissions they charge are limited. The more recent G2P channels involve options to transfer money to debit cards or to prepaid cards. Some projects seek to incorporate mobile banking, but they are yet to reach a significant scale.[14]

There are several initiatives that involve alliances between financial intermediaries and "non-traditional actors". For instance, in 2013, Grupo Bimbo, a dominant corporation in the bread and food market, created an alliance with Visa and Blue Label Telecom Mexico to set up a network, primarily to make payments and buy airtime for mobile phones. This network, called Qiubo, is aimed at micro-entrepreneurs that distribute Bimbo food products. At the same time, MasterCard is introducing services that compete with the established clearinghouses, offering clearing for electronic transfers and cards to financial intermediaries for which access to the established

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[12] Correspondent banking, as we know it today, was introduced in Mexico since the 1990s by major banks. A legal figure for this practice was introduced in the law in 2008.
[13] See Villasenor, West and Lewis (2015).
[14] This also involved regulatory changes to allow simple, low cost, "basic" transactional bank accounts. See Villasenor, West and Lewis (2015).

clearinghouses was limited.[15] Another example is Juntos, which was initially adopted by BBVA Bancomer. Juntos' service is a mobile banking application that enables a relationship between a bank and a user, helping the user to carry transactions and to manage their personal finance.[16] So far, the initiatives and projects are markedly different from one another, showing an ecosystem far from equilibrium and from a dominant technology.[17]

It is worth clarifying that not all innovations are addressed to solve transactional and payment needs; for instance, many new Fintech developments include peer-to-peer lending and crowd-funding platforms. Besides, not all developments purpose to tackle financial inclusion needs. However, financial inclusion has been a key factor for Fintech developments in that country, as well as in all Latin America.

5. Trends in cashless and cash payments in Mexico

Like in other parts of the world, the instruments with the greatest expansion in Mexico have been credit and debit cards. The credit card gained importance in the system of payments since it was introduced in 1968. Nevertheless, the adoption of the debit card thrived much faster. The recent increase in the use of credit and debit cards has been a consequence of a combination of industry strategies and regulatory factors. Table 1 summarizes the statistics of volume and penetration of diverse payment methods in recent years.

Chart 1 shows the evolution of the number of credit and debit cards used over the 2002-2015 period. Chart 2 shows the evolution of the number of credit and debit cards issued in comparison with the number of transactions at point of sale terminals (POS terminals). The growth in the number of cards issued has been significant. As chart 2 shows, the increase in the number of transactions at POS terminals has been even greater. This is due in part to the competitive environment in which the number of participants in this market has grown, both in terms of new issuing banks and greater diversification of this product.[18]

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[15] See MasterCard (2013).

[16] In the context of increasing use of digital instruments an emerging concern has been how to enhance the relationship of a service provider and its client, as discussed in section 6.c of this paper.

[17] Other developments provide services to users that are actively included in the financial system; for example, solutions to transact with cryptocurrencies, such as Bitcoin, which are offered locally by some firms in Mexico. Users of payment services such as Paypal or Apple Pay have expanded in Mexico, but we still need public statistics.

[18] See Castellanos, Del Angel and Garza-Garcia (2015); the conditions of competition increased in response to the creation of new banks from 2004 onwards.

Table 1. Aggregate indicators of use of different payment instruments. Value of accumulated flows in million pesos (USD in parenthesis) inflation adjusted (January 2011=100), and as ratio of GDP. Data from de Banco de México.

	2002 I Q	2007 IV Q	2011 IV Q	2015 III Q
Cheque	3,225,115	3,450,754	2,475,059	1,656,147
Cheque / GDP	0.323	0.247	0.163	0.106
Transactions in POS terminals	20,824	128,180	224,329	348,951
Transactions in POS terminals / GDP	0.002	0.009	0.015	0.022
EFT same bank only	2,050,778	12,105,626	13,453,227	9,816,086
EFT same bank only / GDP	0.206	0.867	0.884	0.629
EFT interbank	910,004	8,202,288	13,656,163	11,522,474
EFT interbank / GDP	0.091	0.587	0.898	0.738
Transactions in ATM / GDP	0.026	0.036	0.037	0.038
Monetary base in hands of the public / GDP	27.56	32.63	39.09	52.94

Chart 1. Volume of credit cards and debit cards issued and in use, 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.
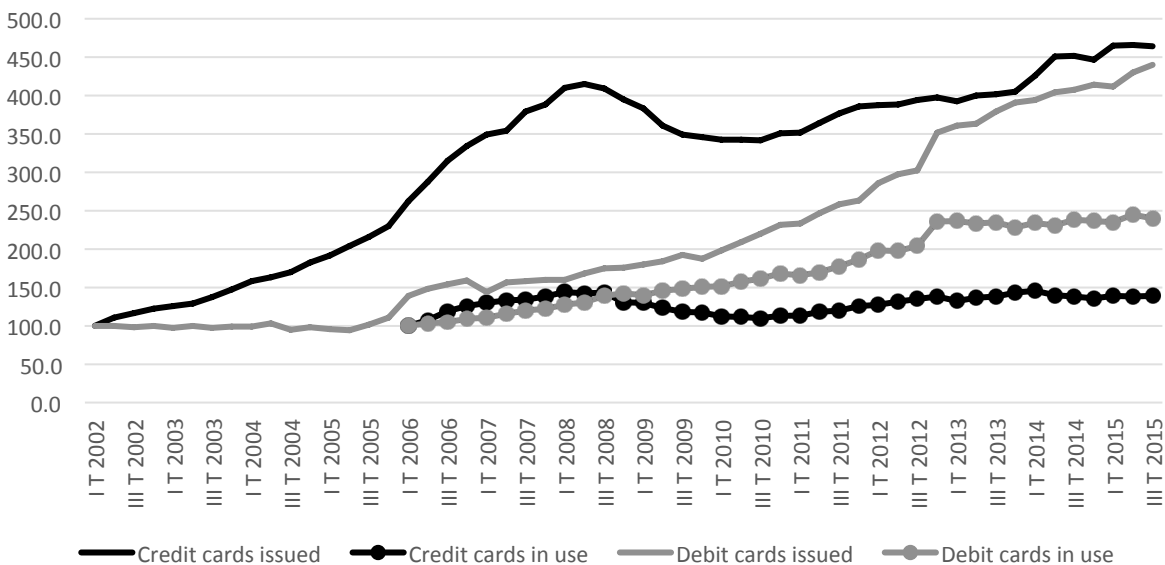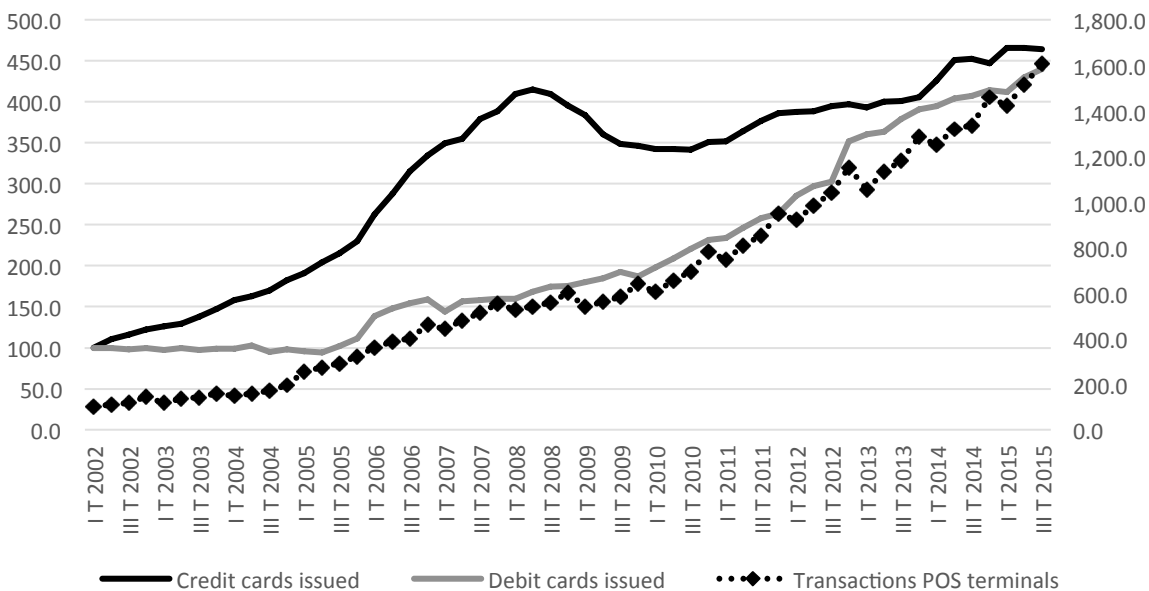
Chart 2. Volume of credit cards and debit cards issued (left axis) and number of transactions in POS terminals (right axis), 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.

Both charts show that the issuing and use of credit cards are influenced by the credit cycle of the financial system and hence, the economic cycle. Many banks in Mexico tightened consumer credit shortly before the 2008 global financial crisis as a result of corporate strategies and prudential regulation. In addition, this crisis caused a significant drop in the consumer credit market. The recovery of the use of the credit card coincided with the recovery of the Mexican economy as a whole in mid-2010.

In comparison, the growth rates in the use and issuance of debit cards have continued practically uninterrupted. This reflects the spread of payroll payments through bank accounts. This growth stabilized from 2012 and showed signs of a slowdown in 2013 and 2014. The latter possibly reflects greater association of cards with existing accounts rather than the opening of new accounts. There are more than 125 million credit cards in Mexico, however many card users hold more than one card, and some cards are idle (Mazzota and Chakravorti 2014).

Transactions at POS terminals on the other hand show increasing use of cards to make payments (with a rate of growth significantly higher than the cards used); in other words, this means that both credit and debit cards are used more. The value of the average card transaction has

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increased too. We might assert that this is one of the greatest changes in the payment habits of Mexicans.

The use of electronic funds transfers is another method that has observed an upward trend. Chart 3 shows EFTs according to the classifications of the Bank of Mexico: those performed in the same bank and those performed between the accounts of two different banks (which are generally measured indistinctly).[19] The growth in electronic funds transfers reflects a greater use and development of Internet banking. Interbank EFTs have shown a continuous growth. It seems that the introduction of SPEI by the central bank in 2004 sparked the use of electronic funds transfers. Same bank EFTs also had a major growth, probably an outcome of the introduction of SPEI and the use of digital transfers for payrolls; a decelerating trend after 2011 may show a limit that reached by payrolls.

Chart 3. Volume of EFTs same bank (left axis) and interbank (right axis), 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.

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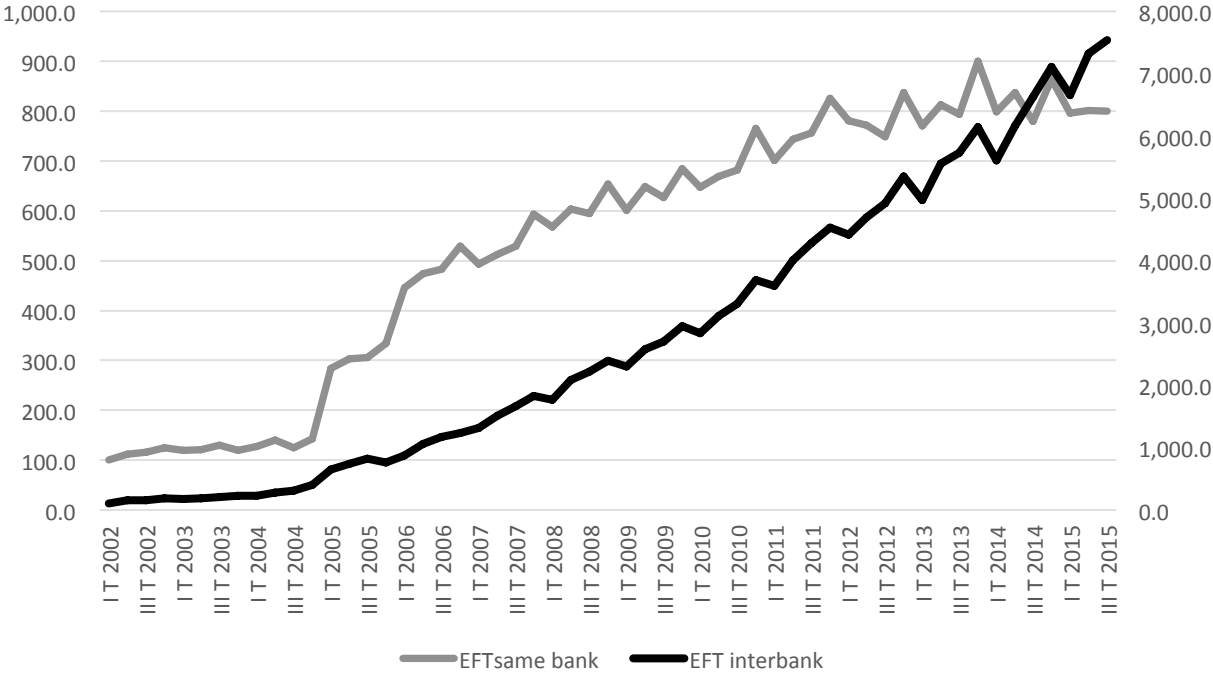
[19] The statistics shown here include transfers by all electronic systems of the banking system; this includes telephone systems, internal electronic systems of banks and Internet banking. Currently, 70 percent of transfers are made over the Internet with a minimal number made via telephone.

Another way of looking at these indicators is through the trend in their value. Chart 4 shows the evolution of values in terms of GDP. Growth in the value of both POS terminal transactions and transfers has remained steady, not just in absolute terms (expressed in inflation adjusted pesos) but, as the chart shows, also with respect to GDP. The greatest sustained increase can be observed in POS transactions; interbank transfers have also undergone accelerated growth. This evidences the increasing importance of these methods to the economy (and consequently, the relevance of the risks associated with such systems).

Chart 4. Value of transactions at POS terminals, and EFTs same bank and interbank, as a ratio of GDP, 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.
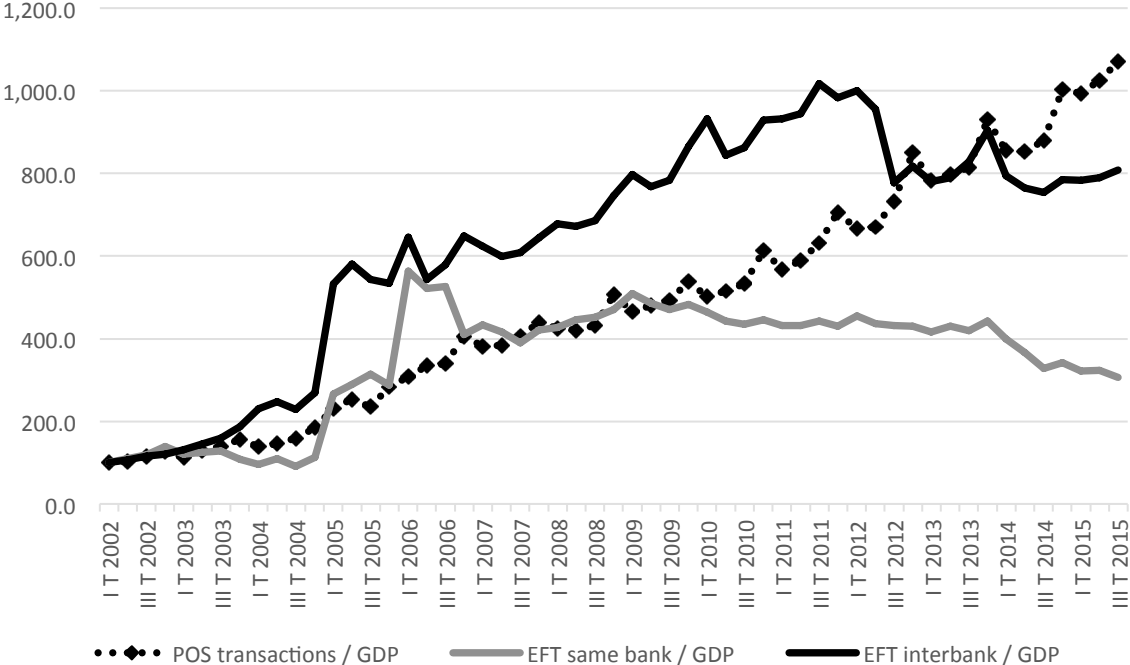
Another channel that has developed in Mexico is mobile banking. Although the financial industry instituted several early pilot initiatives, these took some time to mature. Their regulation started in 2009; in 2010, a regulatory scheme for mobile banking was finalized. Therefore the statistics are limited. By the end of 2011, there were approximately 247,000 bank accounts associated with mobile telephone numbers; by the end of 2013, this figure had risen to 2.7 million accounts, which represented 2.6 percent of the total number of mobile telephone

subscribers, and 1.9 percent of transactional accounts.[20] The volume of transactions via mobile banking is still considered low in Mexico, especially taking into account the number of mobile telephones in the country (over 100 million). The expansion of mobile banking has also been associated with accounts that also have a card. The banks offer this account-associated service with several payment channels (cards, Internet and mobile banking).

Other instruments are being substituted in this evolution in methods of payment different to cash. Such is the case of the use of checks. Chart 5 shows the trajectory in the number and value of checks issued. This value is taken as a ratio of GDP. There has been a downward trend in the use of checks. In 2015 the number and value of checks represented 55 percent and 32 percent respectively, relative to those used at the begining of 2002. The expectation is for this trend to continue to decline. Nevertheless, the use of checks is not expected to disappear entirely, as the method is still widely used in commercial transactions, high-value contracts and legal procedures.

Chart 5. Volume of cheques and value of cheques, 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.
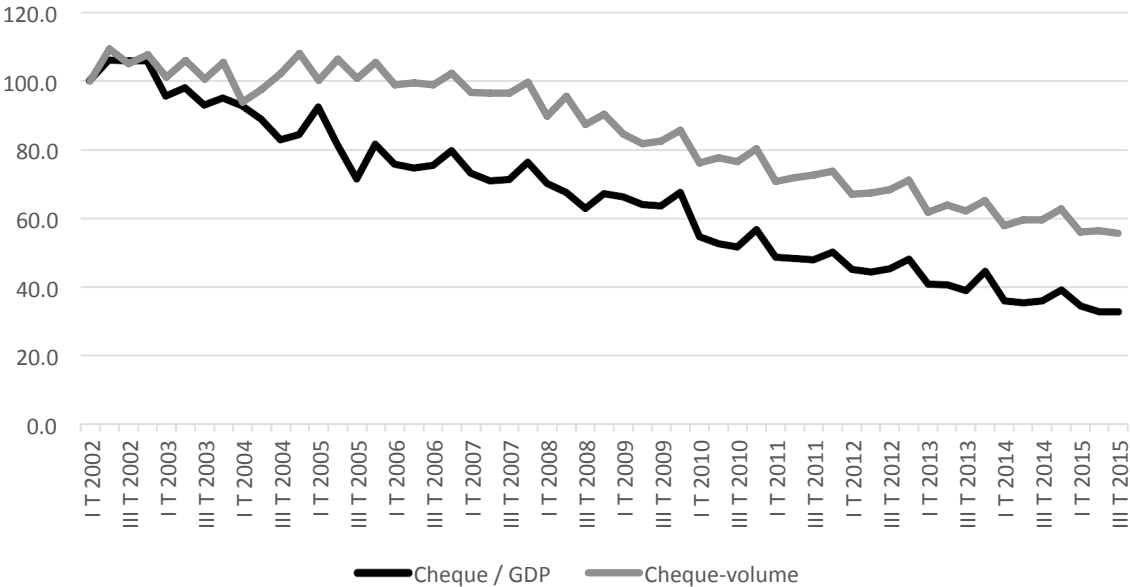
It is unclear however to what extent the increase of cashless instruments is reflected in a reduction in the use of cash. Charts 6 and 7 show data on the cash in the economy. The evolution

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[20] Figures from CNBV (2014).

of cash in hands of the public (in inflation adjusted value), as shown in chart 6, has grown since 2002. This growth without doubt is lower than the other methods of payment discussed earlier. Furthermore, the amount of cash in hands of the public as a ratio of GDP is not expected to vary much, as is evident in some parts of the period under analysis; but its trend has been growing. The chart also shows cash withdrawals from ATMs as a ratio of GDP which are related to the cycle of cash held by the public; this variable has also shown moderate growth as a percentage of GDP. In other words, there has been an increase in the amount of cash held by the public.

Lastly, chart 7 shows an estimate of the use of cash by consumers to pay small retailers for goods and services in five Latin American economies. This chart allows for comparisons between countries.[21] Among the Latin American economies with the largest payment markets, Mexico and Colombia still show the highest proportion of use of cash for payments; this is particularly high in the latter case.[22] The chart reveals that Mexico is the second largest market for payments (the first is Brazil) and Colombia is fourth, bigger even than Chile. Despite being relatively large markets, the proportion of cash payments is high and has remained stable.

Chart 6. Monetary base in hands of the public (inflation adjutsted pesos), monetary base in hands of the public as a ratio of GDP, and value of transactions in ATMs, 2002-2015. Index, first quarter of 2002=100. Data from Banco de México.

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[21] Unlike the previous charts, these were done with data is estimated by Visa and Euromonitor.
[22] This is despite the expansion of payment instruments other than cash Colombia over the last few years.
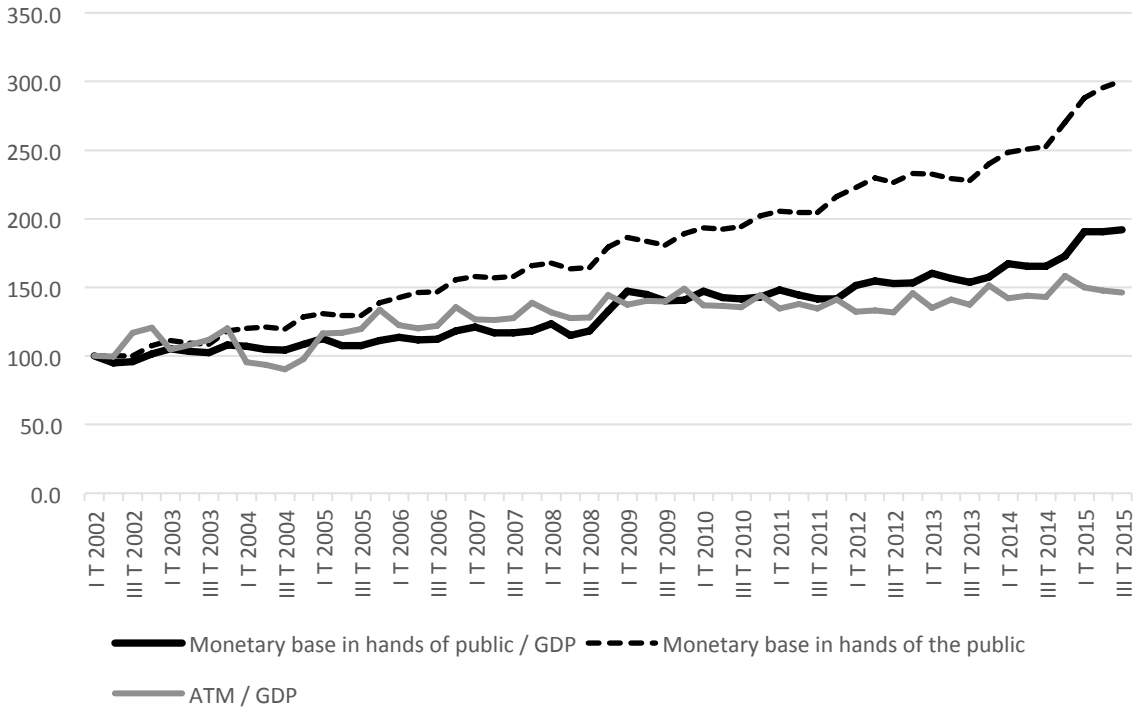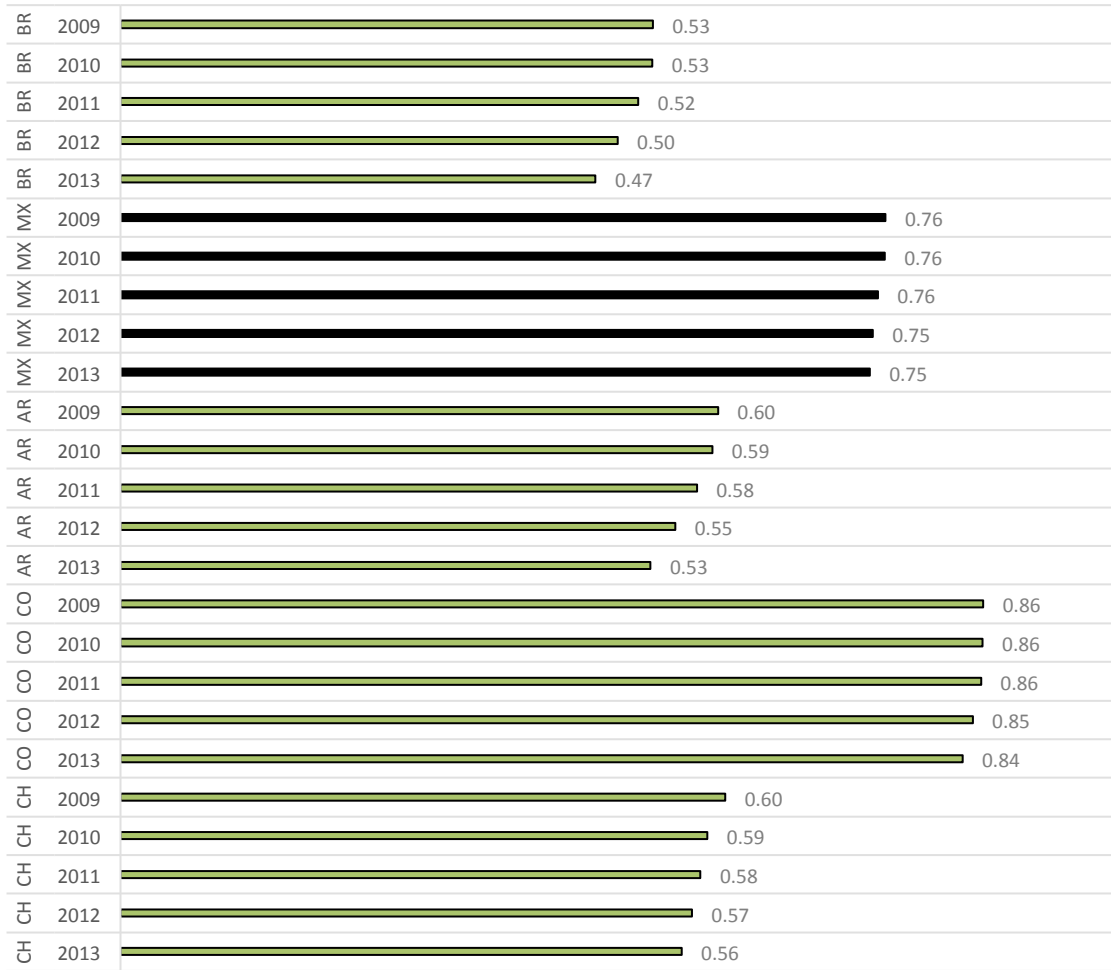
Chart 7. Ratio of cash transactions for consumer payments in retail sales. Brazil, Mexico, Argentina, Colombia and Chile, 2009-2013. Data from estimates by Visa and Euromonitor.

BR	2009	0.53
BR	2010	0.53
BR	2011	0.52
BR	2012	0.50
BR	2013	0.47
MX	2009	0.76
MX	2010	0.76
MX	2011	0.76
MX	2012	0.75
MX	2013	0.75
AR	2009	0.60
AR	2010	0.59
AR	2011	0.58
AR	2012	0.55
AR	2013	0.53
CO	2009	0.86
CO	2010	0.86
CO	2011	0.86
CO	2012	0.85
CO	2013	0.84
CH	2009	0.60
CH	2010	0.59
CH	2011	0.58
CH	2012	0.57
CH	2013	0.56

The estimates vary. Mazzota and Chakravorti (2014) explain that, according to some estimates from major retailers in Mexico, 63 percent of their sales are performed in cash. At supermarkets, 70 percent of transactions are made in cash, the rest splits between cards and employer-issued food vouchers. Part of this behavior is promoted by the large retailers themselves, since some of them reward paying in cash (or apply a fee when paying with plastic). Moreover, small grocery shops and traditional markets (tianguis and mercados), which make up 60 percent of shopping centers in Mexico, are almost fully cash-based.[23]

This is a puzzle since cash has implicit costs. Mazzota and Chakravorti (2014) estimate the cost of cash and show that Mexican consumers face higher costs getting to the point of cash access than they do when withdrawing cash once they arrive (fees). Transportation costs account for the

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[23] See Mazzota and Chakravorti (2014).

large share of these higher costs. The average monthly cost of transit for cash access transactions is 16.9 Mexican pesos versus 2.4 Mexican pesos for transaction fees. Despite that cost, Mexicans –in average- tend to pay in cash rather than using other methods.

A simple exercise with some of the variables in the previous charts helps to shed some light on this issue. Charts 8 a, b and c show a plot of the variables that represent the value of cash vs cashless payments (relative GDP). Table 2 shows the Pearson correlation between cash vs cashless payments, in value and volume of use. The correlation suggests that in the aggregate we see no substitution among holdings of cash and use of cashless instruments. In fact, the correlations might suggest some complementarity.

Nevertheless, this is a rough way to approach the question. An adequate way to evaluate the substitution -or not- of cash payments is to analyze payments by segments of population (income, age and geographical location, among others), and to analyze the use of payment methods by type of transaction (size and other characteristics). Some segments might be substituting cash, other segments using a bundle of instruments, and other simply using mostly cash.

Chart 8 a, b and c. Monetary base in hands of the public vs non cash transactions.
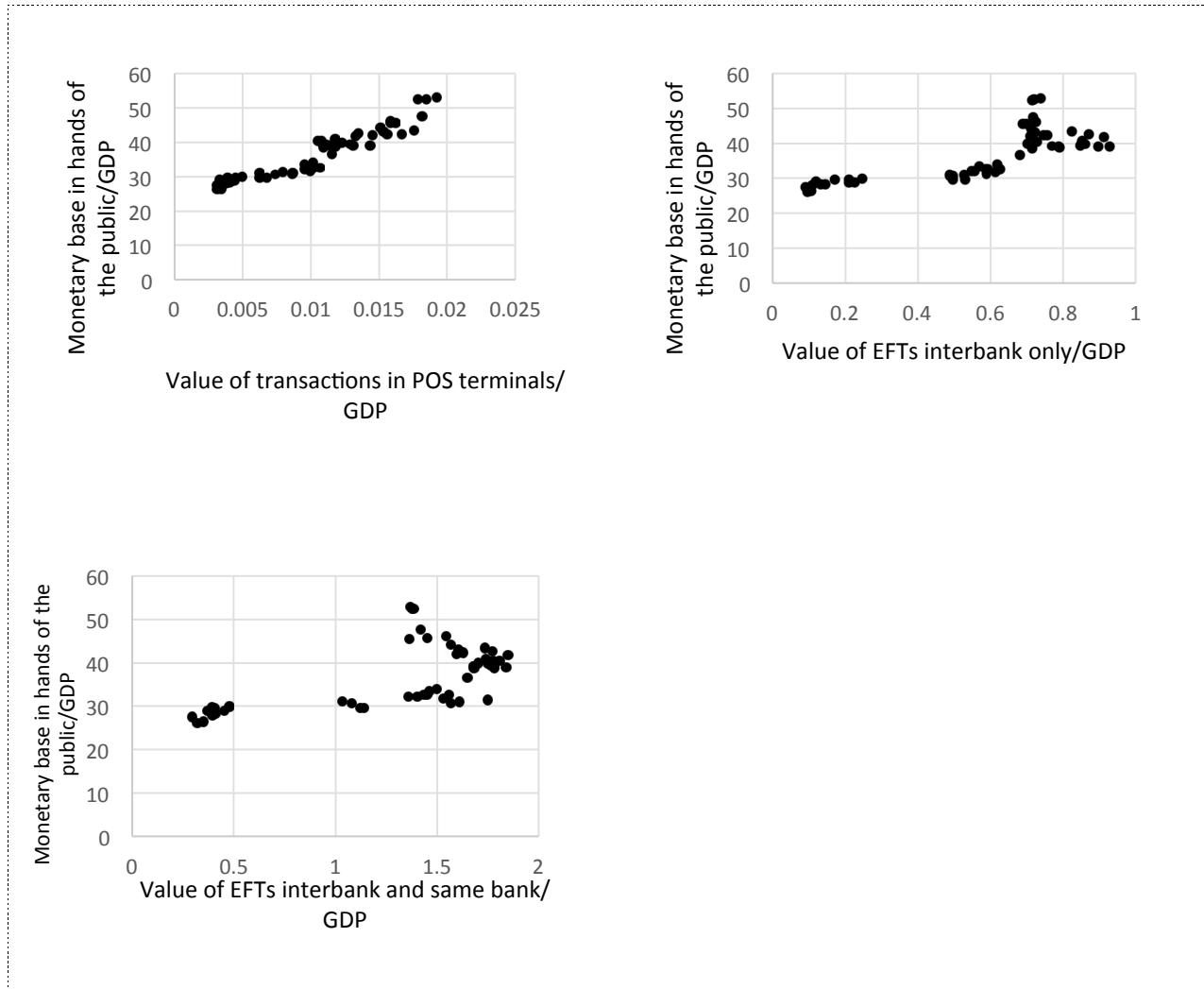

Table 2. Pearson correlation coefficient. Log of the ratio of the variable with respect to GDP

	Monetary base in hands of the public	Credit cards in use -volume	Debit cards in use - volume	Value of transactions in POS	EFTs interbank and same bank
Monetary base in hands of the public	1.000				
Credit cards in use -volume	0.329	1.000			
Debit cards in use - volume	0.922	0.461	1.000		
Value of transactions in POS	0.908	0.525	0.966	1.000	
EFTs interbank and same bank	0.693	-0.559	-0.061	0.895	1.000
EFTs interbank only	0.762	-0.102	0.620	0.923	0.975

6. Open questions about the obstacles

The evidence in the previous section stimulates questions from two angles. First, about the factors that constitute obstacles to the adoption of cashless instruments; and second, about the factors that contribute to the persisting use of cash (even when cashless payments grow). These are usually approached considering whether its origin is in the *supply side* (related to the industry and its regulation) or in the *demand side* (individuals' preferences, behaviour and ways to make choices).

In the supply side, the architecture of the payments system exhibits interacting agents that create and use channels of transmission ("pipelines and roads") as well as rules for execution of transactions. Market structure, technology and regulation play a role to determine how we pay.

In the demand side, users of the system are not passive actors. The consumer's choice of payment instruments embodies a complex interaction of variables. Schreft (2006) argues that payment choices are not the result of simple, static, binary decisions, despite often modelled that way. They are instead the result of complex higher-order, multi-dimensional decisions (with embedded layers of decisions) within the choice of a payment instrument at the point of sale.[24] Many studies view an adoption decision as independent of the other payment decisions, and it is not.

In the following paragraphs I will discuss some of the possible causes behind this problem. These are treated as open questions, because I don not test any of them. I will start with the most recurrent hypothesis, which is the relationship of cashless payments with financial inclusion and the informal economy; then, I will argue that we need to better understand the monetary uses of cashless payment methods. As a consequence of both, the design of the service emerges as a relevant factor.

   a) Financial inclusion, financial access and informal economy

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[24] See Schreft (2006, p. 6): "there are numerous factors that affect payment decisions, including transaction time; transaction costs (including interest costs and opportunity costs); recordkeeping features of the payment instrument; anonymity; risk of loss—monetary loss, identity theft (loss of good credit rating); value of the purchase; physical characteristics of the point of sale; type of bill (recurring or not); consumption-smoothing needs; and the availability of payment instruments". In the same line Briglevics and Schuh (2014) view payment instrument choice as a dynamic decision: using an instrument for a transaction may limit its availability in future transactions.

A recurring view on the persistence of cash transactions is the fact that large groups of the Mexican population do not enjoy an appropriate level of financial inclusion or have little access to formal financial services, thus hindering the use of instruments different to cash. According to the 2012 National Survey on Financial Inclusion, 35.5 percent of adults hold formal savings products, and 27.5 percent have a formal loan; 56 percent of adults make use of some kind of formal financial service. These percentages rose slightly in 2014.[25] Fewer users of formal financial services imply a lower use of payment instruments other than cash.

On the other hand, digital instruments are viewed as a tool for financial inclusion; the inverse causal argument. In recent years, many developing countries –including Mexico- have made commitments to expand financial services for the poor. For example, as of May 2015 government leaders representing 61 countries had signed the Maya Declaration on Financial Inclusion pledging. To accomplish the financial inclusion goals, the financial authorities of several countries have expressed faith in the technological developments that allow digital payments. Practitioners expect that more efficient payment services will facilitate the access and use of formal financial services by the unbanked.[26] However, it is unclear what the causal relationship is. Certainly, it works in both directions.

An accepted view is that a better supply of financial services will help to solve the deficit of financial inclusion. The underlying logic is that a better supply would lead to more accessibility of financial services that would facilitate inclusion. This is a *supply side* view, in which *better* means more extensive and more market-efficient. Hence, some of the problems of the relationship between financial inclusion and use of cashless instruments are attributed to the size and structure of the payments networks.[27] This, in turn, is related to the capacity of the network to promote use of payments and to generate inclusion.

A relevant factor that explains why people use cash is that the number of merchants who accept card payments at POS has not expanded enough in Mexico. This was already shown by Negrin (2005) a decade ago. But despite its recent growth, it has favored urban over rural, semi-rural

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[25] Estimates from the National Survey on Financial Inclusion, CNBV (2014).

[26] Among the studies cited in this paper, Villasenor, West and Lewis (2015), Mazzota and Chakravorti (2014) and the Global Financial Development Report of the World Bank discuss the ideas behind this argument.

[27] Issues related to the structure of the networks and to market structure not only affect financial inclusion, but also affect the efficiency for all users of the financial system.

and low income areas.[28] In fact, there are several regions underserved, since only 61 percent of Mexican municipalities (county) enjoyed the presence of stable POS in 2014.[29] Consequently, the acceptance of cards to pay is limited.

Moreover, the network of ATMs exhibits some fragmentation, with geographical areas that are saturated and other that are underserved, mostly depending on demographic factors, as shown in a study by Moreno and Zamarripa (2013). This study also stresses that the structure of the fees charged by banks may have been a disincentive to the use of ATMs, consequently credit and debit cards. By 2014, only 54 percent of municipalities in Mexico had ATMs.[30]

An extensive diagnosis of the financial system by the anti-trust authority in Mexico stresses the role of the structure of the payments network (Cofece 2014). This study also emphasizes some of the results by Moreno and Zamarripa (2013) about the ATM network.[31]

Restrictions to financial intermediaries other than commercial banks to access the main clearing house for EFTs (Cecoban) have also hindered the expansion of electronic transactions. Up until the 2014 Financial Reform, systems such as those that allowed EFTs, as well as connections to credit card operators and card clearinghouses, were restricted to non-bank intermediaries. These barriers have been eliminated from both the legislation and in practice, but there is still a long way to go.

Despite the removal of regulatory barriers, the regulations on de-risking and prevention of money laundering have made the opening and functioning of transaction accounts more complicated, thereby hindering their growth. Efforts in regulatory change to improve financial inclusion might have been offset by the emergence of a highly complicated and cumulative body of de-risking regulations and norms; this includes obstacles to access digital financial services. De-risking regulations have had a perverse effect arresting access to financial services to segments of clients that cannot comply with all the requirements that banks request.

The problems described above have a broad effect beyond inclusion, since they affect the use of cashless payments by clients of the financial system and potential users (among them those that lack inclusion). In fact, most published research focuses on how the structure of the payments

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[28] Cofece (2014), Negrin (2005).
[29] Estimates from CNBV (2014).
[30] *Ibid*.
[31] See also Cofece (2014); Mazzota and Chakravorti (2014) argue that formal financial inclusion alone does not lower the fees paid to access cash and the type of access point plays a large role in determining the cost of cash access. Moreover, the cost of access to cash has fallen in the last decade (or so), due to the expansion of ATMs and correspondent banking networks (this has also increased its accessibility and hence its use).

networks, the industrial organization of the financial system and its regulation -the three of them-explain market inefficiencies as well as insufficient access.

Additionally, the existence of a widespread informal economy in Mexico has been construed as a barrier to the use of formal financial services and, consequently, to financial inclusion. The value of the informal economy for the 2005-2013 period is estimated to stand at between 27 and 29 percent of GDP. Although transactions in the informal economy can be completed using different methods of payment, cash continues to play an important role in such transactions. The examples are endless, salaries paid to employees in all the food chain from agriculture to produce markets, income from tips in restaurants and tourist zones, petty sales in small villages, services that involve a minor payment (a rapid visit to the doctor, taxis and public transport, plumbing), among many other. Mazzota and Chakravorti (2014) also stress the role of the underground economy, in particular drug trafficking and money laundering; needless to say that it is an almost all-cash activity.[32]

Again, it is unclear how the relationship between low inclusion and economic informality works. Here we are dealing with an issue of endogenous variables. A final conclusion on the causal relation, whether informality contributes to low inclusion or if low inclusion is the cause of informality, is yet to be reached. It is a fact that they are correlated. Some practitioners believe that financial inclusion may help to reduce informality.[33] The underlying reason is that financial inclusion might incentive individuals to eventually formalize its economic activity. Access to the financial system is a first step or a threshold to formalizing.

b) Cashless instruments as money

When discussing the possibilities of substitution of cash by digital instruments, an aspect that is central to the discussion, but that has remained marginal to a great extent, is how these payment methods play a role as money. Most advocates of a cashless economy emphasize the convenience of those instruments, their capacity to reduce transaction costs and its economic efficiency. However, in terms of universal acceptance and unlimited power to discharge debts,

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[32] It is estimated that revenues of illegal drug exports to the U.S. reached 6.2 billion USD in 2011.
[33] As suggested by Sanchez (2015); some practitioners argued this in several roundtables organized by the CEEY during 2014 and 2015.

there is no substitute for cash as money. The feasibility of cash for minor transactions, particularly in low income areas, plays a relevant role.

A note by AT Kearney (2013) asserts that technology has yet to create the perfect substitute for cash, because cash is simple, reliable, safe, private, universally accepted and appears to be free (no explicit cost, however there are implicit ones as already discussed). The discussion by most enthusiast of cashless payments has been missing the fact that money provides a bundle of functions and has a set of characteristics that are unique. The universal acceptance of cash as a legal tender is so far unparalleled. There is no clear answer whether this is going to change or not, and how.

In general, cash has advantages that other forms of payment do not necessarily have and which are important in an environment where accessibility to financial system service points is limited. Among these characteristics we find:

- Feasibility for minor transactions in low income areas – no substitute for cash as money.
- The costs of a system failure in the payment methods of the banking system may prove highly burdensome for the user, a problem that would rarely present with cash.
- Despite the transaction costs the use of cash can generate, the commissions that banks and retailers charge for the use of their payment methods still represent a direct cost for the user.
- The rapid pace of innovation in payments conspires against its adaptation by users, because services and platforms are in constant change. Individuals avid to adapt innovations may respond to a fast evolution, but most people will trust in stable, proven instruments.
- Many low income users consider that they have better control over their finances with the use of cash than with payment instruments associated with a traditional bank account.
- Cash is a form of payment that preserves individual privacy.

The widespread use of cash however causes it to become ingrained in the consumption, payment and transaction habits of users. This leads to a "path dependence" in the use of cash by segments with low financial inclusion: a feedback loop develops in the use of cash that leads to its persistence, hindering its substitution by methods that apparently are more efficient (or more efficient for certain segments of the population).

Some authors argue that different types of monies form a hierarchy, in which trust and functionality are the main determinants. In this view, the position of a particular form of money in the monetary hierarchy is determined by two attributes: its liquidity (the ease with which it is redeemable into the dominant currency), and its effectiveness in performing monetary functions.[34]

However, this analysis cannot be oversimplified. Difficulties emerge when analyzing digital instruments as money.[35] To understand an evolving phenomenon, research is always needed. The nature of cashless instruments as money has been discussed by authors from diverse disciplines in the social sciences, mainly economics, history and anthropology.[36] The paper by Bátiz-Lazo, Haigh and Stearns (2014) shows that it is possible to set bridges across disciplines.

It is unnecessary to remind that in economics, the discussion about the nature of money has always been at the core of the discipline and is studied from many of its fields. Most monetary economists, due to the nature of their questions, need to approach money as monetary aggregate.[37] But increasingly, recent work in empirical microeconomics analyzes the choice of payments by individuals, as some of the studies cited in this essay. Other economists have developed theoretical work to understand money as a medium of exchange, its nature and how individuals select among diverse types of monies; their contributions are indispensable to have benchmarks in the discussion among economists.[38]

Likewise, monetary history, economic history and financial history have proved to be the ultimate source to understand the nature of money.[39] In fact, the historical studies give us an educated intuition about the feasible scenarios for the future. And history facilitates building communication channels between disciplines. However, we still need more work that evinces how those studies help to understand current events.

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[34] See the essay by Miller, Michalski and Stevens in OECD (2002).

[35] For example, credit cards are not part of the money supply since they are credit lines and are not a liability of the financial system. Nonetheless, they function as an instrument for payments and perform functions attributed to money. Prepaid cards are an instrument that is not evident to classify and has gained relevance in payments.

[36] See for instance Maurer and Nelms (2014), Guyer (2012), and the collection of works in OECD (2002).

[37] Any effort would be insufficient to summarize the massive field of monetary economics. However, the seminal work of Baumol (1952) and Alchian (1977) elaborate on the nature of money as a medium of exchange. A more recent paper by Mbiti and Weil (2013) analyzes the effect of mobile banking in the velocity of money supply, bringing into the discussion the use of digital payments as money.

[38] These are works such as Cuadras Morató (1994, 1997 and 2009); Kiyotaki and Wright (1989); and Richter (1988).

[39] Departing form the classic works of Friedman and Schwartz (1971), Bordo and Ehsan (1982), Vilar (1984), to recent contributions, such as Sargent and Velde (2003), the splendid book by Mihm (2007) and recent research by Bautista (2016).

c) Product design vs habits of users

A third factor to consider is how products that provide payments services are designed and to what extent they take into account the habits, needs and behavior of users of financial services. This represents a challenge for the financial industry as it means that there are large segments for which the design of payment services and products is not necessarily the most suitable. This happens in an era when the financial industry claims that the "user experience" is central to the design of the service/product.

In the last decades, the massive character of financial services has undermined an essential aspect of finance: the relationship between an intermediary and a user (borrower or saver). Financial services have an inherent relational nature that comprises repeated interactions, flows of information and trust. Adoption of technology is increasing the distance between the financial firms and the user.

Many of the limitations in service design relate to uncertainties for consumers when problems arise, such as card fraud, cloning and poor customer service and solution to problems by the banks. For a client, it is important to have certainty of "who is in charge" in the solution of a failure. Lack of good service debilitates trust, which is an essential component of any financial service. And lack of trust prevents the use of the service.

However, problems and their solutions are not everything. Adequate design is necessary to make a product relevant. For instance, it is essential to adapt the service to the income-expenditure cycles of users that are considered non-conventional for traditional financial intermediaries (such as micro-entrepreneurs, farmers and self-employed workers). In addition to cycles, understanding habits and evolving preferences is indispensable too. For low income segments, the service needs to be affordable, which is a challenge for financial institutions when they need to prove the profitability of a product.

Some of the issues that emerge and constitute challenges for the industry are:
- Payment service providers, basically the banks, must ensure that the customer experience is consistent thereby ensuring security, as well as easy and timely solutions when

problems arise that jeopardize the funds of users. This does not necessarily occur, which undermines user confidence. When problems emerge, clients need to know that there is somebody "in charge". Maintaining trust and improving experience is necessary for existing platforms.

- Several banks are implementing highly innovative payment solutions; many include mobile banking. Nevertheless, the most innovative solutions have to compete against more traditional and established divisions in order to demonstrate their viability in the business of the bank. Many of these innovations require a certain amount of time to mature and become profitable. As a consequence, many valuable innovations are discarded from the core business of banks for failing to turn a quick profit.

- Large financial intermediaries may face internal reticence to introduce innovation to preserve legacy platforms.

- Various practitioners agree that mass payments services, primarily those aimed at low income segments, must fulfill three characteristics; these must be: *accessible*, *affordable* and *secure*. This rule applies to all financial services for the base of the pyramid, in addition to being a necessary condition for these payments to progress. Otherwise their scope will continue to be restricted.

Failed experiences with G2P platforms provide lessons on the consequences of ill-designed services. [40] First of all, the use of debit and prepaid cards in the government programs was an important step to promote the incorporation of new users to the financial system (this in addition to the inherent goal of having a better control of the allocation of funds). So far, however, the cards have not been widely used by beneficiaries, primarily because the ATM network charge commissions for withdrawals from banks other than the user's, this represents a high cost for low income users. There are other barriers; for instance, users withdraw all the money in a single visit to the ATM because of the lack of possibilities in their communities to make cash withdrawals (ATMs or bank branches are not nearby). These cash withdrawals are necessary because POS terminals are concentrated in urban areas and therefore cards are not widely accepted. The condition of universal acceptance is not met in many areas. Furthermore, G2P channels, which

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[40] The study by Zapata (2013) about the disappointing use of bank correspondents in Mexico explains why G2P channels can be problematic.

are designed and tailored for the distribution of government payments, cannot be easily transformed into a channel for the distribution of financial services (Zapata 2013).

A study by Masino and Niño (2014) shows that innovation may be beneficial in G2P channels. This study uses a quasi-experimental strategy and shows that Mexican households who received government transfers in a bank account decreased their participation in informal savings, increased the frequency of remittance reception, and were more likely to use their savings to cope with idiosyncratic shocks.[41]

Research in this area is still needed for Mexico. Needless to say that it is also needed for other countries that exhibit a transformation of their payment methods, as it is the case of most Latin American nations. First, research on stories of success/failure are necessary to understand what are the factors behind the dissemination (or not) of an innovation.[42]

Second, research that allows a better understanding of the choice of payment methods is indispensable for better product design. Literature is scarce for the entire region, and most existing studies analyze samples of populations that already enjoy financial inclusion (an exception is Sanford 2016). Data however, might be increasingly available. We need more analysis that allows understand behavior as well as culture of payments; this includes both, quantitative and qualitative type of research. For instance, studies that identify segments by groups of age, income and region, among other characteristics, as well as studies that allow understanding context-specific decisions. Some recent contributions, Castellanos and Garrido (2010), Lluberas and Saldain (2014), Masino and Niño (2014), to cite a few examples, show that there is a wide potential for a research agenda for Latin America.[43]

Another vein of studies may emerge from design thinking research, an area which methods are increasingly being applied in Fintech innovation.[44] Design thinking is an area that has strong complementarities with fields of social sciences that analyze behavior and culture.

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[41] The study uses data from recipients of *Oportunidades* program using accounts in *Bansefi-L@ Red de la Gente.*
[42] See for instance Bátiz-Lazo and Del Angel (2016).
[43] Castellanos and Garrido (2010) combine the effect of income and the availability of POS terminals to explain the use of credit cards. Lluberas and Saldain (2014) show that in Uruguay, a large proportion of households concentrate their purchases in a single payment instrument, cash, and the use of other payment instruments increases with income, education and the access to financial services. More education reduces the probability of using cash or checks exclusively, and a more intensive use of electronic payment instruments; the regional number of POS increases the probability of using debit and credit card.
[44] Due to my scarce knowledge in this field, I omit discussing it. However, it is behind many recent innovations.

7. Final remarks

The substitution of the use of cash in transactions for cashless instruments is still a long way off. The Mexican case suggests that alternative payment methods coexist, and their use depends on the convenience of each method, according to its attributes. Such coexistence of methods is shaping the current payments ecosystem of that country. As Bátiz-Lazo, Haigh and Stearns (2014) argue, imaginaries of a cashless society began to appear throughout the developed world during the second half of the twentieth century. But today, the futuristic gloss ideas like "cashless society" or "global information society" are being replaced by a messy reality in which new and old forms of money coexist indefinitely.

In this essay I aimed to open a discussion about the factors that explain the persistence of cash as a medium of payment in the midst of a wave of new innovations. I do not propose a hierarchy nor assess the size of impact of the attributed causes. Nevertheless, I consider that it is important to bring to the discussion two aspects that have received less attention. Most of the discussion focuses in how cashless payments relate to financial inclusion and the informal economy; a relationship that is endogenous. But there is still little understanding of the extent to which digital payments might constitute an actual substitute for cash as money. And second, payments services/products need to prove their convenience and reliability to segments of population that are not intensive users or have little access to them. Characteristics that provide trust, relevance to the needs of people, easy access, user friendly technology, and affordability are essential to payment services.

Competition is one of the drivers that can stimulate these improvements in services. But only further research will provide evidence and knowledge to channel innovation in the best direction.

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