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## Retail payments and economic growth

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# Retail payments and economic growth



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# Retail Payments and Economic Growth

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## Abstract

This paper examines the fundamental relationship between retail payments and overall economic growth. Using data from across 27 European markets over the period 1995-2009, the results confirm that migration to efficient electronic retail payments stimulates overall economic growth, consumption and trade. Among different payment instruments, this relationship is strongest for card payments, followed by credit transfers and direct debits. Cheque payments are found to have a relatively low macroeconomic impact. Retail payment transaction technology itself is also associated positively to real economic aggregates. We also show that initiatives to integrate and harmonise retail payment markets foster trade and consumption and thereby have a beneficial effect for whole economy. Additionally, the findings reveal that the impact of retail payments on economic growth is more pronounced in euro area countries. Our findings are robust to different regression specifications. The study supports the adoption of policies promoting a swift migration to efficient and harmonised electronic payment instruments.

**Keywords:** retail payments, economic growth, financial development

**JEL classification:** G20, G21

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## **Non-technical summary**

It is widely recognised that a well-functioning payment infrastructure is crucial to enhance the efficiency of financial markets and the financial system as a whole, boost consumer confidence and facilitate economic interaction and trade both in goods and services (BIS, 2003; ECB 2010). Unsafe and inefficient payment systems may hamper the efficient transfer of funds among individuals and economic actors (Humphrey et al., 2006). Over the past decades, payment markets have witnessed important continuing challenges and opportunities, comprising regulatory and market initiatives, increased consolidation and competition. In addition, technological advances have paved the migration from paper to electronic payments. (Humphrey et al., 1996). In the European context, these developments have been complemented by the establishment of the Single Euro Payments Area (SEPA), which aims at creating an integrated and harmonised pan-European payments market thereby fostering competition and driving innovation.

Despite its relative importance and recent developments in the field of payment markets, the empirical literature on retail payments is rather sparse (Kahn and Roberds, 2009; Humphrey et al., 2006; Hasan et al., 2009). The present paper contributes to the strand of literature by showing the impact of payment market infrastructure from a new perspective. It examines the fundamental relationship between the retail payment markets and overall economic growth. Specifically, it analyses the linkage between the country level infrastructure of retail payment markets and its effects on the real economic side, specifically, GDP, trade and household consumption.

Based on retail payments data, from all 27 European Member States over the period 1995-2009, the paper demonstrates that migration from paper to electronic retail payments has a positive impact on the real economy. Among different payment instruments, this relationship is strongest for card payments. Cheque payments are found to have a relatively low macroeconomic impact. Retail payment transaction technology itself is also associated positively to real economic aggregates. The presence and diffusion

of ATM and POS machines are found to have a positive impact on GDP and trade. We also show that initiatives to integrate and harmonise retail payment markets foster trade and consumption and thereby have a beneficial effect for whole economy. We also show that initiatives to integrate and harmonise retail payment markets foster trade and consumption and thereby have a beneficial effect for whole economy

From a policy perspective, our paper supports the adoption of policies that encourage the usage and adoption of electronic retail payment instruments. Initiatives and policies aimed at fostering an integrated and harmonised single retail payments area can be expected to lead to positive macroeconomic effects, increased trade and consumer consumption.

## **1. Introduction**

It is widely recognised that a well-functioning payment infrastructure is crucial to enhance the efficiency of financial markets and the financial system as a whole, boost consumer confidence and facilitate economic interaction and trade both in goods and services (BIS, 2003; ECB 2010). Unsafe and inefficient payment systems may hamper the efficient transfer of funds among individuals and economic actors (Humphrey et al., 2006). Over the past decades, payment markets have witnessed important continuing challenges and opportunities, comprising regulatory and market initiatives, increased consolidation and competition. In addition, technological advances have paved the migration from paper to electronic payments. (Humphrey et al., 1996). In the European context, these developments have been complemented by the establishment of the Single Euro Payments Area (SEPA), which aims at creating an integrated and harmonised pan-European payments market thereby fostering competition and driving innovation.

Despite its relative importance and recent developments in the field of payment markets, the empirical literature on payments is rather sparse (Kahn and Roberds, 2009). In this paper, we attempt to fill this gap. This paper examines the fundamental relationship between the retail payment markets and overall economic growth. Specifically, it analyses the linkage between the country level infrastructure of retail payment markets and its effects on the real economic side, specifically, GDP, trade and household consumption.

Based on retail payments data, from all 27 European Member States over the period 1995-2009, evidence confirms that migration to efficient electronic retail payments has a positive impact on GDP, consumption and trade. Among different payment instruments, this relationship is strongest for card payments. Cheque payments are found to have a relatively low macroeconomic impact. Retail payment transaction technology itself is also associated positively to real economic aggregates. The presence and diffusion of ATM and POS machines are found to have a positive impact on GDP and trade. We also show that initiatives to integrate and harmonise retail payment

markets foster trade and consumption and thereby have a beneficial effect for whole economy.

This research makes several important contributions to the literature. Few studies examine costs and profitability related to the use of electronic payment instruments (Humphrey et al., 2006, Hasan et al., 2009). Hasan et al. (2009) document that payment systems have a significant impact on bank performance and efficiency, increasing the availability of resources and ultimately favouring lending, investments and growth. In effect, a limitation of the existing payment literature is that it focuses on the implications that developments in payment systems have on the banking sector without extending it to an analysis of the possible benefits for the economic system as a whole. Our paper contributes to this strand of literature by showing the impact of payment market infrastructure from a new perspective, i.e. the impact on the real economy.

There is vast empirical literature that substantiates more and more the great importance of financial development for the contribution of a financial system to productivity and growth. (King and Levine, 1993; Rajan & Zingales, 1998; Beck, Levine and Loyaza, 2000). King and Levine (1993) provide evidence that overall credit to the private sector matters for economic growth. Levine and Zevros (1998) add that the extent of bank lending and the development of stock markets both have independent beneficial effects on cross-country growth. Focusing on the European Union, Inklaar and Koetter (2008) show that deeper credit and more efficient capital markets enhance production and spur productivity growth. Even though a number of studies show positive effects of financial development and intermediation on growth, the importance of safe and efficient retail payments markets has so far not yet been studied. This paper attempts to introduce a new dimension of financial system performance on growth by considering country level infrastructure in terms of retail payment markets.

The paper proceeds as follows. Section 2 provides a brief literature review and develops a set of research hypotheses to be tested in the paper. Section 3

summarises the data. Section 4 describes the empirical methodology and Section 5 reports the empirical results. Section 6 concludes.

## **2. Literature review and hypotheses development**

Technological developments over the past thirty years are one of the main driving forces behind the change in the structure of the financial markets and the creation of new financial technologies and instruments. Major changes have been characterizing the retail payments market with the emerging of new electronic payments platforms and instruments, such as debit cards and credit cards that have gradually complemented and replaced the usual paper based payment arrangements (Scholnick et al., 2008).

Therefore, issues related to payment systems and instruments have increasingly become a major point of discussion, not only in academic research, but also in financial markets as well as among regulators. The economics of payment systems have attracted researchers from different disciplines, banking, financial economics as well as macroeconomics, monetary and regulatory economics (Humphrey, Pulley and Vesala, 1996; Berger, 2003; Bolt, Humphrey and Uittenbogaard, 2008; De Young, 2005; Hasan, Schmiedel and Song, 2009; Kahn and Roberds, 2009; Scholnick et al., 2008).

There are a number of studies looking at costs and profitability related to the use of electronic payment instruments, showing the potential positive effects on capital allocation, capital accumulation and growth. Berger (2003) showed that technological development in the financial system, such as internet banking, electronic payment technologies and information exchanges, is related to significant productivity increases due to improvements in the services provided by banks. He found that the reduction of the costs of their back-office activities that represent the majority of banks operating costs, by switching from paper to electronic payment instruments has significant effects in terms of gains in productivity and economies of scale.



Humphrey et al. (2006) and Hasan et al. (2009) found that the development in the use of electronic payment systems, mainly electronic retail payment instruments, is related to notable improvements in banking performance. These improvements are related not only to the cost side of banking operations but also to the revenue side (ECB and De Nederlandsche Bank, 2009). In fact, as documented in Humphrey et al. (2006), between 1987 and 1999, European countries may have saved \$32 billion by shifting from paper-based to electronic payment systems that is the 0.38% of the aggregate GDP in 1999. Furthermore, they document that if a country shifts from an all paper-based to a fully electronic-based payment system and substitutes branch offices with ATMs, the annual savings may be around 1% of GDP.

Part of the literature on the economics of retail payments focuses on the role of payments system development and consumer choices. Humphrey et al. (2001) developed a model to estimate consumers' demand for three point-of-sale payment instruments: checks, cash (as proxied by the quantity and price of ATM cash withdrawals) and the use of debit cards (EFTPOS)<sup>4</sup>, showing the existence of a substitution effect between cheques and cards.

According to evidence from the Global Insight study by VISA (2003), US consumer spending increased by 6.5 trillion of dollars in the last two decades. Moreover, it documents an increasing growth in the use of cards in consumer expenditure relatively to cheques and cash (VISA, 2003). Thus, consumers seem to benefit from more convenient payment instruments, both in terms of timing and costs. Furthermore, according to a study from Banca d'Italia (1999), having a more and more efficient payment system will allow countries to realise increasing benefits on the real side of the economy.

From these previous literature, it comes to surface the importance of availability of payment instruments in market economies. To keep pace with increasing costumers' needs, having at disposal a wide range of payment instruments as well as an optimal use of these instruments is fundamental. It is

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4 For further details on the model refer to Humphrey D., B., Kim M. and Vesala J., 2001, "Realizing the Gains from Electronic Payments: Costs, Pricing, and Payment Choice", *Journal of Money, Credit, and Banking*, 33 (2) 216-34.

agreed that the retail payment system is of “systematic-wide importance”, because it facilitates both consumer-to-consumer and commercial transactions and in so doing has a significant impact on the overall economy (Cirasino and Garcia, 2008). Consumers will find themselves with a wider range of payment options that are likely to be globally accepted (ECB, 2010), implying smoother access to funds on deposit and immediate credit (Global Insight, 2003). Similarly, merchants will find themselves with improved speed of transactions, higher security, less costs connected to paper-based transactions.

In fact, by eliminating or reducing market frictions and costs, an efficient payment infrastructure helps trade, services, transfers of funds, fostering economic interactions. Consumption and trade increase, in turn supporting production and so overall growth (Singh and Zandi, 2010). In sum, the impact of developments in electronic payment systems, lead to a virtuous economic cycle that comes both from consumers’, thanks to higher availability of credit and increased efficiency in transactions, and from merchants that find themselves with a large pool of consumers and better guaranteed payments. On the basis of this, we develop first three out of seven hypotheses:

*H1: Efficient non-cash retail payment instruments stimulate economic development.*

*H2: Greater card payment usage score highest on trade and on total consumption, as well as through stimulating consumption in leisure and secondary goods and services.*

*H3: Cheque payments exert a lower contribution on economic growth and consumption and trade in comparison to other non-cash payment instruments.*

Through credit transfers, the payer is able to instruct her bank to transfer funds to a beneficiary. The funds are placed at the disposal of the payee through a single payment order or a series of orders. Credit transfers are, in number of transactions, relatively few compared, for example, to card payments. However, things change when we speak in terms of value. In fact,

they are the main choice for relatively larger value retail payments (ECB, 2010). An effective credit transfer scheme can assure to send and receive payments, involving significant amounts safely and easily making less risky and costly for companies to exchange goods and services both at a national and at a cross-border level. The same can be said for direct debits, defined as “an authorised debit, potentially recurrent, on the payer’s bank account initiated by the payee” (ECB, 2010).

Therefore, the subsequent three hypotheses follow:

*H4: The positive effect of credit transfers on real economic development is higher in euro area countries than in non euro area countries.*

*H5: Economic growth is positively associated with increased use of direct debits.*

Great emphasis has been given to the SEPA and its implementation. Both practitioners and regulators are stressing the benefits of having harmonized account numbers, instruments and procedures in terms of improved market integration, smoother and less costly trade. Therefore, the following hypothesis will also be tested:

*H6: Integration and harmonisation of retail payment markets foster trade and consumption and thereby is beneficial for economic growth.*

Finally, we focus on the role of new payment technologies. Humphrey et al. (2001) found a net substitution effect between ATMs and cheques and one-way net substitution effect between cheques and POS due to an increase in cheques fees<sup>5</sup>. More recently, Scholnick et al. (2008) performed a similar analysis but with more detailed bank level data rather than country level data

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<sup>5</sup> The use of ATMs and checks are net substitutes both ways. Whilst, EFTPOS and checks are significant net substitutes from checks to EFTPOS but the reverse relation is significantly weaker: consumers are willing to substitute from checks to EFTPOS, following an increase in the price of checks, less inclined to substitute from EFTPOS to checks, following an increase in the price of EFTPOS. (Humphrey et al., 2001)

as in Humphrey et al. (2001), finding a substitution effect also between ATMs and EFTPOS. Related to this, we developed the following additional hypothesis:

*H7: The adoption of new payment technologies results in additional economic growth*

In sum, given past findings, our main idea is that innovation in payment systems will benefit society as a whole: the use of new electronic payment arrangements will lower costs and facilitate transactions, benefiting both consumers and retailers. Money will be more easily transferred; consumer purchasing power will increase as well as trade (Berger, 2003; ECB and De Nederlandsche Bank, 2009). Therefore, the following research questions arise:

What are the effects of retail electronic payment instruments on economic development? How are these effects, if any, on consumption and trade? Are there differences across instruments? Is integration among payment systems favouring consumption and trade and aggregate economic development? What are the effects of the development of new payment technologies?

### **3. Data and methodology**

#### **3.1 The model**

The statistical methodology followed in our estimation is the Arellano-Bond dynamic panel GMM (Generalized Method of Moments) estimator (Arellano and Bond, 1991; Blundell and Bond, 1998).

The baseline model specification would be:

$$y(i, t) = \alpha y(i, t - 1) + \beta' X(i, t) + \vartheta(i) + \varepsilon \quad (1)$$

where  $y(i, t)$  is the logarithm of real per capita GDP in country  $i$  at time  $t$ ,  $X$  represents the matrix of covariates, including macroeconomic indicators

as well as payment instrument penetration variables,  $\vartheta(i)$  accounts for country effects and  $\varepsilon$  is the error term. When estimating the link between financial development and economic development several economic problems may arise such as:

- problems in identifying causality, even if a significant relation is found to be in place; causality may run in both directions;
- possibility of autocorrelation;
- discrepancies between time (short) and country (larger) dimensions in the dataset.

Therefore, the OLS estimation would be biased and inconsistent, being unable to account for the above issues. In order to overcome this problem, previous literature has made use of instrumental variables (IV) estimation or first difference GMM (Rousseau and Wachtel, 2000).

However, statistical problems arise for both. In the first case, there are issues related to the weakness of the instruments, rendering the IV estimation subject to the same type of bias of the OLS estimation. The difference GMM estimator is able to eliminate the country effects. Arellano and Bond (1991) develop the difference GMM that is a two-step GMM in which, in the first step, the error terms are considered as being independent and homoscedastic across countries and time whereas, in the second step, the hypotheses of homoscedasticity and independence is relaxed, therefore, obtaining higher efficiency. This estimator is based on the following two moments conditions:

$$E[y_{i,t-k}(\varepsilon_t - \varepsilon_{i,t-1})] \text{ for } k > 2, 3, \dots, N \quad (3)$$

$$E[X_{i,t-k}(\varepsilon_t - \varepsilon_{i,t-1})] \text{ for } k > 2, 3, \dots, N \quad (4)$$

The main issue with this estimator is the fact that the cross-country effect is eliminated by differencing. Moreover, Blundell and Bond (1998)

show that it may be subject to large downward finite-sample bias, especially when the number of time periods is relatively small.

In order to overcome these problems, they developed the System GMM estimator, in which two additional conditions are added to (3) and (4):

$$E[(y_{i,t-k} - y_{i,t-k-1})(\vartheta_i + \varepsilon_{i,t})] = 0 \text{ for } k = 1 \quad (5)$$

$$E[(X_{i,t-k} - X_{i,t-k-1})(\vartheta_i + \varepsilon_{i,t})] = 0 \text{ for } k = 1 \quad (6)$$

The system GMM then combines together in a system the set of first-differenced equations with lagged level as instruments and the set of equations in levels with lagged first-differences as instruments. For this estimator to be consistent the assumption on the validity of the instruments and the absence of serial correlation among the error terms should hold. Two tests have been developed: the Sargan or Hansen test<sup>6</sup> of over-identifying restrictions (Bundell and Bond 1998; Bond, Hoeffler and Temple, 2001) and the autoregressive (AR) test.

Our analysis follows the same line of thinking of a white paper from Moody's (Zandi and Singh, 2010). Rather than referring to payments expressed in absolute terms, as total value of transactions, they use card penetration, namely, value of cards over household consumption. However, while they simply look at household consumption, we focus on aggregate output, measured by per capita GDP, trade, total household consumption and consumption for leisure goods and services<sup>7</sup>. The demand for leisure goods and services is the component of total demand with higher elasticity. Therefore should be significantly influenced by developments in payments instrument

#### 4. Results

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<sup>6</sup> The Sargan and Hansen statistics both test the null hypothesis of overidentifying restrictions. However, the latter is robust to heteroscedasticity and autocorrelation which is why, later in the paper, we refer to this.

<sup>7</sup> Leisure consumption expenditure refers to the following sectors: clothing; recreation and culture; newspapers; restaurant and hotels; personal care.

#### 4.1 Data description and summary statistics

The data on payment statistics are taken from the Statistical Data Warehouse (SDW) and cover the period between 1995-2009 for the EU-27 countries after the adjustments, due to missing observations and some methodological changes in recording data, the series amounts to around 400 observations for volumes and 300 for values.

We focus on the following retail payment instruments: payment cards, credit transfers, direct debits, cheques and cash. For payment cards, in order to retrieve the highest number of observations, we do not distinguish between credit and debit cards<sup>8</sup>. Data on debit and credit cards taken alone are sparse and fragmented, focusing on those would have meant losing a large number of data point and losing also important countries like France and Germany.

We insert also a proxy for cash. Data on cash transactions are almost completely unavailable or extremely sparse. The availability of automated teller machine (ATM) terminals should tend to increase the use of cash in transactions by increasing the number of cash withdrawals (Humphrey et al., 1996). Therefore, we use the number of cash withdrawals as a proxy for cash<sup>9</sup>.

For each specification, following previous literature (King and Levine 1993; Barro, 1991), we include some control variables, such as the log of the lagged values of real per capita GDP, so to account for initial economic development; the interest rate. Besides the SDW from the European Central Bank, we refer to Eurostat and the World Bank<sup>10</sup> to retrieve data on macroeconomic variables. For a more detailed description on the data see Appendix 1.

Figure 1 shows the trend for the different retail payment instruments. The use of cashless payment instruments is increasing over time. Payment

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<sup>8</sup> We refer to *All cards except those with e-money functions* from the SDW

<sup>9</sup> Using the number of withdrawals as a proxy for cash is a rough estimation. However,, cash is not part of our main variables of interest.

<sup>10</sup> <http://databank.worldbank.org/ddp/home.do>

cards, i.e. credit and debit cards, show the highest growth: their compounded average growth rate (CAGR)<sup>11</sup> is around 10%. In the case of cards, this rapid increase is mainly due to debit cards. Credit card use is still limited and data are still fragmented across countries. The decrease in the use of cheques is also striking. Over the entire period there is a negative CAGR of 8.14%. This evidence reveals the existence of an inverse relationship between the use payment cards and the use of cheques: to the constant increase in the use cards corresponds a decrease in the use of cheques (see Figure 2).

Figure 3, Figure 4 and Figure 5 show the most recent developments. Figure 3 reports the last fifteen years, showing a notable development in non-cash payment instruments with a gradual shift away from cheques, the use of which substantially decreased. Counterbalancing this is the increasing trend in the use of cards. However, further developments are still required especially in terms of costs and risks reduction (ECB, 2010). Figure 4 shows the developments in the use of non-cash payment instruments per capita, across the EU 27 countries for 2009<sup>12</sup>. The graphs show that the use of cards as well as credit transfers is widespread across countries, but a lot of variability still remains. Eastern European transition economies are lagging behind, especially the less developed ones such as Bulgaria or Romania. Nevertheless, it should be noted that, for this group of countries, the development of the financial system and of the market economy itself only started less than twenty years ago.

Significant differences can be seen also in Western Europe. For instance, in Italy, Greece or Spain, the use of cashless instruments is significantly lower than in countries, such as Finland, Sweden or the Netherlands. As regards Luxembourg, it should be noted that: the huge increase in cashless instruments registered in 2009 is due to the introduction of a software based

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11 The percentages are the Compound Annual Growth Rate (CAGR) mean of the growth of transactions 2000-09 in the EU. CAGR is calculated through the following formula:  $CAGR = (x_t/x_0)^{(1/t)} - 1$  where t is the number of years and  $x_t$  is the value in the current year.

12 The latest available data for CY, HU, LV, SI are for 2008.



e-money scheme (PayPal Europe S.a.r.l. and Cie S.C.A) that commenced operations.<sup>13</sup>

Figure 5 focuses on card payments and shows the increasing trend and significant share of card payments at POS terminals compared to cash withdrawals. Again, in all the different countries there is a steady increase in the use of cashless payment instruments<sup>14</sup>.

Table 1, Panel a, reports the summary statistics for the volume of transactions as well as the value of transactions and the value of transactions as a share of GDP, for the different payment instruments.

In terms of volume of transactions, most transactions seem to be carried out through payment cards and credit transfers but, in per capita terms, cash is still the most widely used means of payment. As regards electronic payment instruments, cards and credit transfers are the mostly used also in per capita terms, as reflected by Figure 1 and 2. Concerning the value of transactions (Table 1, Panel a): credit transfers, direct debits and cheques are those instruments that account for the highest values of transactions, both in absolute terms or when expressed as a ratio to GDP. This is consistent with the fact that the above instruments are predominantly used for larger value retail payments. In fact, cash and cards are mostly used for transactions involving relatively small amounts. It seems that the usage of cheques remains somewhat significant when larger amounts are involved. However, further developments in transactions practices involving the use of credit transfers and direct debits and further developments in the diffusion of SEPA instruments might bring notable changes in the incoming future.

Of relevance is the high standard deviation that mirrors the high variability across countries in the use of the different instruments. Differences are significantly high not only between the two groups, Western and Eastern Europe, whose differences can be explained by their different

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13 All Paypal transactions initiated in Europe are registered as Luxembourgian Paypal transactions.

14 The number of cashless transactions is given by the sum of all cards, credit transfers, direct debits and e-money transactions.

stage of development, but, also among the most developed countries, where differences in the way transactions are carried out are significant, especially with regard to the use of debit and credit cards and the use of cheques<sup>15</sup>.

Table 1, Panel b, reports the maximum and minimum values for countries. The Eastern European countries are at the very low end of electronic instruments usage, both when looking at volumes and values of payments. Table 1, Panel a and Panel b, report summary statistics for ATM and POS terminals that we introduce in our analysis to directly take into account technological developments. These vary considerably across countries and time and significant differences between the groups of transition countries compared to the euro area countries.

#### **4.2 Penetration of payment instruments**

Our analysis relies on system GMM estimation, in order to deal with endogeneity and small sample bias and, differently from the difference GMM, be able to keep the cross-country effect in our analysis. However, we also report the results from the OLS and difference GMM analysis.

Our expectations are that there will be a positive relationship between the penetration of electronic instruments, our measure for financial development, and the real economy, proxied by the logarithm of real GDP per capita, total final household consumption, final household consumption on leisure goods and trade. In our analysis, we consider other controls such as the initial level of GDP and interest rates, but the tables only shows the results for the main variables of interests<sup>16</sup>.

In order to capture differences between euro area and non-euro area, we divide the sample in two subgroups by mean of an indicator variable, *EURO* that equals 1 for a euro area country. We also look at the adoption of SEPA payment instruments, by introducing a time dummy that takes the value of 1

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15 In the case of cheques, there are large markets such as the French and the English markets in which cheques are still largely in use. On the other hand, there are countries such as the Netherlands or Sweden in which, partly due to changes in regulation, the use of cheques disappeared. This also explains the presence of a minimum value equal to zero

16 Complete estimation results are available on request

after 2008, to identify whether the migration to SEPA is significant. Our conjecture is that, given that the compliance with SEPA requirements and standards implies the attainment of a certain stage of technological development and shows a level of convergence in the payment systems and most likely a higher integration, less risks and lower costs, we should see a positive and significant coefficient for this indicator.

Table 3 reports the main findings of our analysis. It reports the results for each of the three estimation techniques and for each of the dependent variables considered. The first three columns report the results for the aggregate economy, measured in terms of logarithm of real GDP per capita.

The system GMM analysis shows that payment cards have the most significant impact on GDP. The impact remains relatively high and significant in all of the three types of estimation: OLS; difference GMM; system GMM.

Direct debits are not significant, whereas for credit transfers the impact is concentrated in euro area countries, confirming our fourth hypothesis. In fact, significant developments have been characterizing the euro area in terms of soundness and efficiency of electronic credit transfers, as well as direct debits. This is an interesting result, because it signals the need for further development and lends support to the efforts of regulators in fostering payments using these new type of instruments. The SEPA dummy is always positive and significant. This seems to support the current view of regulators who are rigorously attempting to complete the process of full migration towards a fully integrated payment area. In effect, one of the main issues in the area of payments is the rather slow development in the use of SEPA direct debits. While the growth in SEPA credit transfer is increasing, direct debits are still lagging behind. But our findings show that the benefits from their increasing use could be significant.

As regards cheques and cash, looking at the OLS, the coefficients are somewhat significant. However, the OLS estimation is likely to be biased, for the reasons mentioned above. Therefore, we rely on system GMM.

When this type of estimation is used, cash loses significance, whereas the positive effect that cheques have is concentrated in non euro area countries. Similar results are achieved in the case of trade.

When looking at total final household consumption cheques and cards do seem to have an impact. Coefficient on cards is the highest. The effect is concentrated for non euro area. Concerning credit transfers and direct debits, their effect disappears when we turn to system GMM, even though they maintain some degree of significance in the OLS specification. This is reasonable, if we consider that credit transfers are the main choice for relatively larger value retail payments. It would be less risky and less costly for companies to exchange goods and services both at a national than at a cross-border level (ECB, 20010).

A similar argument can be made in the case of direct debits. Therefore, it is likely that the impact will be more on the merchants' side of the market rather than on the consumers' part. Cash has no impact as before. Regarding payment cards and cheques, in both cases cards penetration and cheques penetration seem to have a very significant impact on consumption, but it seems to be coming mainly from non-euro area countries.

We rerun the analysis by dropping out Denmark, Sweden and UK. However, the previous results for cards still hold. Eventually, it seems that the transition countries are driving the results: when we exclude Denmark, Sweden and UK the magnitude of coefficients increases. There are two possible reasons behind these findings: first, for many of the non-euro countries, mainly transition countries, the biggest share in payments penetration is taken by cash and cards (Figure 4); secondly, in countries that are still developing the impact of payments instrument development is larger on consumption compared with countries at an advanced stage of development.

Overall, cards are, by far, the instruments which register the most significant relationship with GDP, trade or consumption. The highest impact is through consumption on leisure goods. We measured the impact of a

variation of 1% in the use of payment cards in 2009 for the different countries: the impact on aggregate GDP is modest, averaging around 0.004%. The impact is usually higher for less developed countries. When we focus on leisure consumption though, the impact becomes relatively significant, averaging around 0.30%, with 0.47% in Austria. This confirms what we previously mentioned in the paper: that the demand for leisure goods is the component of consumption demand with the highest elasticity. Therefore, it is likely to be impacted more by higher efficiency and lower costs of transactions.

#### **4.3 Payment card devices: ATMs and POS**

In the last 15 years, there has been a notable development in the presence of new transactions technologies. Figure 6 shows how the number of POS and ATM terminals has increased over time.

Previous literature, when looking at transactions technology, namely the diffusion of ATM and POS, mainly investigated the effect on currency holdings and demand deposits (Duca and Van Hoose, 2004; Attanasio et al., 2002). Snellman, Vesala and Humphrey (2001) show that the diffusion of POS increases the convenience of cards payments over cash for low value payments. It increases the possibility of earning interest on deposits. Drehmann et al. (2002) find a negative relation between POS diffusion and demand for money. Another field in which the diffusion of payment technologies has been significantly studied is the one related to the economics of technical changes that mostly investigates the determinants of the adoption of some specific technologies in an industry (Hannah and McDowell, 1987; Humphrey, Pulley and Vesala, 1996). Both these strands of literature document risk and cost reductions by switching to new forms of payments. Columba (2009) empirically shows the decrease in transaction costs related to the diffusion of ATMs and POS. The diffusion of transactions technology increases the availability of means of payment, easing transactions and increasing efficiency in processing payments. Brito

and Hartley (1995) claim that consumers benefit from the use of cards because of a reduction in the opportunity cost of holding cash.

In light of this, we expect the diffusion of transactions technologies to have a positive impact on economic development and particularly on household consumption and trade. That is why we run a simple analysis, following the system GMM procedure, also directly looking at the number of ATM and POS devices. Overall, in line with our expectations, the diffusion of ATM and POS seems to have a positive impact on economic development, with a strong impact both on consumption and trade. This could reflect the view according to which the increasing presence of new technologies, by facilitating and smoothing transactions, has a positive impact both on consumption than on trade. In effect, this view is corroborated by the fact that the consumption of leisure goods appears to be impacted the most: the coefficients are much higher than when looking at total final consumption.

#### **4.4 Robustness checks<sup>17</sup>**

We perform some robustness checks on our initial results. As already mentioned, we run the analysis with and without Denmark, UK and Sweden in the sample. In fact, in our analysis we divide the sample in two sub-samples according to whether a country is a member of the monetary union or not. Apart from the countries mentioned above, the non-euro area sub-sample is made up of transition economies. The group of transition countries is completely different both in terms of real economic development and in terms of financial development from the three countries mentioned above. Therefore, in order to verify whether the results are biased by the inclusion of the three Northern European countries, we exclude these countries from the model. However, our previous findings do not change.

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<sup>17</sup> Tables are available on request.

We introduce other controls, choosing among the ones typically used in the finance and growth literature. When consumption is considered, we control for inflation, when we look at GDP per capita and at trade, we also introduce the claims of the banking sector to the private sector as a share of the GDP, taken from the dataset developed by Beck et al., updated at 2010. The previous findings still hold and, for credit transfers, their impact on GDP per capita results to be stronger. Inflation, even if not significant has a negative sign in all the models, whereas private credit as a ratio of GDP is positive and significant.

## **5. Conclusion**

At the best of our knowledge, this study is the first, to provide a comprehensive view on the importance and significance of retail payments for overall economic growth. We conclude that electronic retail payments render the economy more efficient. Specifically, using country-level retail payments data across all 27 European member states, we find evidence that migration to efficient electronic retail payments spurs overall economic growth, consumption and trade. Despite substantial asymmetries of adoption and usage of non-cash payment instruments and growth rates across the sample countries and over the sample period, for all economies and markets analysed there is positive correlation between retail payments and economic growth.

Among different payment instruments, this relationship is strongest for card payments, followed by credit transfers and direct debits. In particular, card payments are designed for consumers to access credit and thereby allowing for consumption smoothing. Most of the aggregate macroeconomic effects are driven by developments in electronic payment systems in the euro area countries, notably for payment card transactions as well as credit transfers and direct debits. Cheque payments are found to have a relatively low macroeconomic impact. Retail payment transaction technology itself is also associated positively to real economic aggregates. We also show that

initiatives to integrate and harmonise retail payment markets foster trade and consumption and thereby have a beneficial effect for whole economy

From a policy perspective, our paper supports the adoption of policies that encourage the usage and adoption of electronic retail payment instruments. Initiatives and policies aimed at fostering an integrated and harmonised single retail payments area can be expected to lead to positive macroeconomic effects, increased trade and consumer consumption.



## Appendix A

Variable	Description	Source
Cash	Volume/Value of cash withdrawals- Millions euro	ECB SDW
Cheques	Volume/ Value of transactions – Millions euro	ECB SDW
Cr Transf	Volume/ Value of transactions – Millions euro	ECB SDW
Dir Debits	Volume/ Value of transactions – Millions euro	ECB SDW
All Cards	Volume/ Value of transactions – Millions euro	ECB SDW
All Cards	Value of transactions/Real GDP	Computed
Cash	Value of cash withdrawals/ Real GDP	Computed
Cheques	Value of transactions/Real GDP	Computed
Cr Transf	Value of transactions/Real GDP	Computed
Dir Debits	Value of transactions/Real GDP	Computed
ATM Num of Terminals	Number of ATM terminals	ECB SDW
POS Num of Terminals	Number of POS terminals	ECB SDW
ATM Num of Terminals per 1 million capita	Number of ATM terminals per 1 million inhabitants	ECB SDW
POS Num of Terminals per 1 million capita	Number of POS terminals for 1 million inhabitants	ECB SDW
GDP Per Capita	Real GDP per capita	World Bank
Hholds Fin Cons per capita	Household final total consumption expenditure	World Bank
Hholds Leisure Cons per capita	Final household consumption expenditure on clothing; recreation and culture; newspapers; restaurant and hotels; personal care	World Bank
Interest RateHholds Leisure Cons per capita	Deposit interest rate (rate paid by commercial or similar banks for demand, time, or savings deposits)	World Bank
Trade per capita	Trade per capita	World Bank
Inflation	CPI Inflation	World Bank
Private Credit over GDP	Bank claims over the private sector/GDP	Beck et al. (2010)
SEPA	Dummy = 1 after 2008 for countries who adopted SEPA instruments	Computed
EURO	Dummy = 1 if the country in the euro area	Computed

## References

Arellano M., and Bond S., 1991, "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations". *Review of Economic Studies*, 58, 277-297.

Attanasio O.P., Guiso L. and Jappelli T., (2002), "The Demand for Money, Financial Innovation, and the Welfare Cost of Inflation: an Analysis with Households' Data", *Journal of Political Economy*, 110 (7), 317-351.

Banca d'Italia, 1999, "White Paper on Payment System Oversight. Objectives, Methods, Areas of Interest"

Beck T. and Levine R., 2004, "Stock markets, banks, and growth: Panel Evidence". *Journal of Banking and Finance*, 28, 243-442.

Beck T., Demirgüç-Kunt A., and Levine, R., 2000, "A New Database on Financial Development and Structure," *World Bank Economic Review* 14, 597-605 (updated at April, 2010)

Beck T., Levine R. and Loyaza, R., 2000, "Finance and the sources of growth". *Journal of Financial Economics*, 14, 597-605.

Berger A. N., 2003, "The Economic Effects of Technological Progress: Evidence from the Banking Industry". *Journal of Money Credit and Banking*, Volume 35.

Berger A. N., Klapper L.F., and Turk-Ariss, R., 2009, "Bank Competition and Financial Stability". *Journal of Financial Services Research*, 35, 99 – 118.

Behabib, J. and Spiegel, M., 2000, "The Role of Financial Development on Growth and Investment". *Journal of Economic Growth*, 5, 341 - 60

Bolt W., Humprey D. and Uittenbogaard R., 2008, "Transaction pricing and the Adoption of Electronic Payments: A cross-country comparison". *International Journal of Central Banking*.

Brito, D. L. and Hartley P. R., 1995, "Consumer Rationality and Credit Cards", *Journal of Political Economy*, 103, 400-33

Bu M. J. G. and Windmeijer F., “The weak instrument problem of the system GMM in dynamic panel data models”, *The Econometrics Journal*, Volume 13, 95-126.

Carbó-Valverde S., Rodrigues-Fernández F., 2009, “Competing technologies for Payments, Automated teller Machines (ATMs), Point of Sale (POS) Terminals and the Demand for Currency”, Fundación BBVA

Cirasino M. and Garcia A., 2008, “Measuring Payment System Development”, Working Paper, Financial Infrastructures Series, The World Bank

Claessens S. and Laeven L., 2003, “Financial Development and Intersectoral Investment: New Estimates and Evidence”, ECB

Columba F., 2009, “Narrow money and transaction technology: new disaggregated evidence”, *Journal of Economics and Business*, 61, 312-325.

De Nederlandsche Bank, 2009, “Retail Payments – Integration and Innovation”. A joint conference by the ECB and De Nederlandsche Bank.

De Gregorio, J., 1994, “Liquidity constraints, human capital accumulation and growth”, International Monetary Fund, Washington, D.C.

Degryse H. and Ongena S., 2008, “Competition and regulation in the banking sector: A review of the empirical evidence on the sources of bank rents”. *Handbook of Corporate Finance: Financial Intermediation and Banking*, 483-554.

Drehmann M., Goodhart C. and Krueger M., 2002, The Challenges Facing Currency Usage: Will the Traditional Transaction Medium Be Able to Resist Competition from the New Technologies?, *Economic Policy – a European Forum*, April, 193-222.

Duca J. V. and Van Hoose D. D., 2004, “Recent Developments in Understanding the Demand for Money”, *Journal of Economics and Business*, 56, 247-272.

ECB, “7<sup>th</sup> SEPA Progress Report”, 2010.

ECB, “The Payment system. Payments, Securities and derivatives, and the role of the Eurosystem”, 2010

Eurostat, “Methodological Notes”, 2008

Fink G., Haiss, P. and Vukčević, G., 2006, “Importance of financial sectors for growth in accession countries”. *Financial Development, Integration and Stability*, pp. 154–185. Liebscher, K., Christl, J., Mooslechner, P., Ritzberger-Grünwald, D. (Eds.), Edward Elgar, Cheltenham.

Greenwood J. and Jovanovic, B., 1990, “Financial development, growth, and the distribution of income”. *Journal of Political Economy*, Volume 98, 1076–1107.

Guiso L., Sapienza, P. and Zingales, L., 2004, “Does Local Financial Development Matter?”. *Quarterly Journal of Economics*, 119, 929-69.

Hasan I., M. Koetter, M. Wedow, 2009, “Regional growth and finance in Europe: Is there a quality effect of bank efficiency?”. *Journal of Banking and Finance* Forthcoming

Humphrey D., B., Pulley L. B. and Vesala J. M., 1996, “Cash, Paper and Electronic Payments: A Cross-Country Analysis”. *Journal of Money, Credit and Banking*, 28, 914-39.

Humphrey D., B., Kim M. and Vesala J., 2001, “Realizing the Gains from Electronic Payments: Costs, Pricing, and Payment Choice”, *Journal of Money, Credit, and Banking*, 33 (2) 216-34.

Humphrey D., B., Willeson M., Bergendahl G. and Lindblom T., 2006, “Benefits from a changing payment technology in European Banking”. *Journal of Banking and Finance*, 30.

Humphrey D., B., Pulley L. B. and Vesala J. M., 1995, “Cash, Paper, and Electronic Payments: A Cross Country Analysis”, *Journal of Money, Credit and Banking*, 1996.

Humphrey D., B., Snellman J. and Vesala J. M., 2000, “Substitution of Noncash Payment Instruments for cash in Europe”, *Bank of Finland Discussion Papers*

Inklaar R. and Koetter M., 2009, “Financial Dependence and industry growth in Europe: Better banks and higher productivity”. University of Gronigen.

Japelli T. and Pagano M., 1994, “Saving, growth, and liquidity constraints”. *Quarterly Journal of Economics*, Volume 109, 83–109.

Jayaratne J. and Strahan P. E., 1996, “The Finance-Growth Nexus: Evidence from Bank Branch Deregulation”. *Quarterly Journal of Economics*, Volume 111(3), 639-70.

Jayaratne J. and Strahan P. E., 1998, "Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence from Commercial Banking". *Journal of Law and Economics*, 41, 239-73.

Kahn C., M. and Roberds W., 2009, "Why Pay? An Introduction to Payment Economics". *Journal of Financial Intermediation*, 18, 1-23.

King R. G., and Levine R., 1993, "Finance and Growth: Schumpeter Might Be Right". *Quarterly Journal of Economics*, 108(3), 717-38.

King R. G. and Levine R., 1993, "Finance, Entrepreneurship, and Growth: Theory and Evidence". *Journal of Monetary Economics*, Volume 32, 513-42.

Levine, R., 2005, “Finance and Growth: Theory and Evidence”. *Handbook of Economic Growth*.

Levine R. and Zervos S., 1998, “Stock Market Development and Long-Run Growth”. *The World Bank Economic Review*, 10, 323-39.

Lusardi, A. and Tufano, P., 2009, “Debt Literacy, Financial Experiences and Overindebtedness”. NBER Working Paper, 14808.

Mann R. J., 2011, “Adopting, using, and Discarding Paper and Electronic Payment Instruments: Variation by Age and Race”, Discussion Paper, Federal Reserve of Boston.

Mann R. J., 2011 “Payment Systems and Other Financial Transactions”, New York, Aspen.

Rajan R. G. and Zingales L., 1998, “Financial Dependence and Growth”. *American Economic Review*, Volume 88, 559-586.

Rousseau P. L. and Wachtel P., 1998 “Financial Intermediation and Economic Performance: Historical Evidence from Five Industrial Countries”. *Journal of Money, Credit, and Banking*, Volume 30, 657-78.

Rousseau P. L. and Wachtel P., 2000, “Equity markets and growth: Cross-country evidence on timing and outcomes, 1980-1995”, *Journal of banking and finance* 24, 1933-1957

Scholnick B., 2009, “Credit Card Use after the Final Mortgage Payment: Does the Magnitude of Income Shocks Matter” Mimeo.

Scholnick B., Massoud N., Saunders A., Carbo-Valverde S. and Rodriguez-Fernández F., 2007, “The Economics of Credit Cards, Debit Cards and ATMs: A Survey and Some New Evidence”. *Journal of Banking and Finance* 32, 1468-1483.

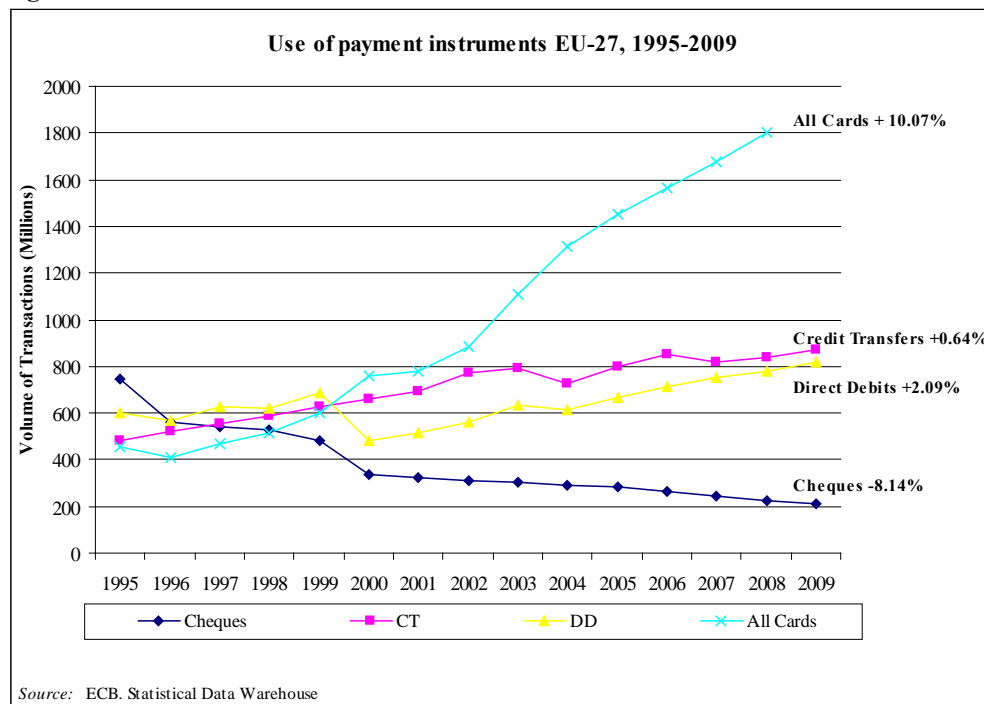
Schumpeter J., 1932, “The Theory of Economic Development”, Harvard University Press 25.

Singh V. and Zandi M., 2010, “The impact of Electronic Payments on Economic Growth”, Moody’s Analytics.

Snellman J.S., Vesala J., Humphrey D.B., 2001, Substitution of Noncash Payment Instruments for Cash in Europe, *Journal of Financial Services Research*, 19 (2/3), 131-145.

VISA, 2003, “The virtuous circle: electronic payments and economic growth”, Global Insight

**Figure 1**



**Figure 2**

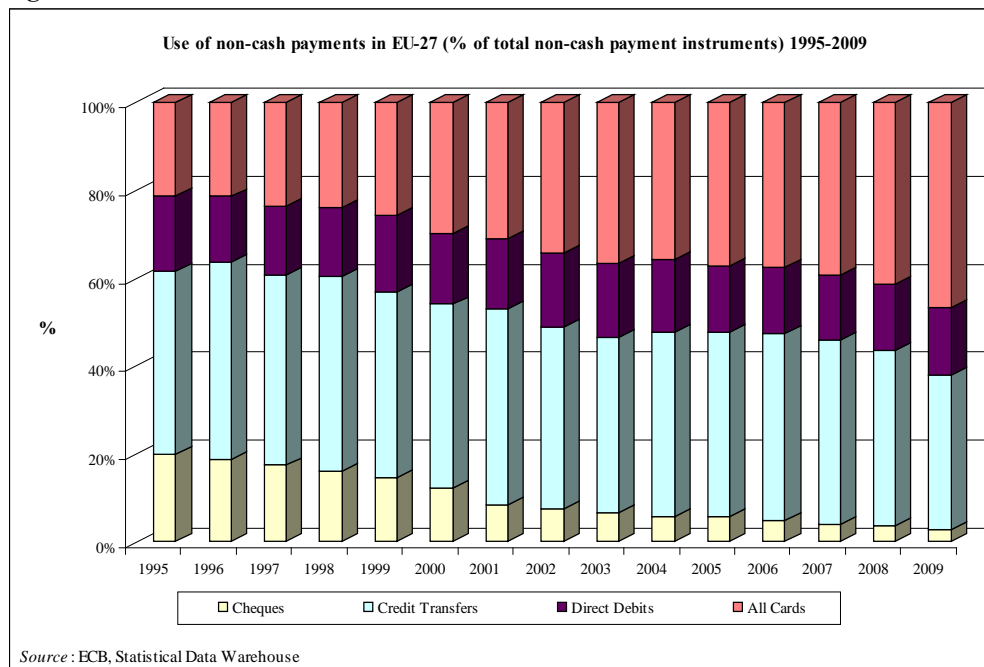


Figure 3

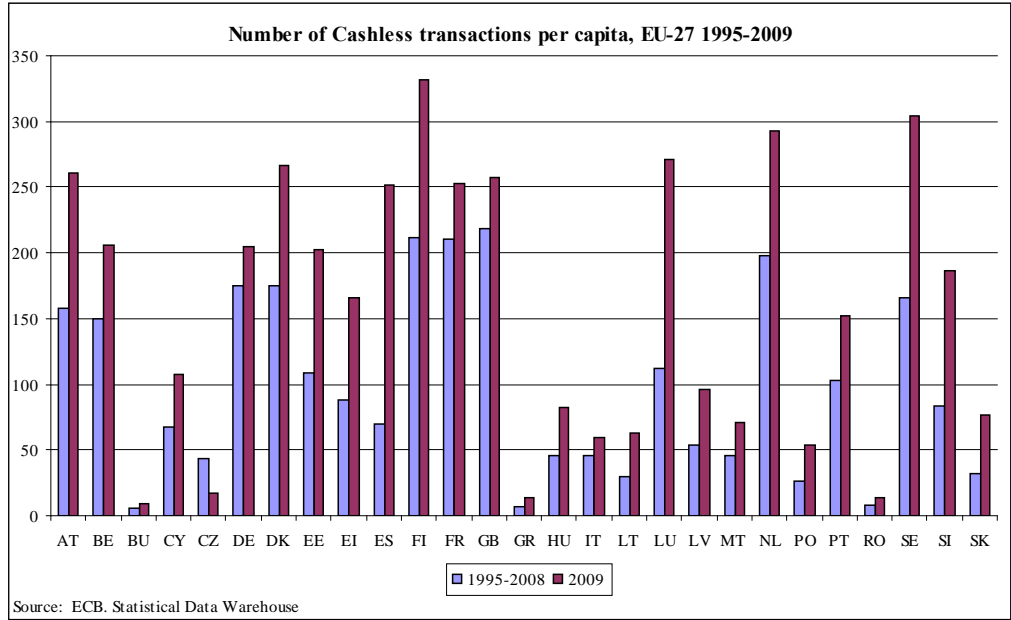
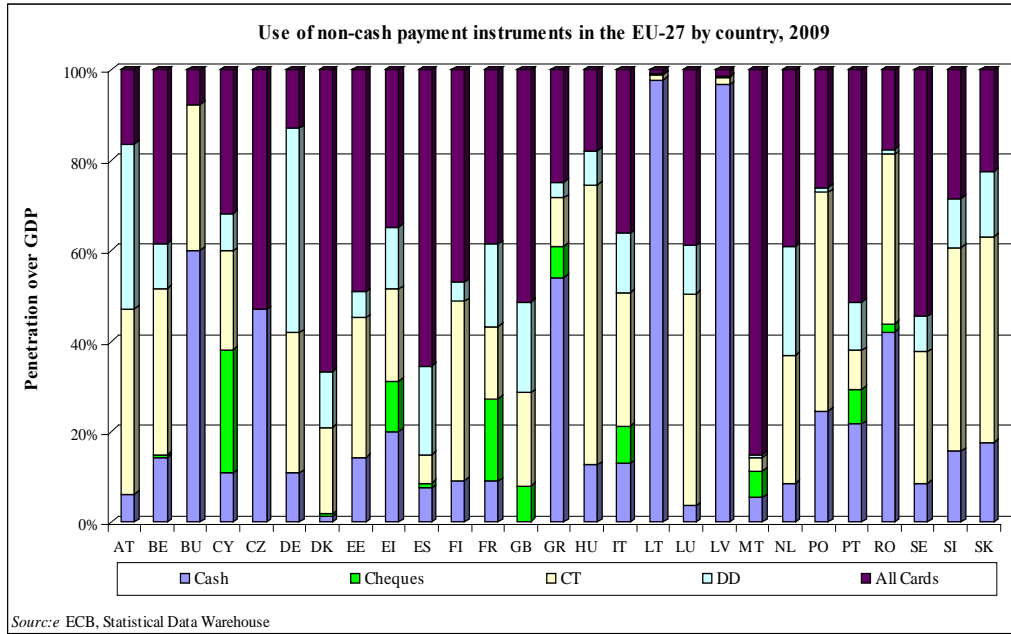
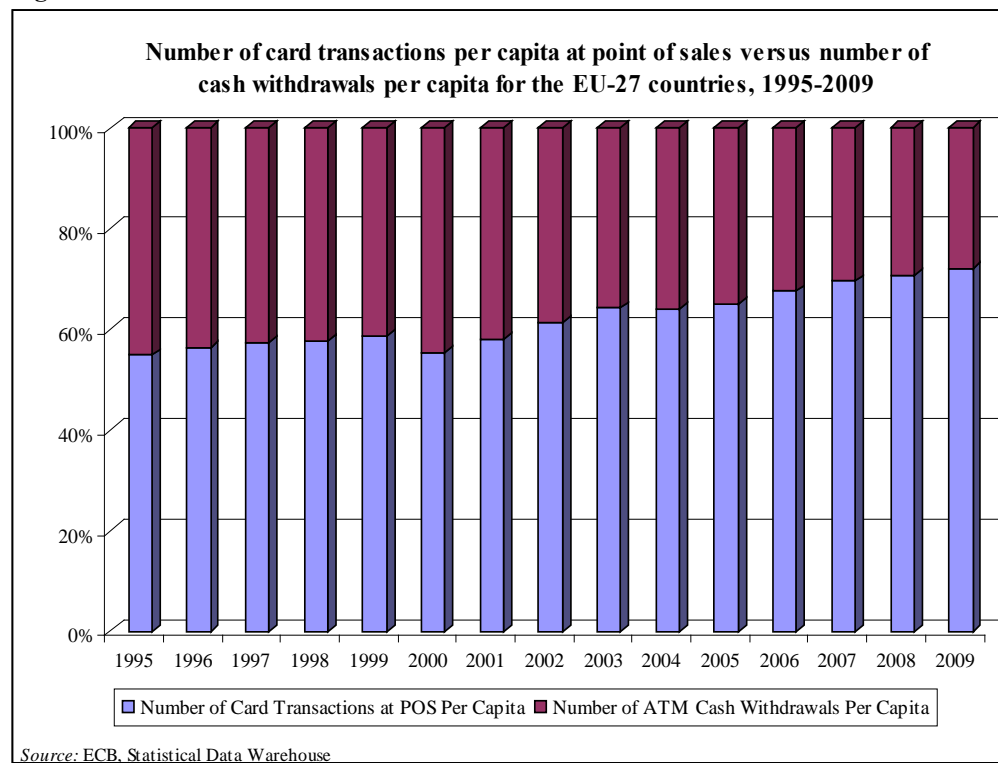


Figure 4

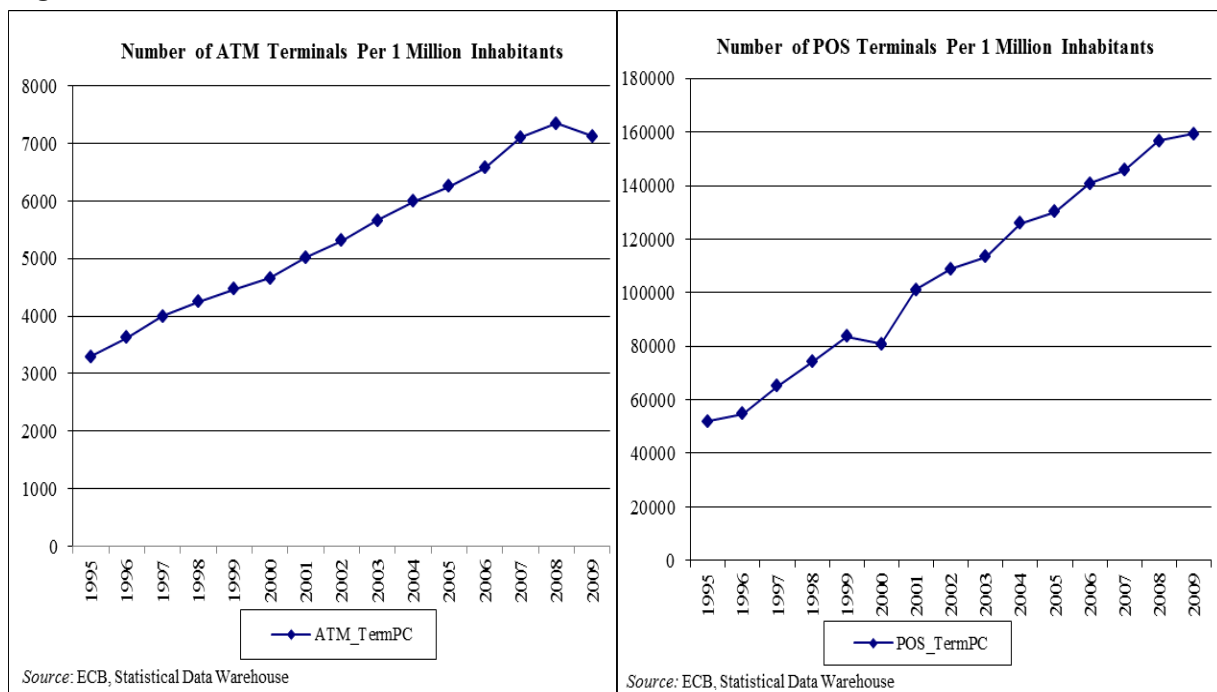




**Figure 5**



**Figure 6**



**Table 1- Panel a. Descriptive Statistics**

*Cash* equals number of cash withdrawals from ATMs, source SDW; *Cheques*, volume/value of transactions using cheques, source SDW; *Cr Transf*, volume/value of credit transfers transactions, source SDW; *Dir Debits*, value/volume of transactions, source SDW; *All Cards*, number of transactions using payment cards; *ATM Num of Terminals*, Number of ATM terminals in a country, source SDW; *POS Num of Terminals*, number of POS terminals in a country, source SDW; *GDP Per Capita*, logarithm of real GDP per capita, source World Bank; *Hholds Fin Cons Per Capita*, Logarithm of final household consumption expenditures per capita, source Eurostat; *Hholds Leisure Cons Per Capita*, Logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear, source Eurostat; *interest rate*, deposit interest rates is the rate paid by commercial or similar banks for demand, time, or savings deposits, taken from the World Bank; *Trade per capita*, logarithm of trade per capita, exports + imports of goods from the World Bank.

Variable	Unit	Obs	Mean	Median	Std. Dev.	Min	Max
Cash	Millions	360	350	147	505	0.30	3,092
All Cards - Volume transactions	Millions	341	750	1,910	1,330	0.95	,8,190
Cheques - Volume transactions	Millions	331	373	268	999	0	4,950
Credit Transf - Volume transactions	Millions	327	814	432	1350	1.30	7,390
Direct Debits - Volume transactions	Millions	337	650	816	1380	0.37	8,420
Cash per capita	Pure Number	360	33	16	106	0.04	1,337
All cards - Volume transactions per capita	Pure Number	324	39	24	42	0.12	182
Cheques - Volume transactions per capita	Pure Number	331	13	4	18	0.00	84
Credit Transfers - Volume transactions per capita	Pure Number	326	42	35	33	0.48	144
Direct Debits - Volume transactions per capita	Pure Number	311	21	13	23	0.10	103
Cash - Value of ATMs Withdrawals	Millions	355	166,325	133,348	549,367	0.1	3,630,044
All Cards - Value of transactions	Millions	348	148,117	213,732	847,328	27	6,886,140
Cheques - Value of transactions	Millions	325	433,430	428,599	745,949	0	3,237,646
Cr Transf - Value of transactions	Billions	333	108,323	63,400	253,000	2.704091	1,880,000
Dir Debits - Value of transactions	Billions	334	348,340	5,042,992	38,000,000	1.245	407,000,000
Cash Value ATMs Withdrawals)/GDP	Percent	344	11.46	128.76	751.21	0.001	4767
All Cards Value/GDP	Percent	345	8.25	9.05	5.90	0.07	34.93
Cheques Value/GDP	Percent	324	34.05	95.08	121.03	0	904
Cr Transf Value/GDP	Percent	333	780	1,307	1,556	31.67	7780
Dir Debits Value/GDP	Percent	334	16.88	41.62	88.05	0.02	741
ATM - Number of terminals	Pure Number	373	11,822	3,191	16565	69	82702
POS - Number of terminals	Pure Number	364	218,554	59,950	315963	27	1420787
ATM - Number of terminals per 1 million capita	Pure Number	372	556	315	310	8	1614
POS - Number of terminals per 1 million capita	Pure Number	364	11,212	7785	7867	3	45164
GDP per capita	Pure Number	401	17,476	13,225	13,685	1,111	81,835
Households final consumption per capita	Pure Number	382	8,410	9,011	5,069	940	21,600
Household consumption on leisure goods	Pure Number	374	4,000	3,000	2,000	215	954
Interest rate	Percent	368	5.68	4.15	7.81	0.01	74.68
Trade per capita	Pure Number	396	20,588	10,700	30,945	116	268,000

**Panel b. Descriptive Statistics**

	Country	Year	Country	Year
Cash	BU	1996	LT	2008
All Cards - Volume transactions	BU	2001	UK	2009
Cheques - Volume of transactions	BU	2001-03	FR	1996
	HU	2002-08		
	NL	2003-09		
Credit Transf - Volume of transactions	ML	2000	DE	1999
Direct Debits - Volume of transactions	LV	2003	DE	2009
Cash per capita	BU	1996	LV	2008
All cards - Volume of transactions per capita	BU	2001	SE	2009
Cheques - Volume of transactions per capita	BU	2001-03	FR	1990
	HU	2002-08		
	NL	2003-09		
Credit Transfers - Number of transactions per capita	GR	2001	FI	2009
Direct Debits - Volume of transactions per capita	BU	2007	DE	2009
Cash - Value of ATMs Withdrawals	BU	1998	HU	2007
All Cards - Value of transactions	RO	2000	SI	1995
Cheques - Value of transactions	NL	2003	GB	2000
Cr Transf - Value of transactions	MT	2003	HU	2006
Dir Debits - Value of transactions	LV	2000	SK	2007
Cash Value ATMs Withdrawals)/GDP	LV	2000	SK	2007
All Cards Value/GDP	BU	1997	HU	2000
Cheques Value/GDP	RO	2000	MT	1999
Cr Transf Value/GDP	HU	2003	EI	1995
Dir Debits Value/GDP	EI	2002	GB	1999
ATM Number of Terminals	BU	1996	DE	2008
POS Number of Terminals	BU	1996	SP	2008
ATM Number of Terminals per 1 million capita	BU	1996	PT	2009
POS Number of Terminals per 1000 capita	BU	1990	GR	2009
GDP per capita	BU	1996	LU	2008
Households final consumption expenditure per capita	BU	1997	LU	2008
Household final consumption expenditure on leisure goods	ES	1991	SE	1990
Interest rate	EI	2004	SL	1993
Trade per capita	EE	2009	LU	2008

**Table 2 –Pairwise Correlation. Table 2 –Pairwise Correlation.**

*Cash Penetration* equals value of cash withdrawals from ATMs over real GDP; *Cheques Penetration* value of transactions using cheques over real GDP; *CT Penetration*, value of credit transfers transactions over real GDP; *DD Penetration*, value of direct debits transactions over real GDP; *All Cards Penetration*, value of transactions using payment cards over real GDP; *ATM Num of Terminals*, number of ATM terminals in a country, source SDW; *POS Num of Terminals*, number of POS terminals in a country, source SDW; *GDP Per Capita*, logarithm of real GDP per capita, source World Bank; *Hholds Fin Cons Per Capita*, Logarithm of final household consumption expenditures per capita, source Eurostat; *Hholds Leisure Cons Per Capita*, Logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear, source Eurostat; *interest rate*, deposit interest rates is the rate paid by commercial or similar banks for demand, time, or savings deposits, taken from the World Bank; *Trade per capita*, logarithm of trade per capita, exports + imports of goods from the World Bank.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Cash- (Vle Withdrawals/GDP)	1											
All Cards Vle/GDP	-0.18*	1										
Cheques Vle/GDP	-0.13	0.13	1									
Credit Transfer Vle/GDP	0.002	0.25*	-0.04	1								
Direct Debits Vle/GDP	-0.08	-0.03	-0.09	0.1*	1							
ATM Terminals (Num)	-0.11	0.48*	0.08	0.15*	0.11	1						
POS Terminals (Num)	-0.16*	0.45*	0.32*	-0.07	-0.12	0.57*	1					
GDP per capita	-0.17*	0.53*	0.02	0.07	0.08	0.52*	0.48*	1				
Trade	-0.08	0.21*	-0.04	-0.04	-0.02	0.30*	0.24*	0.80*	1			
Hhold Final Cons	-0.21*	0.58*	0.19*	0.17*	0.08	0.55*	0.49*	0.90*	0.59*	1		
Hhold Leisure Cons	-0.26*	0.55*	0.33*	0.09	0.06	0.70*	0.58*	0.76*	0.42*	0.91*	1	
Int Rate	0.21*	-0.33*	-0.19*	-0.06	-0.14	-0.59*	-0.31*	-0.39*	-0.20*	-0.44*	-0.58*	1

Table 3 – Regression Analysis									
	LN GDP Per Capita			LN Trade Per Capita			LN Hhold Consumption		
	System GMM	Diff GMM	OLS	System GMM	Diff GMM	OLS	System GMM	Diff GMM	OLS
All Cards NN EURO - Vle/GDP	9.446** (2.90)	2.137 (1.06)	12.02*** (8.33)	3.640 (0.67)	1.395 (0.40)	8.547* (2.32)	8.124** (2.96)	-0.00989*** (-0.778)	9.344*** (7.84)
All Cards EURO - Vle/GDP	3.015* (2.15)	-0.837 (-0.95)	1.812* (2.26)	7.314* (2.35)	-13.96 (-0.93)	5.401*** (3.45)	-0.222 (-0.27)	-0.788 (0.209)	-0.117 (-0.42)
SEPA	0.152** (3.13)	0.191*** (15.46)	0.194* (2.15)	0.143 (1.55)	0.272 (1.93)	-0.0611*** (-6.76)	-0.000610 (-0.03)	0.00228 (0.22)	-0.0215** (-2.91)
CashNN EURO - Vle/GDP	0.0000994 (0.03)	-0.00329* (-2.25)	0.000428 (0.17)	0.309*** (4.69)	-0.0127 (-1.41)	0.00630* (2.06)	-0.0102 (-1.18)	4.507** (3.39)	-0.00917** (-3.14)
CashEURO - Vle/GDP	-0.737 (-0.47)	-7.881* (-2.27)	-2.412** (-3.25)	0.00230 (0.03)	-10.53 (-1.95)	-3.892** (-2.74)	1.092 (0.90)	1.092 (1.02)	-0.663 (-1.95)
SEPA	0.203*** (5.60)	0.105 (1.98)	0.170* (2.16)	0.187** (3.04)	0.0806 (1.01)	-0.0871*** (-7.69)	-0.00637 (-0.21)	0.00687 (0.66)	-0.00702 (-1.51)
Cheques NN EURO - Vle/GDP	0.460*** (4.79)	-0.0541 (-1.12)	0.459*** (12.01)	0.347*** (13.27)	-0.0962** (-3.18)	0.341*** (16.96)	0.309*** (4.69)	-0.497 (-1.68)	-0.00702 (-1.51)
Cheques EURO - Vle/GDP	0.0451 (1.62)	0.110 (1.58)	0.0550* (2.24)	0.00230 (0.03)	0.142 (1.63)	0.0312 (0.62)	0.0229 (0.90)	0.0506 (1.00)	0.0262* (2.02)
SEPA	0.152** (3.13)	0.179*** (9.87)	0.137 (1.78)	0.0959 (1.01)	0.207*** (7.90)	-0.0898*** (-7.31)	-0.0211 (-0.67)	-0.00510 (-0.42)	-0.0338*** (-8.53)
Cr Transfers NN EURO - Vle/GDP	0.0634 (1.58)	0.0283* (2.54)	0.0624** (3.22)	0.144** (3.30)	0.0327 (0.81)	0.135*** (5.38)	0.0393 (1.14)	0.0290** (3.12)	0.0397** (2.91)
Cr Transfers EURO - Vle/GDP	0.00584* (2.18)	-0.00688* (-2.38)	0.00656* (2.18)	0.00709 (0.60)	-0.00564 (-1.41)	0.00898 (1.42)	0.00148 (1.14)	-0.00204 (-1.91)	0.00252** (3.06)
SEPA	0.243*** (6.86)	0.137*** (6.92)	0.210* (2.56)	0.284** (3.46)	0.139*** (6.12)	-0.0788*** (-6.63)	0.033 (0.008)	0.0109 (1.26)	-0.0281*** (-5.23)
Dir Debits NN EURO - Vle/GDP	0.00283 (0.18)	0.00220 (0.48)	0.00000616 (0.00)	0.0146 (0.75)	0.00888 (1.46)	0.00309 (0.32)	-0.00995 (-0.74)	0.00350 (1.52)	0.00270 (0.39)
Dir Debits EURO - Vle/GDP	0.000490 (1.45)	0.000703 (1.53)	0.000396 (1.54)	-0.0000581 (-0.08)	0.000516 (0.67)	-0.000133 (-0.24)	0.000199 (1.00)	-0.000339 (-0.88)	0.000140 (1.12)
SEPA	0.200*** (5.12)	0.181*** (6.91)	0.202* (2.18)	0.246** (3.04)	0.225*** (6.43)	-0.0835*** (-6.83)	-0.00928 (-0.33)	0.0272 (1.88)	-0.0288*** (-4.93)
Constant	yes [1.00]	no [1.00]	yes -	yes [1.00]	no [1.00]	yes -	yes [1.00]	no [1.00]	yes -
Hansenp	-	-	[0.62-0.77]	-	-	[0.34 - 0.46]	-	-	[0.79-0.82]
Adj. R2	-	-	-	-	-	-	-	-	-

**Table 4- Cards Devices: ATM POS**

	LN GDP Per Capita		LN Trade Per Capita		LN Hhold Consumption		LN Sectorial Hhold Consumption	
ATM Num Term Per Capita NN EURO	0.649***		0.638***		0.374***		0.677**	*
	(0.000)		(0.000)		(0.000)		(0.000)	
ATM Num Term Per Capita EURO	0.672***		0.652***		0.387***		0.703**	*
	(0.000)		(0.000)		(0.000)		(0.000)	
SEPA	0.146*		0.319**	*	0.226**	*	0.348**	
	(0.031)		(0.000)		(0.000)		(0.002)	
POS Num Term Per Capita Nn EURO	0.351**	*	0.341**		0.244**	*	0.383**	
	(0.000)		(0.003)		(0.000)		(0.001)	
POS Num Term Per Capita EURO	0.382**	*	0.189*	0.242**	-0.024	-0.023	0.023	0.011
	(0.000)		(0.030)	(0.002)	(0.560)	(0.554)	(0.764)	(0.830)
SEPA	0.190**	*	0.157	0.153*	0.059	0.051	0.024	0.028
	(0.001)		(0.053)	(0.037)	(0.190)	(0.154)	(0.743)	(0.660)
Constant	13.164***	9.899**	12.584**	9.221**	10.576**	8.895**	5.544**	1.928*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.025)
Hansenp	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
arl	1.89	3.13	2.13	1.80	2.20	2.69	1.60	1.96
N	268	267	267	266	259	258	260	258

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