Electronic Payments, E-Commerce and Economic Activity: Theoretical Review and New Evidence for Developed and Emerging Market Economies

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1 Executive Summary

In recent years there has been significant development of payments systems and, in particular, of electronic payments around the world. In the retail payments market, debit and credit cards have gradually complemented and replaced the usual paper-based payment arrangements.

This trend is particularly significant in the case of emerging economies. The value of credit card transactions (as a share of private consumption) increased almost 80% between 2004 and 2009 in emerging economies, while in developed economies increased 20% in the same period. In emerging economies, the total number of point-of-sale terminals has increased 185% between 2004 and 2009; for developed economies this increase has been 38% in the same period (see figures below).

The expansion in retail payments using electronic payments is associated to the increase in the number of credit cards, particularly in emerging market economies. Again, by normalizing the number of credit cards per countries to 100 in 2004, it is possible to see that in emerging economies, the median number of credit cards has increased more than 140% between 2004 and 2009. The increase in developed economies in the same period was close to 40%, but again with a significant slowdown in the years 2008 and 2009.

The increase in electronic payments in recent years is likely to be explained by different factors. Nonetheless, the relationship between economic development, proxy by per capita GDP, and different indicators of electronic payments may be relevant to understand recent trends.
In figures below the number of POS terminals and credit and debit cards per million of inhabitants is presented with respect to per capita GDP. Each point in these figures corresponds to the average number of POS and credit and debit cards per million of inhabitants per country for a group of developed and developing countries in the period 2004-2009.

The relationship between per capital GDP and the variables of interest in all the cases is strongly positive. Higher levels of economic development are associated with a movement towards electronic payments.

![POS Terminals and GDP Per Capita](image1)

![Number of Credit and Debit Cards and GDP Per Capita](image2)

Now, the increase in the utilization of electronic payments instruments raises several questions. Which are the factors that explain this switch towards electronic payments? What are the effects of the increase in the use of electronic payments on economic welfare? If electronic payments are welfare-improving, how can its adoption be encouraged? The objective of this report is to provide a comprehensive assessment of electronic payments and electronic commerce in developed and emerging markets, with the purpose of providing answers to these questions.

Empirical studies show that the development and adoption of electronic payments reduces the cost of the payments system, while theoretical studies indicate that more efficient payments systems increase the level of economic development and economic growth. The speed of adoption of electronic payments depends on the interaction of initial infrastructure costs (associated to the implementation of electronic payments) and technological advances. At a very low stage of development, only two means of payments coexist: cash and paper-based. With the development of new technologies
and/or the reduction in infrastructure costs associated to electronic payments, non paper-based payments become relatively cheaper and the fraction of markets where this payment method is chosen increases.

The positive relationship between the electronic payment system and economic development can be summarized as in the flow chart below. Technological progress generates a reduction in the cost of intermediation services, which at some point trigger the adoption of electronic payments. The adoption of electronic payments increases consumption as the share of resources in the economy devoted to pay intermediation costs shrinks generating a welfare gain for the economy. Additionally, the adoption of electronic payments fosters the development of financial markets, leading to system efficiency gains and to faster capital accumulation and technological progress, which generates higher economic growth. Finally, the adoption of electronic payments increases the number of actors on both sides of a transaction, leading to an intensified competition and service innovation.

**Electronic Payments and Economic Development**

- Higher economic growth
- Technological progress
- Lower costs of intermediation services
- Adoption of electronic payments
- Increase in consumption as the share of resources in the economy devoted to pay intermediation services shrinks
- Financial market development, leading to system efficiency gains and faster capital accumulation; boost to new technological progress
- Increase in the number of actors on both sides of transaction, leading to an intensified competition and service innovations
The resources that an economy devotes to the functioning of its payments system are quite significant. Humphrey, Pulley and Vesala (2000) estimate that by mid-1990s the United States spent around 3% of GDP per year to make payments possible. They estimate that if non-cash transactions in the United Stated had changed at that time to a composition similar to the average for Europe and Japan, the savings would have reached close to 1.25% of GDP. More recent studies, conducted mainly by central banks, have provided more detailed estimates of the cost associated to the different type of payments. For example, the total cost of all point-of-sale payments was estimated to be 0.65% of GDP in the Netherlands and 0.74% of GDP in Belgium (Schmiedel et al 2012).

New empirical evidence regarding the relationship between electronic payments and economic welfare is presented. Using data for a group of 62 developed and emerging economies an index to capture the importance of electronic payments is constructed. As in previous literature, for each country the average value of transactions using credit and debit cards as a percentage of total consumers spending for the period 2004-2009 is computed. A higher value for this ratio (penetration of electronic payments) is associated to a higher importance of electronic payments at the retail payments system.

As figure below shows, the median for the variable penetration of electronic payments for developed economies is significantly higher than the median for this variable in the case of emerging market economies.

The evidence provided also indicates that for lower levels GDP per capita, there is no correlation between the level of GDP per capita and the penetration of electronic
payments. Interestingly, as the figure below shows, there would be a positive relationship between these two variables for higher GDP per capital levels. This would be consistent with the theoretical prediction that at certain level of economic development, the cost of the electronic payment infrastructure is reduced at a point in which the transformation towards an electronic payments system occurs.

![Credit and Debit Cards Transactions and GDP Per Capita](image)

More formal empirical analysis is then developed in order to evaluate the impact of electronic payments on economic development. In the first place, economic growth cross-section regression analysis is performed. Then, panel regression analysis to deal with some of natural criticisms that may emerge from the cross-section analysis is performed.

In the case of the cross-section regression analysis, the new empirical evidence regarding the connection between electronic payments and economic growth for emerging and developed economies provided in this report indicates that the penetration of electronic payments is positively related to the rate of per capita GDP for the countries under analysis when controlling for other variables identified in the literature as potential determinants of economic growth.

When considering the impact of R&D investment, the significance of the electronic payment penetration remains but the variable R&D investment is not significant. Now, the theoretical literature indicates that the impact of technological progress (which in this exercise may be associated to higher R&D investment in this analysis) on economic growth should be higher for higher levels of electronic payment penetration because the degree of knowledge diffusion into the electronic payments is higher in cases in
which electronic payments is more developed. Influenced by this, we introduce a new variable to the analysis: the interaction term between electronic payment penetration and R&D investment. The results indicate that this interaction terms is highly significant.

The coefficients estimated indicate that a one-percentage point increase in electronic payment penetration generates a 0.03% increase in per capita GDP. Considering that the electronic payment penetration in emerging market economies is significantly lower than in developed economies (8.7% versus 28.0% respectively), the potential gains associated to a movement towards electronic payments may be significant.

The results obtained from the GMM system estimation that includes the Great Recession period (2008-2010) indicate that the significance of the electronic payment penetration variable falls significantly with respect to the cross-section estimation. Nonetheless, when the sample estimation is shortened to the period 2000-2007, the statistical significance of this variable is restored.

In terms of the importance of electronic payments on economic growth, the results from the panel estimation are similar to those obtained in the cross section estimation. In particular, a one-percentage point increase in the electronic payment penetration generates an increase in per capita GDP growth that fluctuates between 0.035% and 0.045%.

Given the potential significant gains in resources associated to the adoption of electronic payments and the potential gains in terms of economic growth, the development of the electronic payments system is of particular relevance for policy makers. Along this line, functions that are typically run by the public sector, such as social security, welfare and transfer payments could take full advantage of the new available technologies and through this to speed up the adoption of electronic payments with the positive effects on economic welfare. Conditional cash transfers programs in Latin America, for example, are reaching over 115 million beneficiaries (BBVA, 2011). In that context, electronic payments might provide substantial benefits. Electronic payments cut transaction and administration costs, increase the scope for a better targeting and reduce leakages.

By 1991 the Internet had less than 3 millions of users around the world and e-commerce was almost non-existent. By 1999, it was estimated that 250 million people had access to Internet and approximately one quarter of them made purchases online. By 2002 there were over 650 million Internet users worldwide and 66,810 secure servers only in the OECD area (OECD, 2000). Access to Internet is growing rapidly. From 2000 to 2001 the numbers of Internet users increased by more than 30%.
Since e-commerce has rapidly influenced how commercial transactions are conducted, research has turned to understand and assess the economic impacts of the use of online platforms to buy and sell goods and services. E-commerce can raise productivity and economic growth as a result of more efficient management of supply and distribution, lower transaction costs, higher level of competition, low barriers to entry and improved access to information. At the macro level this would be reflected by higher total factor productivity (higher economic growth) and reduction in prices.

The emergence of electronic payment instruments provides the basis for the expansion of e-commerce. Moreover, the interaction between the development of electronic payments and e-commerce may be a source of significant welfare gains for consumers. The individual gains that electronic payments and e-commerce generate, discussed in this report, may be amplified when electronic payments and e-commerce expand.
2 Introduction

In recent years there has been significant development of payments systems and, in particular, of electronic payments around the world. In the retail payments market, debit and credit cards have gradually complemented and replaced the usual paper-based payment arrangements. The value of credit card transactions (as a share of private consumption) increased 80% between 2004 and 2009 in emerging economies, while in developed economies increased 20% in the same period. In emerging economies, the total number of point-of-sale terminals has increased on average 185% between 2004 and 2009; for developed economies this increase has been 38% in the same period.

This increasing trend in the utilization of electronic payments instruments raises several questions. Which are the factors that explain this switch towards electronic payments? What are the effects of the increase in the use of electronic payments on economic welfare? If electronic payments are welfare-improving, how can its adoption be encouraged? The objective of this report is to provide a comprehensive assessment of electronic payments and electronic commerce in developed and emerging markets, with the purpose of providing answers to these questions.

The payments system pays a crucial role in a market economy by facilitating the exchange of goods and services and the flow of capital across countries. In any of the many transactions that take place each day, the transfer of funds compensates the delivery of goods, services and financial assets. The availability of a reliable and safe payments mechanism is therefore a main requirement for most economic interactions.

There are several channels through which the adoption of electronic payments may foster economic activity. More efficient payments systems may improve bank performance and efficiency, increasing the availability of resources and ultimately favoring lending, investments, and growth. As discussed by Berger (2003), technological advances in the financial system, such as Internet banking, electronic payment technologies, and information exchanges may increase productivity through improvements in the services provided by banks. Technological improvements in payments systems are not only related to the cost savings side of banking operations, but also to the revenue side, as discussed by Hasan et al (2012). The empirical evidence also suggests that the adoption of electronic payments is associated with a significant reduction in the cost of carrying out economic transactions. As more consumers adopt
electronic payments and the volume of transactions increases, the overall cost of the payments system falls.

Based on retail payments data for all 27 European Member States over the period 1995-2009, Hasan et al (2012) provide evidence that migration to efficient electronic retail payments systems has a positive impact on GDP, consumption, and trade. Retail payment transaction technology itself is also associated positively to real economic aggregates. They find that the presence and diffusion of ATM and POS terminals have a positive impact on GDP. They also provide evidence that the integration and harmonization of retail payment markets fosters trade and consumption and thereby has a beneficial effect on the whole economy.

A different channel through which more efficient payments systems may improve efficiency in the economy is consumer choice. In particular, consumers may benefit from more convenient payment instruments, both in terms of timing and costs. In this context, the retail payments system is of “system-wide importance”, because it facilitates both consumer-to-consumer and commercial transactions and in so doing has a significant impact on the overall economy.

A different dimension of the relationship between electronic payments and economic activity involves the role of an efficient infrastructure and regulatory framework in stimulating the development of the electronic payments system. Regarding infrastructure, important elements include the telecommunication system, an acceptance network, credit bureaus, and consumer education. In addition, electronic payments require sound and efficient regulation, both from the relevant government bodies and the private payments network.

All of these dimensions raise new challenges for public policy. The development of electronic payments influences the way in which financial supervision is conducted and implemented. At the same time, many functions that are typically run, at least in part, by the public sector—such as social security, welfare and transfer payments—could take full advantage of the new available technologies and through this to speed up the adoption of electronic payments with the positive effects on economic welfare. Finally, potential issues arise regarding the implementation of monetary when electronic payments are adopted.

The emergence of electronic payment instruments provides the basis for the expansion of electronic commerce and the gains associated to this expansion. Recent literature has highlighted the positive effects that the emergence of e-commerce may have on the economy. E-commerce can raise productivity and economic growth as a result of more
efficient management of supply and distribution, lower transaction costs, higher levels of competition, low barriers to entry and improved access to information. At the macro level, it is also argued that e-commerce may boost total productivity, economic growth and reduce prices by increasing competition in the economy.

Moreover, the interaction between the development of electronic payments and e-commerce may be a source of significant welfare gains for consumers. The individual gains that electronic payments and e-commerce generate, discussed in this report, may be amplified when electronic payments and e-commerce expand.

The report is organized as follows. In the next section we present a detailed definition of the payments system and its structure. Then we provide a review of the main trends in electronic payments system. Later we offer a detailed description of the channels through which the adoption of electronic payments may foster economic welfare and the main triggers in the adoption of electronic payments. Having identified the channels through which electronic payments increase welfare, we provide a review of existing evidence on the impact of electronic payment on economic growth, including new evidence for emerging markets and developed economies. Next we discuss other determinants of demand and supply of electronic payments, and the challenges for public policy that the adoption of electronic payments poses. Last but not least, a discussion on the connection between electronic commerce, electronic payments and economic activity is contained in the last section of the report.
3 Payments system definition and structure

By facilitating the exchange of good and services and the flow of capital across countries, the payments system pays a critical role in a market economy. In any of the many transactions that take place each day, the delivery of goods, services and financial assets is compensated by the transfer of funds—either using cash or through the discharges an obligation from the payer to the payee. The availability of a reliable and safe payment mechanism is therefore a main requirement for the realization of most economic interactions.

The payments system is often defined as the complete set of instruments, intermediaries, rules, procedures, processes and interbank funds transfer systems that facilitate the circulation of money in an economy. To properly operate, a payments system needs to include three elements: a set of instruments to authorize and submit a payment, a process to exchange instructions on the payments and a settlement procedure to compensate payers and payees.

In most countries the payments system is organized in terms of a two-tiered banking structure (Hancock and Humphrey, 1998). Depository institutions that supply services to consumers and final users form the first part. The second consist of the Central Bank and other private organizations that provide clearing and settlement services.

In addition, payments systems need to operate under an institutional framework and based on certain market arrangements. The institutional framework includes a set of laws, rules, procedures and organizations such as regulatory agencies, courts and legislators. Market arrangements consist of standards, conventions and contracts for the production, pricing and use of the various payment instruments and services.

3.1 Types of Payments

The payments that take place in an economy can be categorized along three different dimensions (see European Central Bank, 2010):

- On the basis of the different types of payer/payee involved in the transaction.
- On the basis of the number of payers and payees involved in the transaction.
- On the basis of how the trade is executed (international trade context).
Within the first dimension, a first category corresponds to wholesale payments. It comprises transactions between financial institutions. They only represent a small share in the total number of payments but involve high values, which in the absence of an efficient settlement process may undermine the functioning of the entire financial system. A second category corresponds to the retail payments, which correspond to transactions between non-financial institutions. They represent a large proportion of total payments but have substantially lower values and are not often cleared and settled under the same system than wholesale payments.

An additional category, commercial payments, is often considered. These are payments generated mostly by large corporations, and due to the large values associated, are closer to wholesale rather than retail payments.

Regarding the number of payers and payees involved in the transaction, there are three main categories: in one-to-one transactions, a single payer transfer funds to a single payee (e.g. consumer to business payment); in one-to many transactions, a single payer transfers funds to several payees with a single submission (e.g. social security payments from governments to households); and in many-to-one transactions several payers transfer funds to a single payee (e.g. tax payments from households to the government).

Finally, a distinction among payments is made depending on how trade is executed. In clean payments, all relevant documents are exchanged directly between the trading partners. In documentary payments, which are used in international trade, banks handle payments on behalf of the exporter and the importer making sure the funds as well as the goods or services that initiated the operation are effectively delivered.

3.2 Payment Instruments

In any modern economy a set of different payments instruments can be found, each with its own characteristics, advantages and shortcomings. The most common distinction is between cash and non-cash instruments.

Cash payments are made using banknotes and coins. It often involves face-to-face transactions of low-value payments between individuals or between consumers and merchants. When the parties involved in the transaction do not explicitly exchange information about their identity, cash payment becomes an anonymous transaction. Cash payments are, by definition, a final transfer of value.
Non-cash payments on the other hand, consist of the transfer of funds between accounts. In its most basic form, a payer gives her financial institutions the authorization to transfer resources to a payee.

Non-cash instruments can be then subdivided with respect to its physical form and with regard to the party who is submitting the instrument for processing. With respect to the physical form, we find two main types of instruments: electronic and paper-based. The former -although much more recently introduced- is increasingly gaining importance and becoming the dominant payment instrument in most countries, as it will be discussed later.

Regarding the party submitting the payment instrument for processing, credit and debit instruments can be found. Credit-based instruments such as direct credit and wire transfers are submitted by the payer. Debit-based instruments such as direct debits, credit cards and checks are submitted by the payee.

The most common non-cash payment instruments are credit transfers, direct debit, payment cards and checks.

- Credit transfers are instructions sent by a payer to its bank -either in paper or electronic form- requesting the transfer of funds to the account of a payee.

- Direct debits are payment instruments -generally submitted electronically- initiated by the payee to request the debiting of the payer’s bank account.

- Payment cards are used by their holders to pay for goods and services online, to pay at the point of sale and to withdraw money at automated teller machines. There are two main types of payment cards: debit and credit cards. Debit cards are linked to a bank account and allow cardholders to charge payments directly to this account. Credit cards provide cardholders the possibility of delaying payment by offering a line of credit.

- Checks are written orders of payment from one party to another. Checks are popular from the payer’s point of view because there is often a delay between the drawing of the check and the debiting of the payer’s bank account.

An increasingly popular non-cash instrument used in transaction is e-money. This is defined as a monetary value that represents a claim on the issuer, which is stored on an electronic device and accepted as a means of payment. However, given that the
creation or the reimbursement of e-money involves the core payment instruments this is defined as a means of settlement rather than a payment instrument.

Another type of non-cash payment instruments corresponds to the special purposes instruments. Within this category we find money orders and travellers’ checks. A money order is a payment instrument based on the credit transfer instrument that is used to transfer money. It is commonly used in cases in which the payer (and/or the payee) does not have a current account with a financial institution. Travellers’ checks are prepaid paper-based products issued in specific denominations for general-purpose use in business and personal travel. Their defining characteristics are that they do not specify a specific payee, are non-transferable once signed and can be converted into cash only by their specific owner.

### 3.3 Payments communication network

For any non-cash payment to be processed, information between different parties needs to be exchanged. In a simple retail transaction, for example, customers via point-of-sale terminal send information to their own bank, which then might communicate with other banks involved in the clearing and settlement systems. A payment communication network plays the role of linking financial institutions to their customers – as well as other participants in a payments system- facilitating the process of sending, receiving and processing information between multiple participants.

In a typical communication network a predefined group of users carry out financial transactions, transfer funds, and exchange financial information between each other. In order to limit financial risks, group members are often required need to meet certain standards before they can be part of the network.

In recent decades much of the payment information, as well as the majority of financial transactions, is exchanged electronically. This has allowed the automation of many parts of the clearing and settlement process for payments thus helping to reduce time and cost of making transactions.

ATM and card payment services are good example to illustrate the use of a communication network. In ATM networks, cardholders use the ATM devices that are part of a network consisting of a bank or a group of banks, to withdraw money or make deposits regardless of their location. In card payment services, a network links point-of-sale terminals allowing customers to use payment card for the purchase of goods and services in various locations.
Communication networks can be divided into two groups: proprietary and public. In proprietary communication networks, transactions are made through a central entity which determines the participation rules, fees, technical requirements and selects the communication provider that links all participants. Entities with no direct access to the network can only participate using a third party that handles all the actions on their behalf.

In a public communication network different administrative units share all resources. Under this structure, transactions are made directly between individual participants in a peer-to-peer relationship. The recent use of Internet protocol technology in communication networks has, however, reduced the differences between these two types of network. In a public system Internet protocols replace multiple links by establishing a single connection between participants while in a proprietary payments system participants are also connected to the central entity via a single Internet protocol link.

As in most dimensions of the financial payments system, technology and in particular Internet, mobile communication and satellite technology are responsible for much of the recent development in communication networks. Traditional communication network solutions are now being replaced by encryption-based Internet protocol services, which offer better capability and scalability, while also being simpler and affordable.

The technological advances have created widely accessible payments system networks. For example, Internet protocols help to extend access to new market segments through additional data transfer and processing capabilities. In the case of SWIFT –the Belgium-based Society for Worldwide Interbank Financial Telecommunication- participants have direct access to messaging services for the transmission of information between corporations and financial institutions. Security and technology standards have also influenced the development of communication network, ensuring compatibility and links within payment networks and facilitating accessibility through the formation of interbank networks.

3.4 Payment process

Once the type of payments, alternative instruments, and communication network have been defined, it is possible to describe the entire process behind the payments system.
A typical non-cash payment starts when the payer chooses a payment instrument and he or the payee submits a payment instruction to its bank. The bank initiates an internal process to verify the payment instrument and establish its legal and technical validity. The bank also checks the availability of funds, debits the payer’s account and prepares the payment instructions needed for the following steps of the payment process: clearing and settlement.

If both the payer and the payee have accounts in the same bank, the payment process is handled “in house” by the own institution and without the involvement of any other party. If, on the other hand, the payer and payee have accounts in different institutions, the money will have to be transferred through an interbank arrangement. This process starts with the communication of payment information between the two institutions, which results in interbank claims and liabilities between the two institutions.

Payments are handled through two types of arrangements. In corresponding banking arrangements financial institutions can handle the sorting and processing of payments bilaterally or they can forward payment instructions to a service-providing bank, which holds accounts for each bank and process the payment.

The second and most common type of arrangement is a payments system. It consists of a mutual set of procedures and rules in which financial institutions exchange information related to the transmission, clearing, netting and/or settlement of monetary obligations. An interbank funds transfer system, for example, corresponds to credit institutions subject to banking supervision. In this type of arrangements transfers are made between banks on behalf of their customers.

After the payment order is being accepted, the process continues to the clearing process, which often includes matching, sorting, aggregation, and calculation of participants’ mutual positions for the settlement of obligations. Clearing is often undertaken by a clearing house or an organization that operates central-clearing facilities but also offers bilateral or multilateral netting arrangements.

Once payments are cleared, the next step in the process is settlement, which consists of the transferring of funds from the sending to the receiving bank. A settlement payment is considered final when it becomes irrevocable and unconditional.

The transfers between participants that are needed to achieve settlement takes place through a settlement institution, either a central bank or a commercial bank. Interbank settlement can take place either directly between the two banks or via a settlement agent. For large-value payments systems, the settlement agent is always the central
bank while in the case of retail payments systems the settlement agent is chosen with regards to risk considerations.

In the settlement process each payment instruction can be settled individually across the accounts of the paying and receiving bank, resulting in a debit and credit entry for each and every payment instruction. On the other hand, a group of players can achieve the same financial result by using netting arrangements and settling one single net position per party. When netting involves many organizations, a clearinghouse or a central party provides it. Netting is often preferred because it reduces the cost of holding balances or obtaining credit in order to achieve the settlement.

Finally, once the payment is settled, the account of the recipient is credited and the receipt of payment is communicated to the beneficiary.

As it can be seen from the previous description, the payments system plays a crucial role in the adequate functioning of the economy. A well-designed payment infrastructure contributes to a better functioning of markets, reducing frictions and costs associated with economic transactions.

I. Box: Payment card systems

The payment card system has both common and unique elements that can be used to illustrate the different steps in a payments system.

Card transactions need to achieve certain scale and be carried out in a consistent manner in order to be considered a reliable payment instrument and be widely adopted. For that purpose, all relevant players agree on a common set of rules (for example, a required infrastructure and some standards for point-of-sale terminals and ATMs). Rules are defined by card schemes often owned by credit institutions or banking associations.

The two main players in a payment card are the card issuer and the acquirer. The card issuer is a financial institution that makes payment cards available to cardholders, manages the account and in the case of credit cards extends credit to the cardholder. It also authorizes transactions at point-of-sale terminals or ATMs and guarantees the payment to the merchants. The acquirer is the entity that manages the account for the merchant. It forwards the information resulting from a transaction; ensuring payment is processed and then received. For point-of-sale, the acquirer is often a credit institution
to which the merchant transmits the information necessary to process the card payment. For ATM transactions, it is a credit institution, which makes cash available to the cardholder.

Card transactions are initiated -either at a terminal or remotely by e-mail, over the phone or on the internet- by identifying both the card and the cardholder. Once the card and the cardholder have been successfully authenticated, authorization for payment is requested. For that purpose, the terminal forwards the information to the acquirer (or to the card scheme), who can directly authorize or refuse the transaction or pass it to a switching center. The authorization process usually includes checking balances and card limits.

After the transaction is authorized, it is then forwarded for clearing and settlement directly to the clearing agent or the acquirer. The acquirer extracts the part of the transaction in which the same bank is involved and sends the rest of the transactions day to the issuer or directly to the clearing system. Once the payment is settled the recipient is credited. All the steps in the transaction process are carried out in accordance with the contractual agreements between the parties involved.
4 Main trends in electronic payments system

Payments systems started evolving more than 150 years ago, when consumers and firms slowly shifted from cash to paper-based instruments. Much more recently and as a consequence of technology and innovation, electronic instruments have emerged. In many countries not only electronic instruments are widely used but the payment infrastructure and the institutional and legal framework has adapted to the new challenges of electronic transactions.

A World Bank survey shows that 70% of the countries in the sample cover issues related to electronic payment processing on their legal frameworks (Global Survey Book, 2008). As it will be discussed in the next section this shift would be explained by the welfare improving assumption associated to this means of payment.

In developed economies the recent trends indicate that the use of checks has been declining because check payments, and specially cash payments, are being replaced by payments made with electronic instruments. Is this trend also something that we observe in emerging market economies?

In Figure 1, the evolution of credit card payments in emerging and developed economies is presented. Credit card payments correspond to the value of transactions using credit cards as a fraction of private consumption. In order to facilitate the comparison, for all the countries in the sample, this ratio is normalized to 100 in 2004. There is a clear positive trend in developed and emerging economies in the use of electronic payments.¹

This trend is particularly significant in the case of emerging economies. The median value of credit card transactions as a fraction of private consumption increased almost 80% between 2004 and 2009 in emerging economies while in developed economies increased 20% in the same period. Is important to indicate that the trend in the case of developed economies suffered a slowdown in the years 2008 and 2009, arguably due to the economic crisis that affected those economies in a more significant way than to emerging market economies.

¹ All the data related to the payments system used in this study is obtained from the World Bank Global Payments systems Survey 2010 and local sources. All the other variables are obtained from the World Development Indicator Database.
The expansion in retail payments using electronic payments is associated to the increase in the number of credit cards, particularly in emerging market economies. Again, by normalizing the number of credit cards per countries to 100 in 2004, it is possible to see that in emerging economies, the median number of credit cards has increased more than 140% between 2004 and 2009. The increase in developed economies in the same period was close to 40%, but again with a significant slowdown in the years 2008 and 2009 (Figure 2).

**Figure 1: Payments by Credit Cards**  
(Value of transactions as a fraction of private consumption, 2004=100)

Consistent with the evolution of credit card payments, there has been a significant increase in the number of total number of Point of Sale (POS) terminals emerging and developed economies. In the case of emerging economies, the total number of POS terminals has increased on average 185% between 2004 and 2009. For developed economies this increase has been 38% (Figure 3). It is important to notice that the expansion in POS terminals in 2009 was well below previous rates of increase. Recent evidence for particular economies indicates that the previous trend has been resumed. This is an indication that the effects of the Great Recession of 2008-2009 in the expansion of electronic payments would have been transitory.
Figure 2: Credit Cards
(Total number of credit cards in the country, 2004=100)

Figure 3: POS Terminals
(Total number of Point of Sale (POS) terminals in the country, 2004=100)
Given that information on the use of cash for payments is difficult to obtain directly, an indirect way to assess recent trends in terms of the importance of cash payments comes from the evolution of the total number of ATMs in the country. There is a clear positive trend in the case of emerging economies in the availability of ATMs. This trend is less pronounced in the case of developed economies, still a positive trend. Interestingly, the increase in the total number of ATMs in emerging and developed countries is significantly lower than the increase in number of point of sale terminals. In the case of emerging economies, the increase in the number of ATMs between 2004 and 2009 has been slightly above 80% while in the case of developed economies the increase was close to 20% (Figure 4).

![Figure 4: ATMs](Image)

(Total number of ATMs in the country, 2004=100)

The increase in electronic payments in recent years is likely to be explained by different factors. Those factors will be discussed in details in the next two sections. Nonetheless, a first look at the data may provide some preliminary insights to such evolution. In particular, the relationship between economic development, proxy by per capita GDP, and different indicators of electronic payments may be relevant to understand recent trends.
In Figures 5, 6, and 7 the number of POS terminals, credit and debit cards and ATMs per million of inhabitants is presented with respect to per capita GDP. Each point in these figures corresponds to the average number of POS, credit and debit cards and ATMs per million of inhabitants per country for a group of developed and developing countries in the period 2004-2009.

The relationship between per capital GDP and the variables of interest in all the cases is strongly positive. Higher levels of economic development are associated with a movement towards electronic payments.

**Figure 5: Number of Credit and Debit Cards and GDP Per Capita**
Figure 6: POS Terminals and GDP Per Capita

Figure 7: ATMs and GDP Per Capita
In order to assess the magnitude of this relationship, the elasticity between per capita GDP and the different measures of electronic payments, a simple regression analysis is performed. In particular, the next relationship is estimated:

\[ e_i = \alpha + \gamma y_i + \varepsilon, \]

where \( e_i \) corresponds to the logarithm of the number of credit and debit cards per million of inhabitants, the logarithm of the number of POS per million of inhabitants, or the logarithm of the number of ATMs per million of inhabitants in country \( i \); \( y_i \) is the logarithm of per capita GDP in country \( i \). Therefore, three different elasticities are computed (\( \gamma \)). The results are presented in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Elasticity of Payments Indicators to Per Capita GDP</th>
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<tr>
<td>Elasticity ( \gamma )</td>
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<tr>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Credit and Debit Cards</td>
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<tr>
<td></td>
</tr>
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<td>POS Terminals</td>
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<td></td>
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<td>ATMs</td>
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All regressions are estimated using a constant. Standard error in parenthesis.

(***) significance level at 1%.

From these results is clear that the elasticity of POS terminals to per capita GDP is significantly higher than with respect to credit and debit cards and ATMs. This elasticity is consistent with the evolution of payments systems in recent years. In effect, the
higher increase in POS terminals would be associated to the higher level of income than emerging countries have experienced in recent years.

Now, this analysis implicitly assumes a causal direction from economic development to electronic payments. In the next section it would be discussed in a more rigorous form the relationship between the electronic payments system and economic welfare. The analysis will evidence that the relationship can go in both directions and through different channels.
5 The electronic payments system and economic welfare

As previously documented, in recent years there has been a significant increase in non-cash payments instruments around the world, especially of electronic payments. In this context, several questions are raised. Which are the factors that explain this switch towards electronic payments? What are the effects of the increase in the use of electronic payments on economic welfare? If electronic payments are welfare improving, how can its adoption be stimulated? These are the type of questions that will be addressed in this and next sections.

The literature on the interactions of the payments system and the economy is wide. It ranges from theoretical general equilibrium models to empirical analysis with the objective of explaining the adoption and evolution of different payments systems and the effects of different payments systems on economic welfare.

On the move towards electronic payments, the literature emphasizes the role played by technological innovations. Technological innovations in the economy that affect the costs of alternatives payment instruments affect the demand for different payments instruments and more deeply the shape of the national payments system. Given that among the different payment instruments affected by technology improvements, electronic payments systems are arguably the more affected, there is a direct link between technological improvements and the increase in the use of electronic payments.

Now, this link opens the door to a connection between the adoption of electronic payments system and economic growth. Therefore, the adoption of electronic payment instruments may be associated not only to a one time economic gain associated to more efficient means of payments but also to an acceleration of economic growth as long as there is a feedback between the adoption of electronic payments and the materialization of productivity gains.

The existing empirical literature tends to support this view. Using different methodological approaches, empirical studies have directly estimated the impact of the adoption of different payment instruments on consumption and economic growth. The general result of these studies is that the movement towards an electronic payments system is associated to higher economic growth.
The empirical evidence also suggests that the adoption of electronic payments is associated with a significant reduction in the cost of conducting economic transactions. As more consumers adopt electronic payments and the volume of transactions increases, the overall cost of the payments system falls.

Also the adoption of electronic payments has been associated with an increase in the efficiency in financial markets. Additional advantages of electronic instruments over cash and paper-based instruments, such as convenience, safety and timesaving suggest that the shift towards these payment methods could produce further welfare improvements.

The dimensions previously mentioned will be now discussed with further details.

5.1 The electronic payments system and economic development

What determines the adoption of an electronic payments system in an economy? How does the adoption of an electronic payments system affect economic growth? Many studies relate the emergence of information technology (IT) as a key factor in the transformation of the payment industry. This transformation might be also explained by other factors such as changes in the relative cost of payment instruments, income and infrastructure costs, which will be discussed in section 7.

In the basic exchange economy, a country's payments system relies on cash payments (which is usually represented by the existence of money demand or a cash in advance constraint to do transactions). Cash is provided by the government, from which it obtains seignorage revenues. In more complex environments, non-cash payments are typically provided by the banking system using either deposit balances in transaction accounts or credit balances.

Initially, the studies on the role of different payment instruments analyzed the role of payments systems focusing on the use and trade-offs associated with cash and non-cash payments. Those studies typically assumed that earning assets could be held and accessed to make payments using non-cash payment instruments and considered also the transaction costs associated to obtaining cash. Those models pay particular attention to the welfare effects of inflation.

New studies on the role of the payments system on the economy have attempted to explain the determination of the “equilibrium” payments system that emerges in an economy. In particular, these studies try to answer the question of why some countries
have moved to electronic payments systems. All of these studies have at the core the role that technological improvements play in the adoption of more, as we will see later, relatively efficient payment instruments.

Hromcová (2008) modifies the “traditional” consumption maximization problem that a household faces introducing alternative payment instruments (cash and non-cash instruments). In this context there are two ways of acquiring consumption goods: using money or through private securities (non-cash instrument).

The agents in this economy are willing to accept the private securities in exchange for their goods only because there exists an intermediary that guarantees that they will be paid. The opportunity cost of holding money corresponds to the lost interest on transaction balances. The intermediary provides her service at a cost. The intermediation cost emerges from the realistic assumption that resources must be devoted in order to make non-cash payment available and reliable. As previously discussed, this process involves checking the identity of the buyer and his ability to pay previous to clearing and settlement.

If the accumulation of new knowledge leads to the development of better technologies and cheaper intermediation services, the share of consumption that goes to pay intermediation services shrinks. In this context, agents switch from cash towards (non-cash) credit purchases. In this setup, the transformation of the monetary system triggered by higher levels of knowledge is associated to higher growth rates of income velocity of money. Interestingly, this theoretical prediction is consistent with the empirical evidence on the relationship of GDP per capita and the growth rate of velocity of money.

The previous setup provides an explanation for the switch from cash to non-cash payments. Now, the decision of consumers among cash, paper-based or electronic payments requires additional analysis. Expanding on Hromcová (2008), Callado et al (2010) study the decision of consumers introducing electronic payments.

Consider a situation in which three types of payment instruments are available to economic agents to acquire consumption goods: cash, paper-based and electronic payments. Paper-based and electronic payments are subject to an intermediation cost such as the one discussed previously. In addition, electronic payments are subject to a fixed cost associated to the implementation of the required infrastructure to operate the electronic transactions.
Consider also that technological advances reduce the costs associated to both paper-based and electronic payments. Nonetheless, assume that the degree of knowledge diffusion into the electronic payments is higher than the knowledge diffusion into the paper based transactions.\(^2\)

In this context, technological advances play a crucial role in the creation and adoption of new payment methods. Given that a necessary infrastructure for electronic payment must be in place before it can be used, it is possible to explain the large differences in the level of electronic payment adoption. In particular, electronic transactions would not emerge until the economy is ready to use them (i.e. until they are trustworthy and cheap enough).

This literature provides an important insight. At a very low stage of development, only two means of payments coexist: cash and paper-based. With the development of new technologies, non-cash payment becomes relatively cheaper and the fraction of markets where this payment alternative is chosen increases.

The shape of the payments system at higher levels of economic development depends crucially on the size of the fixed cost associated to electronic payments. Electronic payments require a significant initial investment for the system to be capable of operating (for example, large enough number of stores interested in electronic payments, consumers ready to use them, availability of machines that enable electronic transactions, among others).

Once the relative cost of investment for the electronic payments infrastructure decreases, the transformation of the payments system occurs. Electronic payments emerge when a certain level of technology is reached. Technology improvements reduce the cost of electronic payments more significantly than paper-based instrument, which intensifies its utilization generating additional reductions in its cost per transaction (economies of scale).

These theoretical approaches can also be used to explain the welfare impacts of the introduction of electronic payment. Studies rely on simulation exercises to quantify the potential gains in terms of welfare of the introduction of electronic payments. Callado et al (2010) conclude that the introduction of a cheaper payment instrument may

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\(^2\) This assumption tends to be supported by empirical evidence for the US that indicates that highest productivity gains have generally occurred in industries that tend to use IT intensively (see Stiroh (2002)).
generate welfare gains of 3.9% of the stream of consumption. Therefore, advancing of the arrival of the electronic payment era is welfare improving.

It is important to notice that the speed of technological progress is not the only factor that affects the timing of the switch towards electronic payment instruments. Payment availability and force of habit, institutional influences, network effects, market power and consumer characteristics may also play an important role in the timing of adoption of electronic payments. And given that advancing in the arrival of the electronic payment era may be welfare improving, to understand them is important. These factors will be discussed later.

Additionally, the introduction of an electronic payments system may generate positive effects in other financial services (such as financial service innovation) which decreases further the intermediation costs of the financial system. This generates that the development of the electronic payment system may enhance economic growth through the traditional financial market development channels. The empirical evidence tends to support the view that the level of financial development is a good predictor of future rates of economic growth, capital accumulation and technological change (Levine (1997)).

There are several channels through which financial development may enhance economic growth. By facilitating risk management, mobilizing savings towards productive investments, monitoring managers and exerting corporate control, and by facilitating the exchange of goods and services, financial systems stimulate capital accumulation and technological innovation.

A reduction in the cost of exchange of goods and services may permit greater specialization. As discussed by Lamoreaux and Sokoloff (1996), the introduction of money allowed creative individuals to specialize. But as discussed by the authors and Levine (1997), this reduction in transaction costs is not necessarily a one-time gain. It could actually render the economy more productive by ushering in a new phase of innovations. Therefore, the introduction of more efficient means of payments may generate not only a one-time economic gain associated to more efficient means of payments but also an acceleration of economic growth.

Finally, the emergence of electronic payment instruments provides may provide an additional boost to economic development through e-commerce. It is natural to assume that the existence of electronic payments make possible the development of e-commerce. Now, as it will be discussed in more details in section 9, e-commerce can raise productivity and economic growth as a result of more efficient management of
supply and distribution, lower transaction costs, higher level of competition, low barriers to entry and improved access to information. At the macro level this would be reflected by higher total factor productivity (higher economic growth) and reduction in prices.

The positive relationship between the electronic payment system and economic development is summarized in Chart 1. As it can be seen, technological progress generates a reduction in the cost of intermediation services which at some point trigger the adoption of electronic payments. The adoption of electronic payments increases consumption as the share of resources in the economy devoted to pay intermediation costs shrinks generating a welfare gain for the economy. Additionally, the adoption of electronic payments fosters the development of financial markets, leading to system efficiency gains and to faster capital accumulation and technological progress, which generates higher economic growth. Finally, the adoption of electronic payments increases the number of actors on both sides of a transaction, leading to an intensified competition and service innovation.

**Chart 1: Electronic Payments and Economic Development**
5.2 The payments system costs

The resources than an economy devotes to the functioning of a payments system are quite significant. Humphrey, Pulley and Vesala (2000) estimate that by mid 1990s United States spent around 3% of GDP per year to make payments possible.

By mid 1990s the payments system in the United States relied heavily on checks for consumer and business transactions. Humphrey, Pulley and Vesala (2000) information indicates that the social cost of a check transaction was US$2.97 dollars, the social cost of a debit or credit card transaction was US$1.75 dollars and the social cost of an automated clearinghouse (ACH) transaction was US$1.34 dollars. They estimate that if non-cash transaction composition in the United Stated had changed at that time to a composition similar to the average composition for Europe and Japan, the savings would have reached close to 1.25% of GDP. In the case of Norway, who used paper-based instruments less intensively, they estimate that the savings associated to or for the banking system could be up to 0.6% of GDP.

More recent studies, conducted mainly by central banks, have provided more detailed estimates of the cost associated to the different type of payments. For example, the total cost of all point-of-sale payments was estimated to be 0.65% of GDP in the Netherlands and 0.74% of GDP in Belgium (Schmiedel et al 2012). Depending on the methodologies used in the analysis, significant differences in the cost estimation may be found.

In an attempt to standardize a methodology and allow for comparison, the European Central Bank conducted a study estimating the costs of the most frequently used retail payment instruments in thirteen European countries (Schmiedel et al 2012). The costing exercise focused on the main parties involved in the payment process: issuing authorities (central banks and governments), banks and interbank infrastructure providers (automated clearing houses, ATM networks, etc.), retailers and cash-in-transit companies.

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3 Social costs correspond to the sum of the costs incurred by the relevant individual participants in the payment chain excluding the payments made to other participants in the payment chain for services rendered.
4 These estimations consider the same cost per transaction for debit and credit payments despite the fact that the cost of credit card transactions is significantly higher. As the authors indicate, the cost of a credit card transactions was estimated to be twice (or more) as much as a debit card. Nonetheless, once the credit function of a credit card is removed, the cost of the transaction component of a credit card is similar to that of a credit card.
For banks and infrastructures, the study covered retail payment transactions carried out either by individuals or by companies. For retailers, the analysis focused on consumer-to-business payments. Therefore, the payment instruments included in the study were those used for point-of-sale payments such as cash, credit cards, debit cards and checks, as well as credit transfers and direct debits, which are used mainly for remote payments. As a general rule, instruments that accounted for less than 5% of the volume of cash transactions - for example, e-payments - were excluded from the calculations.

In the study private as well as social costs are estimated for each instrument and relevant player. Private costs referred to all the cost incurred by the individual parties in the supply chain. As mentioned before, social costs take into account that some costs are someone else’s revenues. Therefore the cost measures obtained in this work represent the use of resources in the production of payment services, avoiding double counts due to fees and other payments made to other participants in the payment chain.

In terms of the methodology to classify costs, a distinction is made between direct and indirect costs. Direct costs are those that arise from a direct and exclusive use of resources to produce payment products and services. Direct cost can be easily imputed to a particular payment instrument. Indirect costs are the costs associated to support functions that are necessary to carry out payments activities (e.g. rentals, maintenance, depreciation, etc). These costs are imputed using specific accounting rules.

Overall, the social costs of retail payment instruments for the 13 European countries were estimated to reach on average for those countries 0.96% of total GDP (with a maximum of 1.35% of GDP and a minimum of 0.42% of GDP). In terms of the distribution of those costs among the different participants in the service chain, banks and infrastructures incur in 51% of those costs, retailers incur in 46%, central banks in 3%, and cash-in-transit companies in 1%.

Table 2 presents the private and social cost of the retail payments system per payment instrument. Over 50% of the total costs - or the equivalent to 0.49% of GDP - is related to cash payments. The cost from paying with credit and debit cards accounts for 0.21% of GDP, which is mostly absorbed by banks and infrastructures. Finally, the costs incurred in credit transfers, direct debit and checks accounts for 0.13%, 0.09% and 0.03% of GDP, respectively.

While cash accounts for the largest part of the total costs and checks for the smallest, a cash transaction is significantly less expensive than paying with a check. Cash has on
average the lowest unit social cost at $0.42 euros, followed by debit cards at $0.7 euros. The most expensive payment instruments are checks at $3.55 euros and credit cards at $2.39 euros. It is important to notice though, that in this work unit cost are calculated as the total cost divided by the number of transactions. Therefore, the cheapest instrument does not necessarily means it is the most cost-effective instrument. Economies of scale imply that the unit cost decreases as the volume of transaction increases.

**Table 2: Social cost of retail payment system per shareholder and payment instrument**

(Percent of GDP)

<table>
<thead>
<tr>
<th></th>
<th>Central Banks</th>
<th>Banks and Infrastructures</th>
<th>Cash-in-transit companies</th>
<th>Retailers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>0.03</td>
<td>0.19</td>
<td>0.01</td>
<td>0.27</td>
<td>0.49</td>
</tr>
<tr>
<td>Checks</td>
<td>0.02</td>
<td>0.01</td>
<td></td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>Cards</td>
<td>0.16</td>
<td></td>
<td></td>
<td>0.05</td>
<td>0.21</td>
</tr>
<tr>
<td>Debit cards</td>
<td>0.08</td>
<td></td>
<td></td>
<td>0.02</td>
<td>0.10</td>
</tr>
<tr>
<td>Credit cards</td>
<td>0.08</td>
<td></td>
<td></td>
<td>0.01</td>
<td>0.09</td>
</tr>
<tr>
<td>Combined</td>
<td></td>
<td></td>
<td></td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Direct debit</td>
<td>0.05</td>
<td></td>
<td></td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Credit transfers</td>
<td>0.07</td>
<td></td>
<td></td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.03</strong></td>
<td><strong>0.49</strong></td>
<td><strong>0.01</strong></td>
<td><strong>0.44</strong></td>
<td><strong>0.96</strong></td>
</tr>
</tbody>
</table>


Schmiedel et al (2012) also desegregated payment costs by activities. For example, 43% of central banks’ costs incurred when providing cash consist of printing banknotes, 27% comes from insurance, processing and transportation of banknotes and coins, 23% from minting local coins and 3% from all other activities.

Banks, infrastructures and cash-in-transit companies have a rather different cost structure. The private cost of providing cash is driven mainly by the cost of allowing for cash withdrawals (47%), collection and transportation (11%) and dealing with deposits (21%). The costs related to checks’ payments are explained mainly for managing deposits (34%), clearing activities (27%) and monitoring activities (7%). In the case of debit cards 18% of the cost comes from the management of purchases, 14% from payment processing and 10% from transactions processing.
For retailers the main costs are back office costs (41% in the case of cash, 39% for debit cards and 72% for credit cards), front office costs (32% in the case of cash, 39% for debit cards and 16% for credit cards) and terminal costs (14% in the case of cash, 15% for debit cards and 9% for credit cards). Other types of costs include storage, transportation and telecommunication.

Finally, direct costs account for a large proportion of total estimated costs for each payment instruments included in the study. In the case of cash, the share of direct costs goes from 89% in the case of cash-in-transit companies to 71% for banks and infrastructures. For the other payment instruments, the share of direct costs ranged from 76% for credit cards to 65% for credit transfers.

Schwartz, Fabo, Bailey and Carter (2007) conduct a detailed study of payment costs for the Australian economy. The objective of the study is to measure the long-run incremental resource cost of each payment method, which is the resource cost incurred if a substantial number of extra payments were made using a particular payment method. They indicate that these costs would be significantly higher than the marginal cost of making an extra payment through the existing infrastructure.

The data for the Australian study is collected from the main participants in the Australian payments system: financial institutions, merchants and Reserve Bank. The resource cost that consumers incur is measured indirectly using as a proxy the time it takes to make payments. The resource cost is estimated measuring the average cost of different payment methods. The costs considered include the costs incurred in establishing and operating an account from which payments can be made and the costs incurred in making transactions on that account.

The overhead costs of establishing and maintaining credit card or transaction accounts, which are not particularly sensitive to the number of transactions made, include those for systems and information technology (including internet and phone banking), product development and marketing, application processing and general customer service and account management. Those costs were reported separately associated to the type of account.

The results obtained in this study indicate that cash appears to be the lowest cost payment method for small transaction sizes. Nonetheless, the cost of a cash payment increases with the value of the transaction so that cash becomes more costly than some electronic payments of moderate value. Credit card payments are more costly than debit transactions but significantly less expensive than checks payments.
The differences in this study between the cost of credit and debit transactions are much lower than in the European study discussed previously. Considering the total payment production cost (excluding credit and other functions of credit cards), the estimated cost for a credit card payment is $0.99 Australian dollars, compared with $0.53 for electronic funds transfer at the point of sale ($7.36 for checks). Finally, the annual costs incurred by financial institutions and merchants for payments made by individuals in the Australian economy are estimated around 0.8% of GDP.

Now, the studies just described indicate that within non-cash payments, electronic payments are considerable less costly than paper-based instruments. A movement towards electronic payment instruments should be associated to significant reduction in resources devoted to payments. Considering dimensions such as economies of scale and the size of transactions, electronic payments should also emerge as more cost-efficient instruments, including in this comparison cash transactions.

Given the cost advantages of electronic payment instruments, a desired movement towards this type of payments should be expected. As discussed in the previous subsection, two main drivers of such a movement are related to technological progress and economies of scale associated to higher economic development in the theoretical literature. The empirical evidence tends to support those assumptions.

Bauer and Hancock (1995) found that scale economies and technological changes could largely explain the reduction in the associated cost of electronic payments. In particular, they assess the impact of economies of scale, technological change and lower input prices in the reduction of an automated clearinghouse (ACH) transfer (a crucial component in an electronic payment process).^5^

As documented by Bauer and Hancock (1995), between 1989 and 1994, the unit cost in real terms of Federal Reserve ACH processing felt around 65%, despite significant improvements in the ACH service (mainly associated to more secure transactions). During that period, ACH processing volume at the Federal Reserve grew at an average annual rate of more than 22 percent, which indicates that economies of scale may have played a significant role in explaining the reduction in cost. To determine the effects of

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^5^ An automated clearinghouse (ACH) system is a value-dated electronic funds transfer system. The principal participants in an ACH transaction are the payer, the payee, the payer’s bank, the payee’s bank and the ACH operator. Either credit transfers or debit transfers may be made using an ACH system.
economies of scale, technological change and lower input prices, the authors use a cost-function approach.

The result obtained by Bauer and Hancock (1995) indicates that between 50% to 67% of the 65 percent reduction in unit cost in ACH processing between 1989 and 1994 may be explained by technological change effects. Economies of scale would explain between 50% and 30% of such reduction in unit cost. Finally, falling input prices would have had a lesser impact in the reduction of unit costs.

Berger (2003) assesses the effects of technological progress in the banking industry. Using data from commercial banking in the period 1984-2001 in the US, he studies how different measures of technological changes as internet banking, electronic payment technologies and information exchanges are related to better banking services and significant productivity increases.

He concentrates in three dimensions in which technological changes can be observed and some of their effects can be directly measured: Internet banking, electronic payment technologies and information exchanges.\(^6\)

The results of this study indicate that the reduction of the costs in back-office activities, for example by switching from paper based to electronic payment instruments, produces significant gains in productivity and economies of scale. This is especially relevant as these expenses represent a large part of bank’s operating costs. The author also reports consumer benefits from better front-office services.

Humphrey, Willesson, Bergendahl y Lindblom (2003) study the determinants of the cost of a nation’s payments system for a group of European countries in order to determine how a country may have benefited by a shift to lower cost electronic payments and expanded use of ATMs.

They use the ratio of operating expenses to the value of total assets in the banking industry as their indicator of unit operating costs. This indicator of bank unit costs felt 24% in the period 1987-1999 in Europe. During the same period the number of non-cash transactions in Europe increased 89% while the share of electronic payments (electronic giro and debit and credit card transactions) in all non-cash transactions in Europe expanded from 43% to 79% (checks and paper giro transactions decreased 10% and 79% respectively during the same period). At the same time, the number of ATMs

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\(^6\) Information exchanges corresponds to intermediaries through which banks and other creditors share data relevant to the creditworthiness of loan applicants.
per branch office increased 325% over 1987-1999. The authors test if the reduction in unit operating costs is related to the increase in the importance of electronic transactions and in ATMs away from costly branched.

The authors model the cost function of payments system and use a cross-country panel data to determine how countries benefited by shifting from paper based payments to lower cost electronic payments and ATMs. Their results suggest considerable gains: in 1999, twelve European countries saved up to 0.38% of their combined GDP.

As discussed in this subsection, the reduction in the cost of payments system can be largely explained by the development of low-cost electronic payment methods and by the shift from cash or paper-based to their electronic alternatives. This change can be attributed to technological progress and economies of scales. Now, other factors may accelerate or postpone this change.

Evidence has also shown that reduction in the cost of payment has not necessarily translated one-to-one to the prices that consumers face when choosing a payment method. The study of Schwartz, Fabo, Bailey and Carter (2007) for Australia discussed previously argue that due to due to a variety of practices and restrictions, the country had a less efficient payments system than might otherwise have been the case. Thus, institutional development of the payments system is necessary if countries want to take full advantage of the new technologies.

Right incentives and institutional arrangements to facilitate the adoption of more efficient payment infrastructures are key factors. These and other factors behind the demand and supply of different payment instruments are analyzed in sections 7 and 8.

5.3 Electronic payment and economic activity: previous empirical evidence

As it has been discussed previously, a well-functioning payment infrastructure is key to enhance the efficiency of financial markets and the financial system. But the introduction of more efficient means of payments not only reduces direct costs of transactions and foster financial market development, it may also boost consumer confidence, improve tax compliance and administration and automating electronic settlement and government procurement system among others.

The empirical studies summarized before show how the development and adoption of electronic payments system reduces the cost of the payments system while the theoretical studies reviewed previously indicate that more efficient payments systems
may increase the level of economic development (and through this consumption) and economic growth. The natural question that emerges is if the empirical literature has been able to provide evidence to support these theoretical results.

The empirical literature on the welfare gains of electronic payment has tried to estimate its impact on aggregate variables: consumption, trade and growth. Zandi and Singh (2010) assess the impact of card penetration on private consumption. Card penetration is defined as the value of transactions using credit and debit cards as a percentage of total consumers spending. The sample covers 51 developed and developing countries over a period of six years (2003-2008). Private real consumption is modeled as a function of real disposable income, interest rates, and card penetration.

The study argues that electronic card usage added $1.1 trillion in real dollars to private consumption over that period, or the equivalent to an annual increase in GDP growth of 0.2%. Interestingly, they also argue that the effect is not only driven by increase in access to credit, as countries with almost no revolving credit card products such as Norway, Sweden and Denmark, experienced similar impacts than other countries with large credit volumes.

The study also shows that the results differ for emerging and developed economies. A 1% increase in card usage produced a 0.041% increase in consumption and a 0.025% increase in GDP for developed economies while the same increase in emerging markets produced a 0.031% increase in consumption and a 0.017% increase in GDP. This difference would be associated, according to the authors of this work, to the fact that developed countries have well-established payment networks, consumers are comfortable using cards, and many merchants accept them. In this context, an increase in card usage in developed countries would have a larger multiplier impact.

Based on dynamic panels and retail payments data from all the European Member States during 1995-2009, Hasan, De Renzis and Schmiedel (2012) presented evidence that the shift towards electronic retail payments had positive though somehow modest impact on GDP, consumption and trade. Similar to Zandi and Singh (2010) they also used product penetration rather than payments in absolute values as the independent variable, but they estimated impact directly on aggregate variables.

Their results showed that most of the aggregate macroeconomic effects are explained by developments in electronic payments systems in the euro area countries, notably for payment card transactions as well as credit transfers and direct debits. A 1% increase in card penetration was associated to a 0.004% increase in GDP and 0.3% increase in leisure consumption. The larger impact on leisure consumption is consistent with the
high elasticity associated to these types of goods. Lower transaction costs translated to prices and then into a higher demand for that particular component of consumption.

Guiso, Sapienza and Zingales (2004) shed light on the same issue by studying the effects of differences in local financial development within an integrated financial market. The results show that moving from the least financial developed area in Italy to the most developed one increases the likelihood of starting a new business. Further per capita GDP grows 1.2 more in the most financially developed areas.

Overall, these studies provide evidence on the importance of the development and adoption of electronic payment methods for economic efficiency and growth. The result is consistent with a large literature on the role of financial markets. Interestingly, as shown in Guiso, Sapienza and Zingales (2004) financial development has heterogeneous effect, even within a country with perfectly integrated market.

Now, the empirical literature just reviewed, in particular that related to the impact of electronic payments on economic development has either stressed its impact on consumption or being concentrated in developed economies. In the next section, empirical evidence on the impact of electronic payments on GDP growth for developed and emerging economies is presented.
6 Empirical assessment of the impact of electronic payments system on economic development: new evidence

The theoretical and empirical literature suggests that the adoption of electronic payments is associated with a significant reduction in the cost of conducting economic transactions with positive effects on economic welfare. As discussed in section 5, those welfare gains are associated to the saving in economic resources devoted to the payments system, which is associated to a higher trajectory for consumption. But a more efficient payments system may also enhance economic growth associated to the better functioning of financial markets.

Additionally, the adoption of electronic payments may also foster the gains associated to the participants in the market place. Electronic payment expands the range of payment options available to consumers. Higher availability of credit and increased efficiency in transactions, increase the number of actors in both side of the economic transaction, which leads to more competition and innovation at the market place. This channel will be related to electronic commerce and discussed later.

Therefore, the introduction of more efficient means of payments may generate not only a one time economic gain associated to more efficient means of payments but also an acceleration of economic growth.

Before moving to a more formal empirical strategy it is useful to provide a first view to the data in terms of the main conclusions from the theoretical review on the impact of electronic payments on economic development.

One of the results of the theoretical literature is that at a very low stage of development, only two means of payments coexist: cash and paper-based. With the development of new technologies and/or the reduction in infrastructure costs associated to electronic payments, non paper-based payments become relatively cheaper and the fraction of markets where this payment method is chosen increases.

Using data for a group of 65 developed and emerging economies an index to capture the importance of electronic payments is constructed. Following Zandi and Singh (2010), for each country the average value of transactions using credit and debit cards as a percentage of total consumers spending for the period 2004-2009 is computed. A higher
value for this ratio (penetration of electronic payments) is associated to a higher importance of electronic payments at the retail payments system.\(^7\)

As Figure 8 shows, the median for the variable penetration of electronic payments for developed economies is significantly higher than the median for this variable in the case of emerging market economies. In the case of developed economies, the median of value of credit and debit cards with respect to private consumption was 28.0% in the period 2004-2009. In the case of emerging economies this value reached 8.7% in the same period.

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\(^7\) The countries considered in the analysis are: Luxembourg, United Arab Emirates, Norway, Singapore, United States, Ireland, Hong Kong, Switzerland, Netherlands, Canada, Austria, Denmark, Australia, Sweden, United Kingdom, Belgium, Finland, Japan, France, Italy, Spain, Cyprus, Greece, Slovenia, Korea, Rep., Trinidad and Tobago, Malta, Czech Republic, Portugal, Slovak Republic, Estonia, Hungary, Lithuania, Poland, Latvia, Russian Federation, Chile, Mexico, Malaysia, Botswana, Turkey, Bulgaria, Uruguay, Romania, Costa Rica, Montenegro, Serbia, Brazil, Macedonia, Colombia, Jamaica, Peru, Dominican Republic, Thailand, Albania, Belize, El Salvador, Armenia, Guatemala, Bolivia, Sri Lanka, India, Tanzania, Rwanda and Mozambique.
Figure 9 exhibit the relationship between the level of GDP per capita and the penetration of electronic payments. It can be seen that for lower levels GDP per capita, there is no correlation between these two variables. However, the figure would indicate a positive relationship for higher GDP per capital levels. This would be consistent with the theoretical prediction that at certain level of economic development, the cost of the electronic payment infrastructure is reduced at a point in which the transformation towards an electronic payments system occurs. Interestingly, the relationship between the importance of checks payments and GDP per capita does not follow a clear pattern as shown in Figure 10.

Figure 9: Credit and Debit Cards Transactions and GDP Per Capita
Now, the empirical strategy to evaluate the impact of electronic payments on economic development consists on estimating in the first place economic growth cross-section regressions and in second place estimating panel regressions to deal with some of natural criticisms that may emerge from the cross-section analysis. The sample consists of 44 developed and emerging countries presented in Appendix A. We concentrate our analysis in the impact of electronic payments on GDP growth controlling for the usual determinants of economic growth considered in the literature.

6.1 Electronic payments and economic growth: cross-section analysis

The regression analysis implemented in the first stage corresponds to a cross-sectional analysis. In particular, the next relationship is estimated:

\[ \Delta y_{lt,t-T} = \alpha + \gamma y_{lt,T-T} + \beta EP_{lt} + \delta X_{lt} + \epsilon, \]
where $\Delta y_i$ corresponds to the average rate of growth of the logarithm of PPP real per capita GDP in country $i$ over the period 2004-2008; $y_{i,t-T}$ is the level of per capita GDP at time $t-T$ (2003 in this estimation); $EP_i$ correspond to the electronic payment penetration index for country $i$ (for each country the average value of transactions using credit and debit cards as a percentage of total consumers spending); the vector $X$ includes controls for per capita GDP growth usually included in empirical literature such as private credit to the private sector as a percentage of GDP, the fraction of the labor force with secondary education, trade openness (exports plus imports) as a percentage of GDP, and research and development (R&D) investment as a percentage of GDP; and $\varepsilon$ is the error term.

The results of the econometric analysis are presented in Table 3. These indicate that the penetration of electronic payments is positively related to the rate of per capita GDP for the countries under analysis when controlling for other variables identified in the literature as potential determinants of economic growth. When considering the impact of R&D investment, the significance of the electronic payment penetration remains but the variable R&D investment is not significant.

Now, the theoretical literature indicates that the impact of technological progress (which in this exercise may be associated to higher R&D investment in this analysis) on economic growth should be higher for higher levels of electronic payment penetration because the degree of knowledge diffusion into the electronic payments is higher in cases in which electronic payments is more developed. Influenced by this, we introduce a new variable to the analysis: the interaction term between electronic payment penetration and R&D investment. The results indicate that this interaction terms is highly significant.
The coefficients estimated indicate that a one-percentage point increase in electronic payment penetration generates a 0.03% increase in per capita GDP. Considering that the electronic payment penetration in emerging market economies is significantly lower than in developed economies (8.7% versus 28.0% respectively), the potential gains associated to a movement towards electronic payments may be significant.

It is important to notice that when controlling for private credit to GDP, a variable usually used to control for the importance of financial market depth on growth, the
importance of electronic payment penetration remains significant. Also, the value of transactions using checks as a percentage of GDP is not significantly related to GDP growth.

6.2 Electronic payments and economic growth: dynamic panel regressions

The empirical results presented in the previous subsection indicate that the impact of electronic payments on growth, controlling for other relevant factors affecting growth considered in the literature, are relevant. However, there are some potential problems when estimating the cross sectional regression. In the case of the empirical analysis performed endogeneity seems to be the most important. Growth can spur the development of an electronic payments system while a more efficient payments system can influence growth through efficiency gains.

In order to check the robustness of the results obtained to the endogeneity problem, a panel regression analysis using an Arellano-Bond dynamic panel GMM (Generalized Method of Moments) estimator along the lines of Hasan, De Renzis, and Schmiedel (2012) and Loayza, Fajnzylber and Calderon (2005). The base specification under analysis takes the following form:

\[ y_{i,t} = \mu_i + \alpha y_{i,t-1} + \beta EP_{i,t} + \delta X_{i,t} + \varepsilon_{i,t}, \]

where \( y_{i,t} \) corresponds to the logarithm of PPP real per capita GDP in country \( i \) at time \( t \), \( EP_i \) correspond to the electronic payment penetration index for country \( i \) at time \( t \); \( X \) represents the matrix of variables that determine per capita GDP including the variables used in the cross sectional analysis, \( \mu_i \) accounts for country effects and \( \varepsilon_{i,t} \) is the error term.

As a difference to the previous analysis, the data considers the period 2000-2010 (notice that for some countries data is only available since the year 2004). To eliminate the country-specific effect the previous equation is differentiated. Now, as shown by Blundell and Bond (1997), when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. To reduce the potential biases, the estimator developed in Arellano and Bover (1995) and Blundell and Bond (1997) is used.
The results obtained from the GMM system estimation are presented in Table 4. The first result is that including the Great Recession period (2008-2010) the significance of the electronic payment penetration variable falls significantly with respect to the cross-section estimation. Nonetheless, when the sample estimation is shortened to the period 2000-2007, the statistical significance of this variable is restored.

In terms of the importance of electronic payments on economic growth, the results from the panel estimation are similar to those obtained in the cross section estimation. In particular, a one-percentage point increase in the electronic payment penetration generates an increase in per capita GDP growth that fluctuates between 0.035% and 0.045%.

Now, if the adoption of electronic payments is associated to significant economic activity gains, how can those gains being achieved? The empirical literature highlights demand and supply factors in the adoption of payment instruments such as price, income, payment availability, force of habit, institutional influences, network effects, market power, fixed costs for electronic means of payments and consumer characteristics. In the next section, these determinants will be studied.
### Table 4: Per capita GDP growth and electronic payments - GMM system estimation

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Dependent variable: Per capita GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
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<tr>
<td>Electronic payment penetration</td>
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</tr>
<tr>
<td></td>
<td>(0.10)</td>
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<tr>
<td>Educational level</td>
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<tr>
<td></td>
<td>(2.71)***</td>
</tr>
<tr>
<td>Trade openness</td>
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<tr>
<td></td>
<td>(2.94)***</td>
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<tr>
<td>Financial market depth</td>
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<td></td>
<td></td>
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<tr>
<td>Emerging market dummy</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>R&amp;D Investment</td>
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<td></td>
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</tr>
<tr>
<td>Number of observations</td>
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</tr>
<tr>
<td>Hansen p value</td>
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</tbody>
</table>

All regressions are estimated using a constant, t test in parenthesis. 

(***);(**);(*) indicate significance levels at 1%, 5% and 10% respectively.
7 The determinants of demand and supply of payment instruments

Since countries could benefit significantly from relying more on electronic payments over other paper-based instruments, it is key to understand in more details those factors in addition to technological change that may affect the demand and supply of electronic payment instruments.

The determinants of demand and supply of payment instruments include price and income, payment availability and force of habit, institutional influences, network effects, market power, fixed costs for electronic means of payments, lower supply of electronic payments for low income consumers, credit versus debit, substitution between ATMs and POS and consumer characteristics. These factors will be analyzed in more detail next.

7.1 Price

The theory of demand implies that the use of different means of payments will be influenced by the relative prices among the different instruments. A first attempt to estimate price elasticities of payment instruments was an early work by Humphrey, Pulley and Vesala (1996). They used payment data from fourteen countries for the period 1987 to 1993 to assess the impact of different factors in explaining the gradual shift towards non-cash payment instruments (check, debit card, credit card, paper giro, and electronic giro).

In order to construct prices for different payment instruments some definitions were established. Check price corresponded to a function of the lost interest on transaction balances, the bank price charged per check written and the cost to print a check. Paper giro, electronic giro and debit card prices corresponded to published prices while credit card price corresponded to the sum of annual fees and the number of invoices per year.

According to their results, prices seemed to exert very little influence on the demand for electronic payment. The estimated own price elasticities for checks and debit cards were positive but insignificant while the elasticities for paper giro, electronic giro and credit card found were low ranging from -0.09 to -0.26.
The authors argue that there are several reasons why the influence of prices may be low. One of them is that in some cases the users do not pay a transaction price but rather they are given a choice of paying a per-transaction fee or holding a minimum balance or incur in a fixed annual fee. And these alternatives are equivalent to having a zero marginal cost of a transaction. Other reason mentioned by these authors is that the differences among the different payment instruments’ prices are small and they represent a very small fraction of the size of the transaction. Alternatively, given that the true user cost of a check payments and of a credit-card payment include the imputed value of payment float, users do not have a clear idea of the cost the incur. All of these reasons make empirical identification very difficult.

Humphrey, Kim and Vale (2001) tried to overcome these problems using a panel survey data from Norway to estimate own price and relative price elasticities of retail payment services at the point of sale for the period 1989-1995. Three payment instruments were considered in the study: cash (reflected in the quantity and price of ATM cash withdrawals), checks and debit cards.

In their identification strategy they took advantage of the fact that in late 1992 an institutional change occurred. This was the opportunity to withdraw cash through a POS terminal at the same time a consumer paid for a purchase at the point of sale without paying an ATM fee (“cash back”).

They showed that consumers respond greatly to prices. The estimated price elasticity for ATM cash withdrawals was -0.5, for checks was -1.07 and -0.29 for debit cards. They also find that the introduction of “cash back” had a significant positive effect on demand for EFTPOS (debit card) and a significant negative effect on the use of checks. These findings suggest even modest pricing policies can accelerate the transition towards electronic payments.

Bolt, Humphrey and Uittenbogaard (2008) used a different approach to analyze the sensitivity to prices. They use a policy change in Norway that changed the timing when consumers faced the cost of payment, making prices more salient. In general, consumers face very few payment services that are priced on a per-transaction basis as discussed previously. In Norway transaction prices were made explicit for consumers. Since electronic payments are cheaper than the alternatives, a policy that makes costs more explicit for consumers, without changing its level, should increase the demand for the cheaper alternative.

The authors compare Norway’s experience with that of Netherlands (which did not price its payment services) for the period 1990-2004. During this period these countries
experienced a rapid adoption of electronic payments. According to their estimation, a 10 percent reduction in the price of debit cards relative to an ATM cash withdrawal is associated with a 2.2 percent increase in the relative use of card in Norway compared with the Netherlands. Additionally, they find that when the relative price of electronic giro transactions falls 10 percent, relative use of this instrument in Norway rises 4.6 percent in Norway compared with the Netherlands. Finally, they show that the direct pricing policy accelerated the shift to electronic payments by 20%.

7.2 Income

Regarding the impact of income in the demand for electronic payments, Humphrey, Pulley and Vesala (1996) find that real income per capita is strongly negatively related to the use of debit cards and electronic giros. This is a surprising result. The authors associate this result to the fact that the highest levels of use of these two instruments occur in those countries with relatively lower GDP per capita, which would indicate that a factor correlated with GDP capita in their sample is missing in the analysis.

Bolt, Humphrey and Uittenbogaard (2008) did not find evidence of a positive effect of per capita personal consumption on relative electronic payment use. This result may be explained by the fact that they also control in their econometric estimation by terminal availability, which may be a function of per capital GDP.

Stavins, (2001) examines the effect of consumer characteristics on the use of electronic payments with one of that characteristics being income. He finds that an increase in household income increases the use of electronic payment, especially of credit cards but also of Internet banking. Higher income is also associated to higher uses of ATMs but in a lower magnitude than in the case of credit cards.

7.3 Consumer characteristics

Beyond price and income, other demand side reasons may explain the demand for different payment instruments. Stavins, (2001) examines the effect of consumer characteristics on the use of electronic payments. Using consumer surveys the study found strong effect of education, marital status, and other demographic characteristics on the probability of using electronic payments.

Stavins (2001) use regression analysis to isolate the effects of individual characteristics on people’s likelihood of using specific payment instruments. She finds that younger
people were found to have a higher probability of using ATMs, debit cards, computer banking but less likely to use credit cards, direct deposits and direct payments. Higher education levels were associated to higher probability of using any type of electronic payments. She finds that the effect is particularly strong in the case of credit cards and computer banking. The results regarding gender are less conclusive. Women were found to have a higher probability of using any type of electronic payment (but only in the case of direct deposit the result was found strong). Men were found to have a substantially higher probability of using computer banking. Married people were also more likely to use any type of electronic payment than single respondents.

7.4 Cost of infrastructure and input requirements

An alternative view to demand side considerations claims that the adoption and use of electronic payment is mainly influenced by supply side variables. In many countries the path towards cheaper and more efficient electronic payments has been slower than expected given the potential welfare gains associated to their adoption.

One reason to explain this slow transformation is that the new instruments require a large initial investment in infrastructure, such as expensive computer systems. The potentially large initial fixed costs imply that the average cost of new electronic payment instruments may exceed the average cost of paper-based instruments. This is clearly related to the one discussed in section 4. In this regard, as discussed previously, technology improvements reduce the cost of electronic payments more significantly than paper-based instrument, which intensifies its utilization.

In their study of the costs of various payment instruments for Australia, Schwartz, Fabo, Bailey and Carter (2007) consider the overhead costs of establishing credit card and transaction accounts. The costs considered by these authors are system and information technology, product development and marketing, application processing and general costumer service. The reported weighted-average cost is $109 Australian dollars per account per year compared with $77 per account per year in the case of a transaction account. Given the level of transactions at the time of the study, account overhead costs reach $0.82 Australian dollars per average size transaction in the case of credit cards compared to $0.48 in the case of transaction accounts. Nonetheless, as discussed before, this comparison not necessarily implies cost-effectiveness. Economies of scale imply that the unit cost decreases as the volume of transaction increases.
7.5 Network externalities

In the presence of large economies of scale, network effects can play an important role (Mester, 2000). A network externality occurs when an increase in the number of users of a good or service increases the value to other users. As discussed by Stavins (2001), electronic payments have some characteristics of network industries, as people are more likely to use electronic payment instruments the more others in their network use them. In particular, consumer’s adoption of a new payment instrument depends on how many merchants accept it, and merchants’ acceptance depends on the expectation of sufficient demand.

Stavins (2001) documents that the use of electronic payment instruments varies significantly by geographic regions in the United States. Using these differences across different regions she test for the existence of network externalities. In particular, she test whether a given payment instrument is more widely used in regions with more users, controlling for individual characteristics of consumer such as the ones discussed in subsection 7.3. She finds a positive and significant effect of the fraction of people using a particular payment instrument on the probability of using that payment instrument for each type of electronic payment consider in the study (debit, credit and smart card, direct deposit and payment, PC/Internet and other electronic transfers).

7.6 Institutional influences

Specific market conditions can also influence why countries choose a different portfolios of payment instruments. The reason why the US continued to rely on check, in spite of the associated higher prices, attracted the attention of many researchers. In an influential study, Humphrey and Berger (1990) argued that check float -or the income (in term of interest) earned by the writer of the check between the time a check is received and the time it is settled- was the reason why the US firms and consumers preferred them. These authors estimate that the average amount of float earned per check more than compensates for the cost advantage of alternative payment instrument.

The net result in this case, however, is an inefficient allocation of resources. As the income of the payer is the exact loss of the payee, the result is a zero social benefit for the use of a more expensive instrument.

Humphrey, Pulley and Vesala (1996) argue that concentration of the banking industry should be inversely related to the use of paper-based instruments. They claim that the
more concentrated is the banking industry, the more likely is that individual banks agree to establish a jointly owned and centralized electronic payment network for consumers bill payments, point-of-sale transactions and payments among business. In their empirical study they find that greater banking concentration is associated with less reliance on paper transactions but they only find a positive association with electronic transactions for debit cards.

Carbo-Valverde and Rodriguez-Fernandez (2012) argue that the adoption and use of electronic payment instruments can be explained by the overlapping objectives of banks in deploying the infrastructure for competing payment instrument. On the one hand, banks typically expand ATM networks to allow for easy cash withdrawal. But at the same time, they also spread out point of sale devices to offer cardholders a cashless method of payment at the point of sale.

Their estimation suggest that the intensity of adoption and diffusion of ATM and POS transactions is mostly driven by rival precedence, network effects and market power, while demand factors do not seem to be significant. Further, the growth of ATMs to move certain front-desk services away from branches has increased cash use and has negatively affected the use of cards at point of sale.

In this same line, Carbo-Valverde, Massoud, Rodriguez-Fernandez, Saunders and Scholnick, (2008) used data from Spanish banks on ATM and point of sale transactions to estimate substitution between these payment alternatives. Their estimation suggests that a 10% increase in the number of transactions per ATM result in a reduction of 3.7% of point of sale transactions. Further, the evidence also confirmed a cross substitution between the ATM fees and the volume of the point of sale transactions.

Another interesting result from Carbo-Valverde and Rodriguez-Fernandez (2012) is the heterogeneous influence that market power exerts on alternative payment instruments. Market power increases margins in the ATM side reducing consumer's adoption, while increasing the margins in the point of sale side does not influence adoption.

Many authors have therefore argued that there is a role for policy to encourage more use of electronic payments. For example, through a large-scale investment in an electronic check presentment system o -as in the case of Canada- though the elimination of any float advantage by backdating the dollar amount of interbank settlement to the day the check is deposited (McAndrews and Roberds, 2000).
7.7 Behavioral considerations

Finally, the choice among payment instrument could also be shaped by behavioral considerations such as self-control and intertemporal tradeoffs. Zinman (2005) takes that approach and deviate from the traditional neoclassical consumer model to study the choice between credit and debit. Zinman points out that debit cards -which draw immediately on checking account balances- offer no comparative benefits to consumers. However, he argues that debit transactions are increasingly overtaking credit as the most prevalent form of electronic payment at the point of sale.

He indicates that one behavioral reason might be that consumers use debit to constrain themselves from over borrowing. However, there could also be standard economics motives to choose debit over credit, for example, to minimize transaction costs or due to restrictions in the access to credit. He used cross-country data to analyze these alternative hypotheses and found that the neoclassical model can better explain consumer’s choice of debit payment. The use of debit cards was more prevalent among revolvers and consumers facing binding credit limit constraints or lack of credit access. On the other hand, he found little evidence for the behavioral hypothesis. More importantly, those results may be affected by the fact the credit and debit transactions may not be considered necessarily substitutes, as it is the case of debit and cash transactions.
8 Electronic payments and the role for policy

As the payments system evolves, new challenges for public policy and in general for the public sector arise. The development of electronic payments influences the way in which financial supervision is conducted and implemented. At the same time many functions that are typically run, at least in part, by the public sector such as social security, welfare and transfer payments could take full advantage of the new available technologies and through this to speed up the adoption of electronic payments with the positive effects on economic welfare. These issues are discussed now.

8.1 Electronic payments and supervision

Traditionally central banks are responsible for the efficiency and integrity of the payments system. This task has been conducted through the supervision of banks and by regulating the clearing system. But the recent and rapid changes in payments have brought new players, new challenges and therefore the need to assess whether a new set of rules needs to be put in place or whether central banks can easily adapt to deal with new products and players.

Nonbanks are increasingly more important in a modern payments system. While many are regulated by central banks or other regulatory agency, it is still a question whether countries have already the right instruments to protect the system from these new players. The answer to this question is very specific to the context, local institutions, legal framework and the evolution of the payments system in each country.

A recent BIS report of the Working Group on Innovations in Retail Payments (BIS (2012)) identifies a set of challenges and issues for central banks in relation with their responsibilities associated with the proper functioning of the payments system in the context of rapid and significant innovations in this area. Those challenges and issues are:

- Monitoring and assessment of new developments in retail payments will require additional efforts in collecting statistical data to foster analytical research and the availability of appropriate skills.

- To communicate objectives and assessment regarding new developments in retail payments is important to ensure transparency and to provide guidance to the market.
• To find an appropriate level of involvement in the standardization and interoperability in retail payment markets.

• Reviewing their existing oversight frameworks considering cooperation with other authorities (domestic and internationally) given the growing role of non-banks and global providers.

• To assess the potential effects of innovations on the services they offer. In particular in terms of liquidity and operational risk. Also central banks might also monitor the impact of innovations on cash and monetary policy (issue that is reviewed with more details in subsection 8.3)

8.2 Electronic payments and social programs

Given that consumer’s acceptance of a new payment instrument depends on how many merchants accept it, and merchants acceptance depends on the expectation of sufficient customer demand, the speed of electronic payments adoption may be influenced by some particular government actions. An area where electronic payment is not only becoming important but also has a great potential is in the administration of social programs. Governments around the world run programs that transfer resources in a regular basis to a large number of beneficiaries.

Conditional cash transfers programs in Latin America, for example, are reaching over 115 million beneficiaries (BBVA, 2011). In that context, electronic payments might provide substantial benefits. Electronic payments cut transaction and administration costs, increase the scope for a better targeting and reduce leakages. Also, by facilitates audits it makes the process more transparent and less prone to capture and corruption. To the beneficiaries, electronic payment reduces the time and cost for receiving the benefits, reduces the risk of loss or theft and incentivize financial inclusion and financial education.

The potential benefits of relying on electronic payment for government programs are substantial. Estimations of BBVA (2001) suggest that the efficiency gains from using electronic payment in Oportunidades and Apoyo Alimentario, two of Mexico’s largest program, would account for 0.1% of GDP. If electronic payments were used in all government grants the gains could even multiply by four.
As discussed by Hogart and O’Donnell (1999), the gains from a movement of government to electronic payments may also include the gains in access of lower-income families to financial services.
9 E-commerce and economic activity

As the number of Internet users has surged in the recent decades, more consumers and firms are using the Internet to buy and sell goods and services online. The Internet is also providing a platform for other related activities such as auctions, government procurement, and transfer payment and tax compliance, among others. The occurrence of these diverse commerce activities is partly the reason why electronic commerce, e-commerce, means different things to different people.

Several definitions have been put forward, and no strong consensus for a single definition has been reached yet. For example, the UK Department of Trade and Industry defines electronic commerce as “the exchange of information across electronic networks, at any stage in the supply chain, whether within an organization, between businesses, between businesses and consumers, or between the public and the private sectors, whether paid or unpaid.”

While most definitions of e-commerce are very broad, including a wide range of interactions undertaken through different electronic or digital mediums, most studies tend to focus on economic transactions made online. Thus, when reviewing evidence, e-commerce can be better understood as all paid transactions of goods and services between businesses and consumers, or between businesses, which take place over the Internet.

Ongoing advances in technology and lower costs associated to this progress make possible for buyers and sellers to communicate in more efficient ways, creating new opportunities for reorganizing processes and changing the way products are distributed, exchanged and consumed (OECD, 2000). All of this suggests that the Internet has the potential to significantly affect how commercial transactions are conducted and producing large economic gains. All of this is likely to increase competition, which creates higher welfare gains for consumers and also more incentives for innovation.

9.1 Evolution of e-commerce

By 1991 the Internet had less than 3 millions of users around the world and e-commerce was almost non-existent. By 1999, it was estimated that 250 million people had access to Internet and approximately one quarter of them made purchases online. By 2002 there were over 650 million Internet users worldwide and 66,810 secure servers only in
the OECD area (OECD, 2000). Access to Internet is growing rapidly. From 2000 to 2001 the numbers of Internet users increased by more than 30%.

More recent data from Australia –where almost 75% of households have Internet access- shows that over 70% of Internet users engaged in e-commerce and over 50% purchased products and paid bills online (Australia, 2011).

E-commerce is also starting to reach more countries. According to a United Nations’ report (UN (2002)), developing countries accounted for almost one third of new Internet users worldwide and e-commerce represented 18 % of business-to-business and retail transactions in 2006. In Latin America between 50 and 70% of firms in the formal sector are have access to the Internet, but still a smaller proportion of them carry out online transactions.

The fact that more people have access to the Internet is not necessarily an indication of the expansion of e-commerce. Access does not mean regular use which is thought to be a key requisite to generate the confidence that are needed in order to become an e-commerce practitioner. As a result, the gap between developed and developing countries in terms of access to Internet would be much smaller than the one in terms of e-commerce volumes.

As the number of user of e-commerce is growing, the volumes of transaction online have started to rise, making e-commerce an increasingly important player in trade. It is estimated that in 2006 e-commerce represented about 18% of total global sales. Out of them, a majority are transactions made between enterprises, roughly 95% of all e-commerce transactions (UN, 2002).

E-commerce is constantly evolving, taking advantage of better access to information and new technologies. Constant changes in the ways people connect to the Internet directly affect how e-commerce takes form. Mobile commerce (M-commerce), for example, includes all transactions made by wireless handheld devices such as mobile phones and tablets. This alternative, which may be considered as a subgroup within e-commerce, has rapidly emerged as a response of the increase in the number of mobile users worldwide and the cost advantage of mobile infrastructure. M-commerce revenues are expected to amount to $50 billion, mostly from transaction in the US and Europe. Differently from the case of traditional e-commerce, most transactions made by mobile device are business to consumers. The main services are text messaging, micro-payments, financial and information services and customer relationship management.
Although it is not easy to foresee how technology will evolve in the next decades and how it will shape the way people make transaction, it seems reasonable to think that e-commerce will become a large player in business transactions.

9.2 Internet, e-commerce and economic transactions

The Internet as a place for conducting transaction has special characteristics not available in alternative platforms. Internet provides universal and remote access while also allowing for large amount of data to flow at high speed. Internet protocols facilitate considerable interactivity between websites and end-users, and makes possible to link servers within a single organization and build platforms for corporate management and information systems.

These characteristics give the Internet significant advantages over alternative sales channels. Some of the main advantages that consumers receive when conducting transactions online are summarized in Office of Fair Trading (2000):

- E-commerce allows buyers to access any supplier readily, irrespective of geographical location or time of day, with little cost and effort.

- By reducing search cost, E-commerce is likely to reduce switching costs and increase price transparency.

- The potential to buy online from anywhere in the world can result in increased customer choice and wider geographic markets.

- The large amounts of information deposited online can be made readily available to buyers, for example through products reviews and options to sample products before purchasing (e.g. music, books and movies).

- Internet provides the chance of constant interaction, which allows consumers to specify their needs and supplier to offer tailored advice once a relationship, is established.

- Online information allows clients to track packages, provide feedback and get access to instant after-sale services.

But buying online has also some disadvantages. The quality of non-standard products is difficult to verify and the returning of product is still difficult and expensive. Prices might
be less clear online as additional charges and fees could be more easily concealed in online transaction. The lack of client’s attention is a good example of how online pricing structure can negatively impact consumers.

Regarding e–commerce and payments, concerns related to security. Although online transactions systems have improved in recent years, security remains as a source of worry for many consumers. Finally, access is mostly limited to those with credit or debit cards and transactions are still difficult in the case of foreign merchants.

From the point of view of the seller, Internet reduces procurement costs and significantly decreases inventory, distribution and menu costs. Internet also helps sellers to attract and target clients more efficiently while also providing information to adapt to clients’ needs.

9.3 The economic impact of e-commerce

Since e-commerce has rapidly influenced how commercial transactions are conducted, research has turned to understand and assess the economic impacts of the use of online platforms to buy and sell goods and services.

E-commerce can raise productivity and economic growth as a result of more efficient management of supply and distribution, lower transaction costs, higher level of competition, low barriers to entry and improved access to information. At the macro level this would be reflected by higher total factor productivity (higher economic growth) and reduction in prices (Suijker, 2002).

As e-commerce is becoming more prominent a growing literature has emerged trying to explain its economic impact and the channels through which efficiency gains are achieved. The relation between e-commerce and prices (or even inflation) has been study both theoretically and empirically.

Friberg, Ganslandt, Sandstrom (2000) presents a consumer maximization model that predicts that as the number of consumer with access to internet reaches a critical level, prices in conventional store falls. However, final prices will depend on the difference in transaction costs between Internet and conventional stores, which is inversely related to the purchase volume. Using price data from several e-commerce sites as well as conventional stores in Sweden they found that prices were about 15% lower online. However, these differences were still not large enough to compensate for the associated cost of buying a single good. In the same spirit Willis (2004) has also argued
that e-commerce has produced cost savings that are likely to translate into higher productivity and lower prices.

Another relevant dimension of e-commerce is its impact on the number and type of producers operating in an industry. In Goldmanis et al (2008) the authors studied how different industries - travel agencies, bookstores, and new auto dealers- benefited and suffered as consumers switch to purchasing products online. Although the industries experienced similar changes, the specific mechanisms differed. For bookstores and auto dealers firms’ exit occurred in specific local markets where consumers' use of e-commerce grew more rapidly. For travel agencies, on the other hand, the shifts reflected aggregate changes driven by the reduction on agent commissions as consumers started buying tickets online. This result suggests that as online transactions increase, the strategy to retain or gain markets becomes context specific.

Criscuolo and Waldron (2003) study the relation between e-commerce and productivity. They used firm level data to show e-commerce is changing the performance of firms and markets. In their estimations e-commerce is positively correlated to labor productivity -measured as value added per employee- and total factor productivity – measured as gross output and value added per employee.

A different channel though which e-commerce can increase economic efficiency is by increasing competition. According to Ahn (2002) e-commerce resembles the market conditions that produce fierce competition. As in the case of many innovative sectors, firms often compete for the entire market rather than within the market. And even in the case of markets with many players, the reduction in transaction and search cost provides consumers with many more options, favoring a more competitive environment.

In terms of economic welfare e-commerce offers consumers lower prices and access to a variety of products from local and external markets. A study by Civic Consulting (2011) estimated large welfare gains for EU consumers resulting from lower online prices and increased online choice. Under the hypothetical scenario that 15% of retailing is made online—from a current 3.5% - the welfare gains amount to 1.7% of the EU GDP.

Finally, as countries adapts to the new available technologies for making transactions, concerns have been raised on whether everyone is able to take full advantage of the benefits of Internet and e-commerce. The main issue is whether these rapid changes can leave behind women and low-income groups or, on the other hand, if technology can help reducing current gaps. For example, e-commerce has the potential to largely benefit women entrepreneurs, who account for the majority of small and micro firms in

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developing countries. Online tools could help them reduce transaction cost and reach more consumers. However, most entrepreneurs women in developing countries are still far from been able to use these technologies and the numbers of e-commerce users in this part of the world remain still very low (UN, 2002).

9.4 E-commerce and electronic payments

By its nature e-commerce development is closely related to the electronic payments system. In general online payment instruments may be divided in two categories: account-based systems and electronic currency systems. The category of account-based systems includes credit cards, debit cards, mobile payments and payments via online banking. The electronic currency systems include smart card systems and online cash systems.

Credit cards are widely used to pay online. As reported by OECD (2004) based on data from European group Pago, 94% of the total number of worldwide e-commerce transactions carried out via Pago used credit cards in 2003. Several reasons may explain this dominance. Merchants may prefer credit card payments because of the guarantee associated to the payment. Credit card information submitted by the customer is sent to the bank that issued the card. If the transaction is approved, the merchant notifies the customer that the order has been placed. Customer may prefer paying by credit card because they can easily cancel a transaction in case they do not receive the product or services according to the initial agreement.

The emergence of electronic payment instruments provides the basis for the expansion of e-commerce. Moreover, the interaction between the development of electronic payments and e-commerce may be a source of significant welfare gains for consumers. The individual gains that electronic payments and e-commerce generate, discussed in this report, may be amplified when electronic payments and e-commerce expand.
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