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**Working Paper**

# Retail payments and the real economy

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# RETAIL PAYMENTS AND THE REAL ECONOMY

Iftekhar Hasan, Tania De Renzis and Heiko Schmiedel

In 2013 all ECB publications feature a motif taken from the €5 banknote.

**NOTE:** This Working Paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

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# ABSTRACT

This paper examines the fundamental relationship between retail payments and the real economy. Using data from across 27 European markets over the period 1995-2009, the results confirm that migration to efficient electronic retail payments stimulates the overall economy, consumption and trade. Among different payment instruments, this relationship is strongest for card payments, followed by credit transfers. 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 the real economy 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, real economy, financial development

**JEL codes:** G20, G21

# 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.*, 2012). 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 the real economy. 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 the positive relation between the migration from paper to electronic retail payments and the real economy. Among different payment instruments, this relationship is strongest for card payments. We find that if card payments increase by 1 million euro, which corresponds to an increase in the card penetration ratio of 1.2% in the EU, then the level of GDP would increase by 0.07% or about 6 million euro. 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 the whole economy. Within the boundaries of the approach of this paper, we also find an overall positive effect on a country's GDP by 0.02% if SEPA instruments were effectively implemented and adopted.

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 household consumption.

# I 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 the real economy. 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 the existence of a positive relation between the migration to efficient electronic retail payments and GDP, consumption and trade. Among different payment instruments, this relationship is strongest for card payments. We find that if card payments increase by 1 million euro, which corresponds to an increase in the card penetration ratio of 1.2% in the EU, then the level of GDP would increase by 0.07% or about 6 million euro. 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 the whole economy. Within the boundaries of the approach of this paper, we also find an overall positive effect on a country's GDP by 0.02% if SEPA instruments were effectively implemented and adopted.

This research makes several important contributions to the literature. Only a few studies examine costs and profitability related to the use of electronic payment instruments (Humphrey

*et al.*, 2006, Hasan *et al.*, 2012). Hasan *et al.* (2012) document that payment systems have a significant impact on bank performance and efficiency, increasing the availability of resources and ultimately favouring lending, investments and the real economy. 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. The aim of this paper is to provide a new perspective by investigating another aspect rather than bank-level efficiency. By this, the present study focuses on the social relevance of retail payments for the economy as a whole. The novel feature of this paper is that it takes an aggregate approach considering more aggregate measures to show the relation between payment market infrastructure and 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. (Greenwood and Jovanovic, 1990; King and Levine, 1993; Rajan and Zingales, 1998; Rousseau and Wachtel, 1998; Beck *et al*., 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. Benhabib and Spiegel (2000) suggest that indicators of financial development are correlated with both total factor productivity growth and investment. Focusing on the European Union (EU), Hasan *et al.* (2009) shows that improvement in bank efficiency spurs five times more regional growth then an identical increase in credit does. 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 real economic development by considering retail payment market infrastructures.

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

All transactions are exposed to a variety of risks. Thus, in order to facilitate enhanced risk management, many countries have introduced real-time gross settlement systems for the handling of critical payments. Progress has been made in the implementation of safer and more efficient systems and procedures both in wholesale as well as retail payment systems, (ECB, 2010). A well-designed payment infrastructure is important for the proper functioning of markets and helps in eliminating frictions in trade. In order for assets, services and products to be exchanged, the benefits from trade have to exceed transaction costs. Therefore, reliable and safe payment mechanisms for the transfer of funds are the condition *sine qua non* for the majority of economic interactions (ECB, 2010).

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 characterising 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 *et al.*, 1996; Berger, 2003; Bolt *et al.*, 2008; Hasan *et al.*, 2012; Kahn and Roberds, 2009; Scholnick *et al.*, 2008).

There are a number of studies considering costs and profitability related to the use of electronic payment instruments and 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.* (2012) 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 equivalent to 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 (POS) payment instruments: cheques, cash (as proxied by the quantity and price of ATM cash withdrawals) and the use of debit cards (EFTPOS)[1], 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 dollars in the last two decades. Moreover, it documents an increasing growth in the use of cards in consumer expenditure relative 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.

The previous literature stressed the importance of smooth and safe functioning payment systems and infrastructures in market economies. To keep pace with increasing customers' needs, having at their disposal a wide range of payment instruments as well as an optimal use of these instruments is fundamental. It is agreed that payment systems and market infrastructures can be of "systematic-wide importance", as they facilitate consumer-to-consumer and commercial transactions. By this, they also have a significant impact on the overall economy (Cirasino and Garcia, 2008). Consumers appreciate a wider range of payment options that are widely accepted (ECB, 2010), implying better access to funds on deposit and immediate credit (VISA, 2003). Similarly, merchants find themselves with improved speed of transactions, higher security, less cost associated with paper-based transactions. In fact, by eliminating or reducing market frictions and costs, an efficient payment infrastructure facilitates trade, services, and transfers of funds, fostering economic interactions. Consumption and trade increase, in turn supporting production and thereby overall economic development (Singh and Zandi, 2010).

On the basis of this, we develop the first three out of seven hypotheses:

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

1 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.

*H2: Greater card payment usage scores 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 GDP, 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 it 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: Real economic development is positively associated with increased use of direct debits.*

Great emphasis has been given to the SEPA project and its implementation. Both practitioners and regulators are stressing the benefits of having harmonised 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 development.*

Finally, we focus on the role of new payment technologies. Humphrey *et al.* (2001) found a net substitution effect between ATMs and cheques and a one way net substitution effect between cheques and POS due to an increase in cheques fees[2.] More recently, Scholnick *et al.* (2008) performed a similar analysis but with more detailed bank level data rather than country level data as in Humphrey *et al.* (2001), finding a substitution effect also between ATMs and EFTPOS. Related to this, we developed the following additional hypothesis:

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

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

In summary, 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 ESTIMATION METHODOLOGY

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

$$y_{i,t} = \alpha y_{i,\,t-1} + \beta X_{i,t} + \mu_i + \varepsilon_i \qquad (1)$$

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, $\mu_i$ accounts for country effects and $\varepsilon_i$ 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 and
- 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. 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 homoskedastic across countries and time whereas, in the second step, the hypotheses of homoskedasticity and independence are relaxed, therefore, obtaining higher efficiency. This estimator is based on the following two moment conditions:

$$E[y_{i,t-k}\,(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } k > 2,3,\ \ldots,\ N \qquad (2)$$

$$E[X_{i,t-k}\,(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } k > 2,3,\ \ldots,\ N \qquad (3)$$

The main issue with this estimator is the fact that the cross-country effect is eliminated by differencing. It would be worthwhile to study the cross-country relationship between the financial sector and the real economy. 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: the bias related to measurement errors in variables that can be exacerbated by differencing (Beck and Levine, 2004).

In order to overcome these problems, they developed the System GMM estimator, in which two additional conditions are added to (2) and (3):

$$E[(y_{i,\,t-k} - y_{i,t-k-1})\,(\mu_i + \varepsilon_{i,\,t})] = 0 \text{ for } k = 1 \tag{4}$$

$$E[(X_{i,\,t-k} - X_{i,t-k-1})\,(\mu_i + \varepsilon_{i,\,t})] = 0 \text{ for } k = 1 \tag{5}$$

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[3] of over-identifying restrictions (Blundell and Bond 1998; Bond *et al.*, 2001) and the autoregressive (AR) test.

However, Beck and Levine (2004) point out that asymptotic standard errors from the two-step panel estimator may be a poor guide for hypothesis testing in small samples where over-fitting becomes a problem. Moreover, Bu and Windemeijer (2010) show how, under certain conditions, also the system GMM also suffers from a weak instrument problem. Therefore, next to the system GMM we perform an additional analysis using a traditional cross-sectional IV estimator as in Beck *et al.* (2000).

Nevertheless, even if we recognise biases associated with standard errors emerging from the two-step estimator in small samples, the advantages of using the new GMM techniques in terms of endogeneity and simultaneity biases are significant. Therefore we decided to rely mainly on this methodology. Moreover, it should also be noted, that IV estimation and GMM give overall similar results.

Our analysis follows the approach taken by Zandi and Singh (2010). Rather than referring to payments expressed in absolute terms, as total value of transactions, Zandi and Singh (2010) use

3 The Sargan and Hansen statistics both test the null hypothesis of over-identifying restrictions. However, the latter is robust to heteroskedasticity and autocorrelation which is why, later in the paper, we refer to this.

card penetration, namely, value of cards over household consumption. In extension of the paper by Zandi and Singh (2010), this paper focuses on aggregate output, measured by per capita GDP, trade, total household consumption and consumption for leisure goods and services[4]. The demand for leisure goods and services is the component of total demand with higher elasticity.It should therefore be significantly influenced by developments in payments instrument.

4 Leisure consumption expenditure refers to the following sectors: clothing; recreation and culture; newspapers; restaurant and hotels; personal care.

# 4 DATA AND SUMMARY STATISTICS

The data on payment statistics are taken from the Statistical Data Warehouse (SDW) and cover the period between 1995 and 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[5]. Data on debit and credit cards taken alone are sparse and fragmented, focusing on those would have meant losing a large number of data points 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[6].

For each specification, following previous literature (King and Levine 1993), 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[7] 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 cards, i.e. credit and debit cards, show the highest growth: their compounded average growth rate (CAGR)[8] is around 8%. 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 4.31%. This evidence reveals the existence of an inverse relationship between the use payment cards and the use of cheques: the constant increase in the use of cards corresponds to a decrease in the use of cheques as depicted in Figure 2.

5 We refer to All cards except those with e-money functions from the SDW

6 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.

7 http://databank.worldbank.org/ddp/home.do

8 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.

Figures 3, 4 and 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, with a counterbalancing increasing trend in the use of cards. However, further developments are still required especially in terms of reduction of costs and risks (ECB, 2010). Figure 4 shows the developments in the use of non-cash payment instruments per capita, across the EU 27 countries for 2009[9]. 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 e-money scheme (PayPal Europe S.a.r.l. and Cie S.C.A) that commenced operations.[10]

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[11].

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 Figures 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 of 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 transaction

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

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

11 The number of cashless transactions is given by the sum of all cards, credit transfers, direct debits and e-money 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 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[12].

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.

12 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

# 5 EMPIRICAL RESULTS

## 5.1 RETAIL PAYMENTS PENETRATION

Our analysis relies on system GMM estimation, in order to deal with endogeneity and small sample bias and, differently from the difference GMM, to be able to better account for the cross-country effects. However, the system GMM estimation has limitations as well, especially when a relatively small sample size is used. Therefore, in line with previous literature (Beck and Levine, 2004; Beck *et al*., 2000) we also report the results from IV analysis. Table 3 - panel a to d - shows the results of the system GMM and IV estimations For completeness, the summary Table 4 provides the results from the OLS and difference GMM estimations.

In the system GMM specification, the variables instrumented with GMM-style instruments (i.e., lagged values of the list of endogenous variables in levels) are the payment instruments[13]. The estimation uses up to the second lag: the second lag is required because it is not correlated with the error term. It can be possible to use deeper lags but this will reduce the sample size and, given that we are starting from an already limited sample, the choice of the second lag is seen as the most appropriate.

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, trade, total final household consumption and final household consumption on leisure goods.

In order to capture differences between euro area and non-euro area, we divide the sample in two subgroups by means 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 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 risk 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 two estimation techniques and for each of the dependent variables considered. Panel a and b refer to the analysis on GDP and trade. The system GMM analysis shows that payment cards have the most significant impact on GDP. The results are even stronger when IV is used in Panel b and

13 The estimation uses Stata command xtabond2 that distinguishes between endogenous variables (in our case variables proxying for financial development), for which GMM-style instruments and the rest of exogenous variables (GDP, interest rates, SEPA dummy). For further details, about the rationale and syntax of the Stata command refer to Roodman, D. (2006). How to do xtabond2: an introduction to "Difference" and "System" GMM in Stata. Center for Global Development Working Paper Number 103.

the effect remains relatively high and significant also in the OLS and difference GMM estimations.

In view of cheques, the coefficients are significant only for the group of non-euro area countries. In fact, Eastern European countries, with lower developed and transparent payment systems, and European countries with highly developed payment infrastructures, such as UK, in which cheques have been so far of large use, pertain to this group.

We investigate also the possible economic impact of an increased card usage. Overall, we find that if card payments increase by 1 million euro, which is equal to a 1.2% increase in card penetration in the EU, then the level of GDP would increase by 0.07% or about 6 million euro respectively. We also find an overall positive effect on countries' GDP by 0.02% if SEPA instruments were effectively implemented and adopted.

We perform such an analysis focusing on payment cards, given that they are the instruments for which we find a higher significance in the relationship with GDP as well as its components. This is also in line with our expectations as payment cards have become the most used non-cash payment instrument in Europe. The success of payment cards is associated to their convenient, safe, and efficient use compared to other payment instruments. Our findings are also in line with previous studies (Singh and Zandi, 2010), but should, however, be considered with some caution, given a reasonable amount of uncertainty due to the type of analysis and approach chosen in the study.

Regarding cash, the OLS and IV estimates show signs of significance. However, it is worth mentioning that the OLS estimations are likely to be biased for the reasons as mentioned above. In addition, the IV estimates seem to be counterintuitive given the negative sign of the coefficients. One plausible explanation would be that the proxy of cash, namely ATM cash withdrawals, is a rather rough measure for cash. Given data limitation on cash and the potential bias in the estimation methods, interpretation of these results need to be taken with care. This supports our choice of relying mainly on system GMM. When this type of estimation is used, cash loses significance whereas the positive effect of cheques remains concentrated in non-euro area countries. Similar results are achieved in the case of trade as depicted in Table 3 panel b.

Direct debits are not significant, whereas for credit transfers the impact is concentrated in non-euro area countries, which does not seem to confirm our fourth hypothesis. However, the SEPA dummy variable is positive and highly significant. Therefore, the effect of electronic credit transfers for euro-area countries maybe captured by the use of SEPA instruments. In fact, even if significant developments have been characterising the euro area in terms of soundness and efficiency of electronic credit transfers, as well as direct debits, it signals the need for further

development and lends support to the efforts of regulators in fostering payments using this new type of instruments. Furthermore, 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 euro payments area. In effect, one of the main issues 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.

Considering total final household consumption, Table 3 panel c shows that cheques and cards seem to have an impact. The coefficient on cards is the highest, with the effect concentrated in 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 both in the IV as well as in the OLS specifications. This is reasonable, if we consider that credit transfers are the main choice for relatively larger value retail payments.

A similar argument can be applied 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. In order to shed some light on this result, we rerun the analysis by dropping Denmark, Sweden and UK out of the sample. However, the previous results for cards still hold. It seems that the transition countries are driving the results as the magnitude of coefficients increases when excluding Denmark, Sweden and UK. 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 made up by cash and cards (Figure 4). Second, in countries that are still developing the impact of progress in payments instrument infrastructure seems to be stronger 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. This confirms the view that the demand for leisure goods is the component of consumption with the highest elasticity. Therefore, it is likely to benefit most from improved efficiency and lower costs of transactions. We measured the impact of a variation of 1% in the use of payment cards in 2009. The economic impact on aggregate GDP is modest, averaging around 0.06% in the EU. When we focus on consumption on leisure goods, for which we found highest coefficients, the impact becomes more significant, averaging around 0.11%. As previously illustrated for the

case of GDP for which an increase of 0.07% was found, an increase in the use of payment cards for 1 million euro in the EU would bring consumption on leisure goods to increase by 0.1%.

Throughout the analysis the strongest impact comes from payment cards compared to other new electronic means of payment such as credit transfers or direct debits. In fact, this can be linked to the nature and the scope of the different means of payments: among these three payment instruments cards are those primarily used at the point of sales and are associated with their convenient, safe and efficient use. Credit transfers and direct debit payments are used mainly for remote payments and they are used by different business parties. Typically, the heavy users of credit transfers and direct debits are large corporates, while retailers use more point of sale payment instruments. Against this, we would also expect the impact of card payments used at the point of sale on GDP to be stronger than the effect of more remote payments.

## 5.2 PAYMENT CARD DEVICES

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

Considering the diffusion of ATM and POS terminals as a transaction technology variable, earlier research focuses mainly on its effect on currency holdings and demand deposits (Duca and Van Hoose, 2004; Attanasio *et al.*, 2002). For example, Snellman *et al.* (2001) show that the diffusion of POS increases the convenience of card payments over cash for low value payments as well as the possibility of earning interest on deposits. Additionally, Carbó-Valverde and Rodríguez-Fernández (2012) show that the effects of these technologies on the demand for currency, showing that POS devices and higher debit and credit POS transactions may significantly reduce the demand for currency. Drehmann *et al.* (2002) find a negative relation between POS diffusion and demand for money. A number of other studies analyses the determinants of the adoption of some specific technologies in an industry (Humphrey, Pulley and Vesala, 1996). 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.

Against this background, we expect the diffusion of transactions technologies to have a positive impact on economic development and particularly on household consumption and trade. Following the system GMM procedure, the paper provides additional estimations considering

directly the number of ATM and POS devices. As shown in Table 5, the diffusion of ATM and POS has a positive impact on economic development, consumption and trade. This supports the view that increased presence and adoption of new technologies facilitate payment transactions and in turn has a positive impact both on consumption, in particular leisure goods, and trade.

## 5.3 ROBUSTNESS CHECKS

A number of checks have been carried out in the paper to test the robustness of the results. For example, we have carried out some sub-sample regressions to test for the sensitivity of the results when including specific groups of countries. More specifically, we have 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 substantially 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.

We include additional control variables in the estimations, which have been typically used in the finance and growth literature. Table 6 shows the additional estimations for GDP using bank credit to the private sector as a ratio of GDP and total public expenditure. Overall, our initial findings do not change and are confirmed even when controlling for additional variables. It turns out that card penetration still has a significant relation with GDP. Similar results are found for trade in Table 6 panel b. When consumption is considered, we control for inflation and labour productivity so to account for increases in income as shown in Table 6 panel c and d. Overall, the previous results are confirmed.

As a final test we focus on possible substitution effects of cash by payment cards as depicted in Table 7, panel a to d. It is interesting to observe that the coefficient sign of the interaction variable, *cash*cards,* turns out to be negative. A negative sign indicates that there is some substitution effect of cash by card payments in Europe.

# 6 CONCLUSION

This study provides a comprehensive analysis on the economic importance and significance of retail payments. Using country-level retail payments data across all 27 European member states, we find evidence that migration to electronic retail payments spurs overall economic development, consumption and trade. Among different payment instruments, this relationship is the strongest for card payments. In particular, card payments are designed for consumers to access credit or to use overdraft of consumers account 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, most prominently by payment card, credit transfers and direct debits. Cheque payments are found to have 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 the 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 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.

# REFERENCES


Arellano, M. and S. Bond (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 T. Jappelli (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 R. Levine (2004) "Stock markets, banks, and growth: Panel Evidence", *Journal of Banking and Finance*, 28, 243-442.

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

Beck T., Levine R. and R. Loyaza (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*, 35, 141-176.

Behabib J. and M. Spiegel (2000) "The Role of Financial Development on Growth and Investment", *Journal of Economic Growth*, 5, 341 – 360.

BIS (2003) "The role of central bank money in payment systems".

Blundell, R. and S., R., Bond (1998) "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, 87, 115-143.

Bond, S., R., Hoeffler A. and J. Temple (2001) "GMM Estimation and Empirical Growth Models", *CEPR Discussion Papers*, 3048.

Bolt, W., Humprhey D. and R. Uittenbogaard (2008) "Transaction Pricing and the Adoption of Electronic Payments: A cross-country comparison", *International Journal of Central Banking,* 4, No. 1, 89-123.

Brito, D. L. and P. Hartley (1995) "Consumer Rationality and Credit Cards", *Journal of Political Economy*, 103, 400-433.

Bu, M. J. G. and F. Windmeijer (2010) "The weak instrument problem of the system GMM in dynamic panel data models", *The Econometrics Journal,* 13 (1), 95-126.

Carbó-Valverde, S. and F. Rodrigues-Fernández (2012) "Competing technologies for Payments, Automated teller Machines (ATMs), Point of Sale (POS) Terminals and the Demand for Currency", Fundación BBVA.

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

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

Drehmann, M., Goodhart, C. and M. Krueger (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 D. D. Van Hoose (2004) “Recent Developments in Understanding the Demand for Money”, *Journal of Economics and Business*, 56, 247-272.

ECB (2010) “7th SEPA Progress Report”.

ECB (2010) “The Payment system. Payments, Securities and Derivatives, and the Role of the Eurosystem”.

ECB and De Nederlandsche Bank (2009) “Retail Payments – Integration and Innovation.

Eurostat, “Methodological Notes”, 2008.

Greenwood, J. and B. Jovanovic (1990) “Financial Development, Growth, and the Distribution of Income”, *Journal of Political Economy*, 98, 1076–1107.

Hasan, I., Schmiedel, H., and Song, L., 2012, “Retail Payment and Bank Performance,” Journal of Financial Services and Research, 41 (3): 163-195.

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*, 33, 1446-1453.

Humphrey, D. B., Pulley L. B. and J. Vesala (1996) “Cash, Paper and Electronic Payments: A Cross-Country Analysis”, *Journal of Money, Credit and Banking*, 28, 914-939.

Humphrey, D. B., Kim M. and J. Vesala (2001) “Realizing the Gains from Electronic Payments: Costs, Pricing, and Payment Choice”, *Journal of Money, Credit, and Banking*, 33 (2), 216-234.

Humphrey, D. B., Willesson M., Bergendahl G. and T. Lindblom (2006) “Benefits from a Changing Payment Technology in European Banking”, *Journal of Banking and Finance*, 30, 1631-1652.

Humphrey, D. B., Snellman J. and J. Vesala (2001) “Substitution of Noncash Payment Instruments for cash in Europe”, *Journal of Financial Services Research*, 19, 131-145.

Inklaar R. and M. Koetter (2008) “Financial Dependence and Industry Growth in Europe: Better Banks and Higher Productivity”, University of Gronigen.

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

King, R. G. and R. Levine (1993) "Finance and Growth: Schumpeter Might Be Right", *Quarterly Journal of Economics*, 108(3), 717-738.

King, R. G. and R. Levine (1993) "Finance, Entrepreneurship, and Growth: Theory and Evidence", *Journal of Monetary Economics*, 32, 513-542.

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

Levine, R. and S. Zervos (1998) “Stock Market Development and Long-Run Growth”, *The World Bank Economic Review*, 10, 323-339.

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

Roodman, D. (2006). How to do xtabond2: an introduction to “Difference” and “System” GMM in Stata. Center for Global Development Working Paper Number 103.

Rousseau, P. L. and P. Wachtel (1998) “Financial Intermediation and Economic Performance: Historical Evidence from Five Industrial Countries”, *Journal of Money, Credit, and Banking*, 30, 657-678.

Rousseau, P. L. and P. Wachtel (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 F. Rodriguez-Fernàndez (2008) “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 M. Zandi (2010) “The Impact of Electronic Payments on Economic Growth”, Moody’s Analytics.

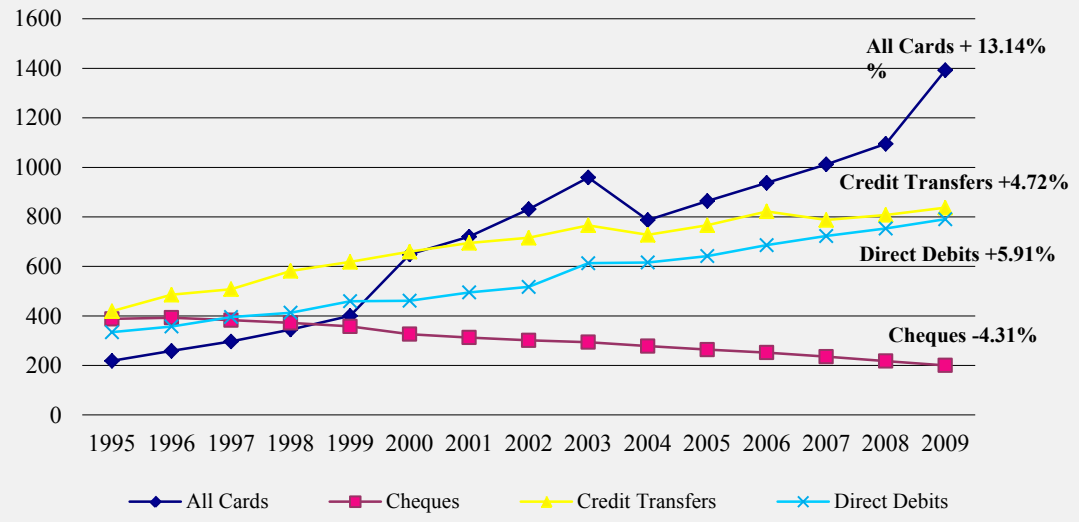
Snellman, J.S., Vesala J. and D. B. Humphrey (2001) “Substitution of Noncash Payment Instruments for Cash in Europe”, *Journal of Financial Services Research*, 19 (2/3), 131-145.

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

# APPENDIX A – VARIABLES DESCRIPTION

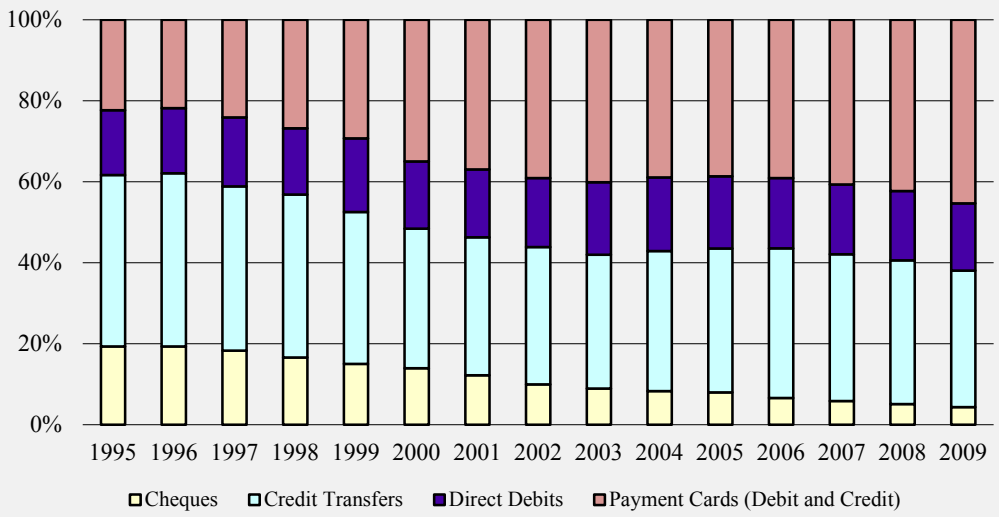
| Variable | Description | Source |
|---|---|---|
| Cash | Volume/Value of cash withdrawals- Millions euro | ECB SDW |
| Cheques | Volume/ Value of transactions – Millions euro | ECB SDW |
| Credit Transfers | Volume/ Value of transactions – Millions euro | ECB SDW |
| Direct Debits | Volume/ Value of 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 |
| Credit Transf | Value of transactions/Real GDP | Computed |
| Direct 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 |
| Trade per capita | Trade per capita | World Bank |
| Hholds Final Consumption per capita | Household final total consumption expenditure | Eurostat |
| Hholds Leisure Consumption per capita | Final household consumption expenditure on clothing; recreation and culture; newspapers; restaurant and hotels; personal care | Eurostat |
| Inflation | CPI Inflation | World Bank |
| Interest Rate | Deposit interest rate (rate paid by commercial or similar banks for demand, time, or savings deposits) | World Bank |
| Bank Private Credit over GDP | Bank claims over the private sector/GDP | Beck et al. (2010) |
| Tot Current Expenditure | Total current public expenditure | Eurostat |
| Labour Productivity | Hourly labour productivity index | Eurostat |
| SEPA | Dummy = 1 after 2008 for countries who adopted SEPA instruments | Computed |
| EURO | Dummy = 1 if the country in the euro area | Computed |
| NN EURO | Dummy = 1 if the country is not in the euro area | Computed |

**Figure 1 – Use of payment instruments of EU27 Member States, 1995-2009, volume of transactions in euro millions**



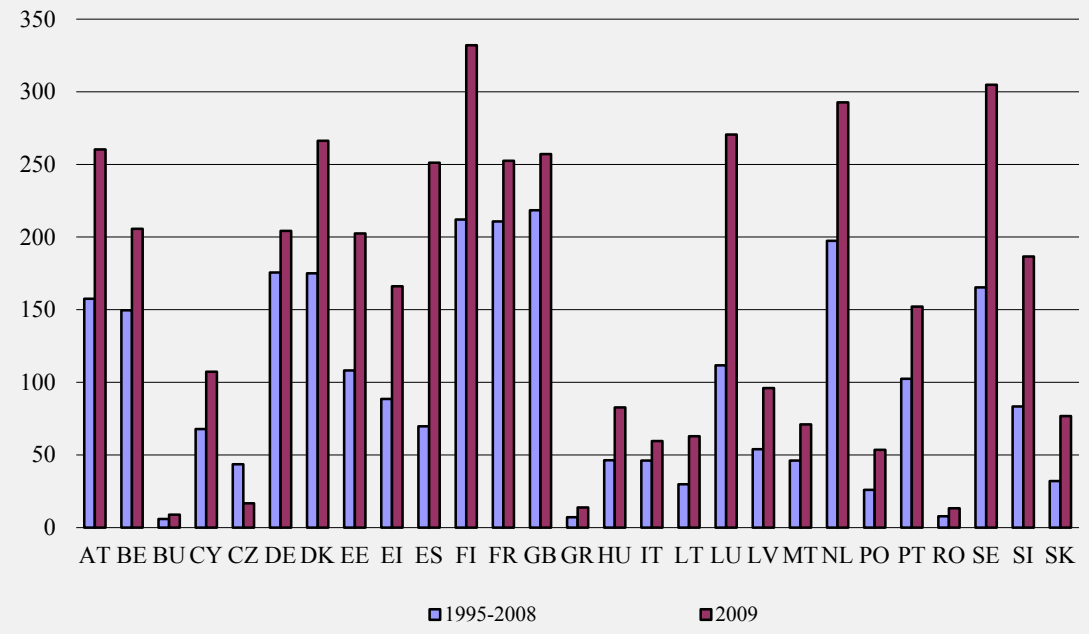

Source: ECB, Statistical Data Warehouse.

**Figure 2 - Use of non-cash payment instruments in EU-27 (% of total non-cash payment instruments) 1995-2009**



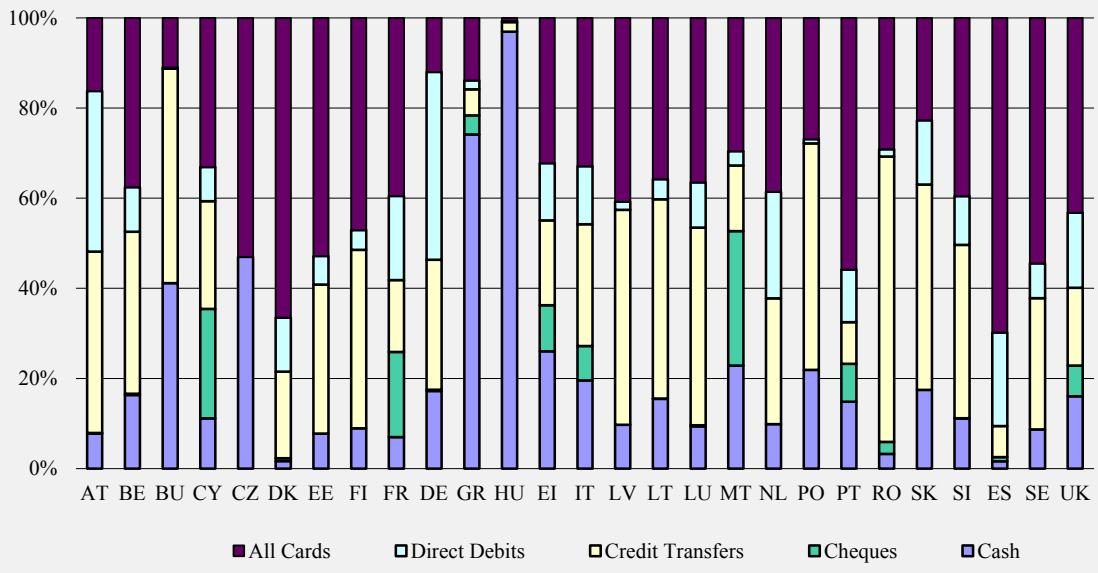

Source: ECB, Statistical Data Warehouse.

**Figure 3 - Number of cashless transactions per capita, EU-27 1995-2009**



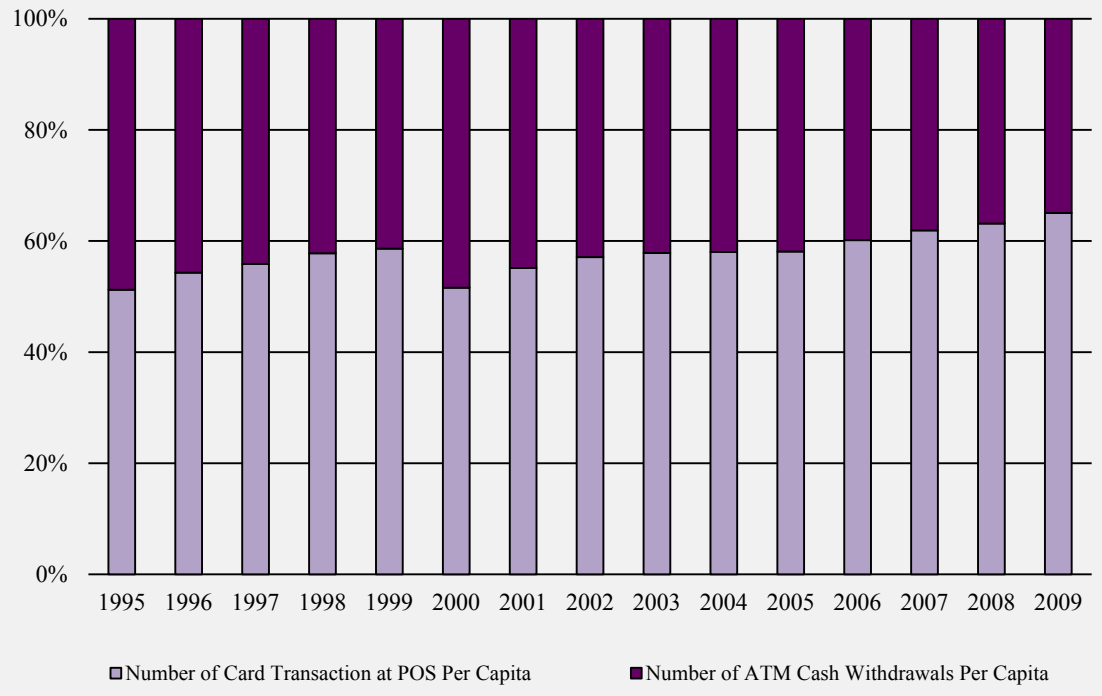

Source: ECB, Statistical Data Warehouse.

**Figure 4 - Penetration of payment instruments (as a ratio of GDP) across EU-27 countries, 2009 (% of total value of non-cash payment instruments)**



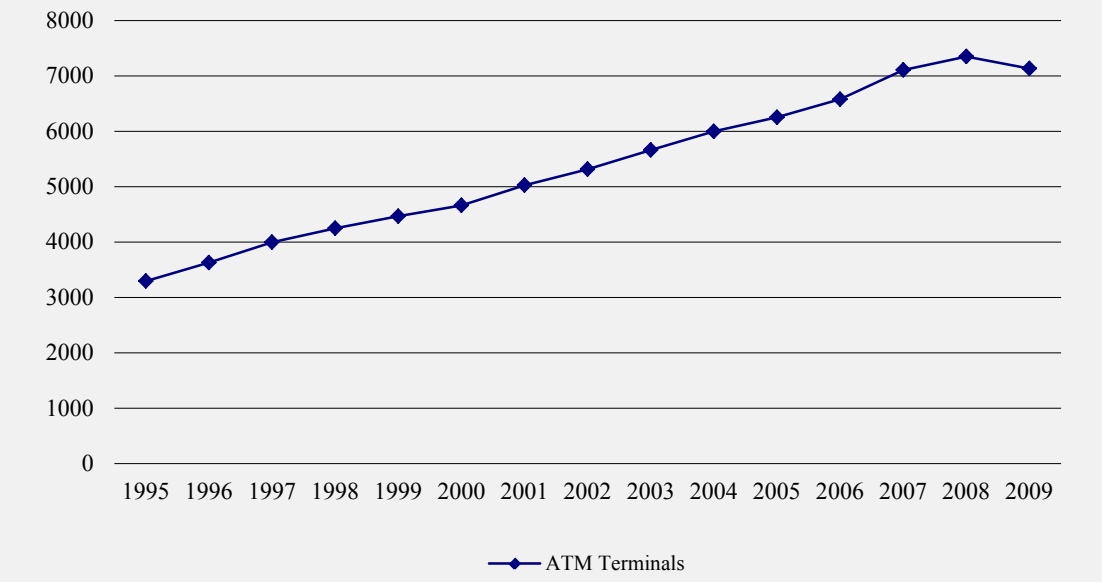

Source: ECB, Statistical Data Warehouse.

**Figure 5 – Number of card transactions per capita at point of sales (POS) versus number of ATM cash withdrawals per capita for the EU-27 countries, 1995-2009**



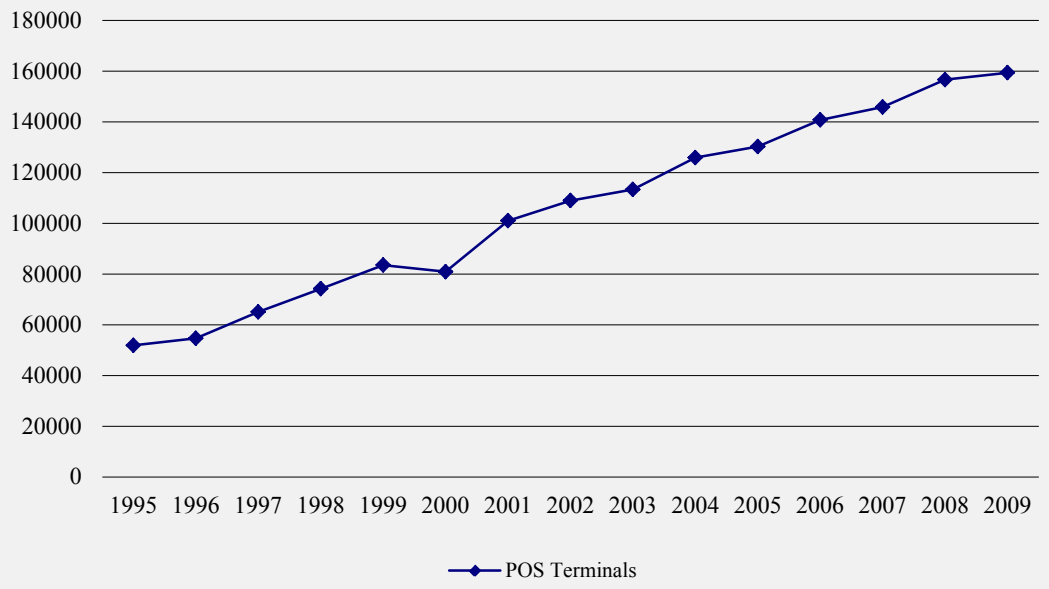

Source: ECB, Statistical Data Warehouse.

**Panel a - Number of ATM Terminals Per 1 Million Inhabitants**




Source: ECB, Statistical Data Warehouse.

**Panel b – Number of POS Terminals Per 1 Million Inhabitants**




Source: ECB, Statistical Data Warehouse.

## Table 1- Panel a. Descriptive Statistics

| Variable | Unit | Obs | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|---|
| Cash | Millions | 360 | 350 | 147 | 505 | 0.30 | 3,092 |
| All Cards - Number of transactions | Millions | 341 | 750 | 1,910 | 1,330 | 0.95 | 8,190 |
| Cheques - Number of transactions | Millions | 331 | 373 | 268 | 999 | 0 | 4,950 |
| Credit Transfers - Number of transactions | Millions | 327 | 814 | 432 | 1,350 | 1.30 | 7,390 |
| Direct Debits - Number of transactions | Millions | 337 | 650 | 816 | 1,380 | 0.37 | 8,420 |
| Cash per capita | Pure Number | 360 | 33 | 16 | 106 | 0.04 | ,1337 |
| All cards – Number of transactions per capita | Pure Number | 324 | 39 | 24 | 42 | 0.12 | 182 |
| Cheques – Number of transactions per capita | Pure Number | 331 | 13 | 4 | 18 | 0 | 84 |
| Credit Transfers – Number of transactions per capita | Pure Number | 326 | 42 | 35 | 33 | 0.48 | 144 |
| Direct Debits – Number of transactions per capita | Pure Number | 311 | 21 | 13 | 23 | 0.1 | 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 |
| Credit Transfers - Value of transactions | Billions | 333 | 108,323 | 63,400 | 253,000 | 3 | 1,880,000 |
| Direct Debits - Value of transactions | Billions | 334 | 348,340 | 5,042,992 | 38,000,000 | 1 | 407,000,000 |
| Cash Value ATMs Withdrawals/GDP | Percent | 344 | 11 | 129 | 751 | 0.001 | 4767 |
| All Cards Value/GDP | Percent | 345 | 8 | 9 | 6 | 0.07 | 35 |
| Cheques Value/GDP | Percent | 324 | 34 | 95 | 121 | 0 | 904 |
| Credit Transfers Value/GDP | Percent | 333 | 780 | 1307 | 1556 | 32 | 7781 |
| Direct Debits Value/GDP | Percent | 334 | 17 | 42 | 88 | 0.02 | 741 |
| ATM – Number of terminals | Pure Number | 373 | 11,822 | 3,191 | 16,565 | 69 | 82,702 |
| POS - Number of terminals | Pure Number | 364 | 218,554 | 59,950 | 315,963 | 27 | 1,420,787 |
| ATM - Number of terminals per 1 million capita | Pure Number | 372 | 556 | 315 | 310 | 8 | 1,614 |
| POS - Number of terminals per 1 million capita | Pure Number | 364 | 11,212 | 7,785 | 7,867 | 3 | 45,164 |
| GDP per capita | Pure Number | 401 | 17,476 | 13,225 | 13,685 | 1,111 | 81,835 |
| Trade per capita | Pure Number | 396 | 20,588 | 10,700 | 30945 | 116 | 268,000 |
| Household final consumption expenditure per capita | Pure Number | 382 | 8,410 | 9,011 | 5,069 | 940 | 21,600 |
| Household final consumption expenditure on leisure goods per capita | Pure Number | 374 | 4,000 | 3,000 | 2,000 | 215 | 954 |
| Interest rate | Percent | 368 | 5.68 | 4 | 8 | 0.01 | 75 |
| Inflation | Percent | 404 | 8 | 27 | 54 | -4 | 11 |
| Private Credit/GDP | Percent | 395 | 82 | 72 | 50 | 6 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Current Expenditure | Millions | 404 | 40 | 40 | 7 | 27 | 61 |
| Labour Productivity | Index | 342 | 95 | 97 | 11 | 62 | 120 |

*Cash*, volume/value of cash withdrawals from ATMs (SDW); *All Cards,* volume/value of payment cards transactions (SDW); *Cheques,* volume/value of cheque transactions (SDW); *Credit Transfers,* volume/value of credit transfers transactions (SDW); *Direct Debits,* volume/value of transactions (SDW); *ATM Number of Terminals,* number of ATM terminals in a country (SDW); *POS Number of Terminals,* number of POS terminals in a country (SDW); *GDP Per Capita,* logarithm of real GDP per capita (World Bank); *Trade per capita,* logarithm of trade per capita, exports + imports of goods (World Bank); *Household Final Consumption per capita,* logarithm of final household consumption expenditures per capita (World Bank); *Household Consumption per capita on leisure goods,* logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (World Bank); *Interest rate,* rate paid by commercial or similar banks for demand, time, or savings deposits (World Bank); *Inflation,* CPI inflation (World Bank); *Private Credit/ GDP*, ratio of bank credit to the private sector to GDP, (Beck *et al.*, 2010); *Total Current Expenditure*, total current public expenditure (Eurostat); *Labour Productivity,* hourly labour productivity index (Eurostat).

**Table 1 - Panel b. Descriptive Statistics- Minimum and Maximum Values per country and year**

| | Min | | Max | |
|---|---|---|---|---|
| | **Country** | **Year** | **Country** | **Year** |
| Cash | BU | 1996 | LT | 2008 |
| All Cards - Number of transactions | BU | 2001 | UK | 2009 |
| Cheques - Number of transactions | BU | 2001-03 | FR | 1996 |
| | HU | 2002-08 | | |
| | NL | 2003-09 | | |
| Credit Transfers - Number of transactions | ML | 2000 | DE | 1999 |
| Direct Debits - Number of transactions | LV | 2003 | DE | 2009 |
| Cash per capita | BU | 1996 | LV | 2008 |
| All cards - Number of transactions per capita | BU | 2001 | SE | 2009 |
| Cheques - Number 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 - Number 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 |
| Credit Transfers - Value of transactions | MT | 2003 | HU | 2006 |
| Direct 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 |
| Credit Transfers Value/GDP | HU | 2003 | EI | 1995 |
| Direct 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 |
| Household 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 |
| Inflation | EI | 2009 | SE | 1995 |
| Private Credit/GDP | RO | 2000 | LU | 2009 |
| Total Current Expenditure | EI | 2000 | SE | 1995 |
| Labour Productivity | AT | 1995 | UK | 2009 |

## Table 2 – Pairwise Correlation

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cash** | 1 | | | | | | | | | | | | | | | |
| **All Cards** | -0.06 | 1 | | | | | | | | | | | | | | |
| **Cheques** | -0.06 | 0.15* | 1 | | | | | | | | | | | | | |
| **Credit Transfers** | 0.14* | 0.1 | -0.44* | 1 | | | | | | | | | | | | |
| **Direct Debits** | -0.08 | -0.32* | -0.29 | 0.21* | 1 | | | | | | | | | | | |
| **ATM Terminals** | -0.09 | 0.08 | 0.15* | -0.13* | 0.42* | 1 | | | | | | | | | | |
| **POS Terminals** | -0.09 | 0.15 | 0.25* | -0.26 | 0.33 | 0.89* | 1 | | | | | | | | | |
| **GDP per capita** | -0.19* | 0.42* | -0.07 | -0.22 | 0.42 | 0.33* | 0.35* | 1 | | | | | | | | |
| **Trade** | -0.1 | 0.30* | -0.20* | -0.11* | 0.29 | 0.03 | 0.05 | 0.86* | 1 | | | | | | | |
| **Hhold Final Cons** | 0.20* | 0.37* | 0.12 | -0.30* | 0.43* | 0.36* | 0.38* | 0.97 | 0.78* | 1 | | | | | | |
| **Hhold Leisure Cons** | -0.26* | 0.32* | 0.14* | -0.36* | 0.41* | 0.35* | 0.38* | 0.93* | 0.76* | 0.97* | 1 | | | | | |
| **Int Rate** | -0.21* | -0.40* | -0.03 | 0.07 | -0.34* | -0.19* | -0.20* | -0.58* | 0.50* | -0.54* | -0.58* | 1 | | | | |
| **Inflation** | 0.13* | -0.36* | -0.03 | 0.06 | -0.27* | -0.05 | -0.05 | -0.23* | -0.17* | -0.23* | -0.60* | 0.46* | 1 | | | |
| **Private Credit/GDP** | -0.18* | 0.32* | 0.22* | -0.27* | 0.44* | -0.30* | 0.31* | 0.73* | 0.63* | 0.71* | 0.75* | -0.37* | -0.12* | 1 | | |
| **Total Current Exp** | 0.07 | 0.15* | -0.1 | 0.12* | 0.26* | 0.17* | 0.18* | 0.45* | 0.24* | 0.50* | 0.41* | -0.13* | -0.09 | 0.19* | 1 | |
| **Labour Productivity** | -0.06 | 0.41* | 0.02 | -0.18* | 0.01 | 0.17* | 0.17* | 0.42* | 0.34* | 0.30* | 0.24* | -0.41* | -0.20* | 0.34* | 0.11 | 1 |

Cash, value of cash withdrawals from ATMs over real GDP (SDW); All Cards, value card transactions over real GDP (SDW); Cheques, value of cheque transactions over real GDP (SDW); Credit Transfers, value of credit transfers transactions over real GDP (SDW); Direct Debits, value of direct debits transactions over real GDP (SDW); ATM Terminals, number of ATM terminals in a country, (SDW); POS Terminals, number of POS terminals in a country (SDW); GDP per capita, logarithm of real GDP per capita (World Bank); Hholds Final Cons, logarithm of final household consumption expenditures per capita (Eurostat); Hholds Leisure Cons, logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (Eurostat); Interest rate, rate paid by commercial or similar banks for demand, time, or savings deposits (World Bank); Trade per capita, logarithm of trade per capita, exports + imports of goods from the (World Bank); Inflation, CPI inflation, (World Bank); Private Credit/GDP, ratio of bank credit to the private sector to the GDP, (Beck et al., 2010); Total Current Exp, total current public expenditure (Eurostat); Labour Productivity, hourly labour productivity index (Eurostat).

## Table 3 – Panel a – GDP: System GMM and IV Estimation

| GMM | (1) LN GDP PC | (2) LN GDP PC | (3) LN GDP PC | (4) LN GDP PC | (5) LN GDP PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | 0.0000994 | | | | |
| Cash Penetration Euro | -0.737 | | | | |
| Card Penetration Nn Euro | | 9.446** | | | |
| Card Penetration Euro | | 3.015* | | | |
| Cheque Penetration Nn Euro | | | 0.290*** | | |
| Cheque Penetration Euro | | | 0.0451 | | |
| Cr Transf Penetration Nn Euro | | | | 0.0634 | |
| Cr Transf Penetration Euro | | | | 0.00584 | |
| Dir Debits Penetration Nn Euro | | | | | 0.00283 |
| Dir Debits Penetration Euro | | | | | 0.000490 |
| SEPA | 0.203*** | 0.185*** | 0.152** | 0.243*** | 0.200*** |
| LN GDP PC Nn Euro (-1) | -0.0959*** | -0.168*** | -0.109*** | -0.104** | -0.104* |
| LN GDP PC Euro (-1) | 0.0413* | -0.00639 | 0.0269* | 0.0238 | 0.0286 |
| Interest Rate | -0.0554*** | -0.0401** | -0.0608*** | -0.0554*** | -0.0558*** |
| Intercept | 9.967*** | 10.00*** | 10.01*** | 9.977*** | 9.990*** |
| Number of Observations | 299 | 268 | 258 | 258 | 256 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **IV** | | | | | |
| Cash Penetration Nn Euro | 0.00159 | | | | |
| Cash Penetration Euro | -4.504*** | | | | |
| Card Penetration Nn Euro | | 12.76*** | | | |
| Card Penetration Euro | | 2.546* | | | |
| Cheque Penetration Nn Euro | | | 0.287*** | | |
| Cheque Penetration Euro | | | 0.082 | | |
| Cr Transf Penetration Nn Euro | | | | 0.0737*** | |
| Cr Transf Penetration Euro | | | | 0.00533 | |
| Dir Debits Penetration Nn Euro | | | | | -0.000977 |
| Dir Debits Penetration Euro | | | | | 0.000577 |
| SEPA | 0.129 | 0.181* | 0.128 | 0.199* | 0.183 |
| LN GDP PC (-1) Nn Euro | -0.0991*** | -0.195*** | -0.103*** | -0.101*** | -0.0947*** |
| LN GDP PC (-1) Euro | 0.0719*** | -0.00675 | 0.0232** | 0.0248** | 0.0271*** |
| Interest Rate | -0.0767*** | -0.0403*** | -0.0802*** | -0.0651*** | -0.0702*** |
| Intercept | 10.12*** | 10.06*** | 10.08*** | 10.02*** | 10.05*** |
| Number of Observations | 277 | 246 | 236 | 237 | 235 |
| Adjusted $R^2$ | 0.619 | 0.76 | 0.717 | 0.641 | 0.639 |

*LN GDP PC,* logarithm of GDP per capita (World Bank); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *LN GDP PC (-1)*, lagged GDP per capita (World Bank); *Interest Rate,* rate paid by commercial or similar banks for demand, time, or savings deposits (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel b – Trade: System GMM and IV Estimation

| GMM | (1) LN Trade PC | (2) LN Trade PC | (3) LN Trade PC | (4) LN Trade PC | (5) LN Trade PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | 0.00377 | | | | |
| Cash Penetration Euro | 0.0783 | | | | |
| Card Penetration Nn Euro | | 1.353 | | | |
| Card Penetration Euro | | 7.541* | | | |
| Cheque Penetration Nn Euro | | | 0.321*** | | |
| Cheque Penetration Euro | | | -0.0193 | | |
| Cr Transf Penetration Nn Euro | | | | 0.169*** | |
| Cr Transf Penetration Euro | | | | 0.00367 | |
| Dir Debits Penetration Nn Euro | | | | | 0.00612 |
| Dir Debits Penetration Euro | | | | | -0.000272 |
| SEPA | 0.204* | 0.174* | 0.143 | 0.286*** | 0.291*** |
| LN GDP PC Nn Euro (-1) | -0.0652 | -0.0774 | -0.0900* | -0.0852* | -0.0878* |
| LN GDP PC Euro (-1) | 0.0438 | -0.0387 | 0.0413* | 0.0375 | 0.0391 |
| Inflation | -6.361*** | -4.894** | -4.660*** | -5.091** | -5.477*** |
| Intercept | 9.798*** | 9.743*** | 9.746*** | 9.781*** | 9.822*** |
| Number of Observations | 322 | 289 | 282 | 280 | 278 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **IV** | | | | | |
| Cash Penetration Nn Euro | 0.00379 | | | | |
| Cash Penetration Euro | -7.852*** | | | | |
| Card Penetration Nn Euro | | 4.935 | | | |
| Card Penetration Euro | | 6.091*** | | | |
| Cheque Penetration Nn Euro | | | 0.328*** | | |
| Cheque Penetration Euro | | | -0.0318 | | |
| Cr Transf Penetration Nn Euro | | | | 0.190*** | |
| Cr Transf Penetration Euro | | | | -0.000242 | |
| Dir Debits Penetration Nn Euro | | | | | 0.00767 |
| Dir Debits Penetration Euro | | | | | -0.001 |
| SEPA | 0.0617 | 0.143 | 0.0257 | 0.154 | 0.188 |
| LN GDP PC (-1) Nn Euro | -0.0718*** | -0.101** | -0.0838*** | -0.0797*** | -0.0807*** |
| LN GDP PC (-1) Euro | 0.114*** | -0.025 | 0.0452*** | 0.0455** | 0.0489*** |
| Inflation | -8.854*** | -5.786*** | -6.594*** | -7.166*** | -7.359*** |
| Intercept | 10.02*** | 9.809*** | 9.790*** | 9.841*** | 9.850*** |
| Number of Observations | 301 | 266 | 261 | 258 | 256 |
| Adjusted $R^2$ | 0.328 | 0.377 | 0.33 | 0.351 | 0.341 |

*Trade,* logarithm of trade per capita (World Bank); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *LN GDP PC (-1)*, lagged GDP per capita (World Bank); *Inflation,* CPI inflation (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel c – Total Final Household Consumption: System GMM and IV Estimation

| GMM | (1) LN Fin Cons PC | (2) LN Fin Cons PC | (3) LN Fin Cons PC | (4) LN Fin Cons PC | (5) LN Fin Cons PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | -0.0100 | | | | |
| Cash Penetration Euro | 1.148 | | | | |
| Card Penetration Nn Euro | | 7.754** | | | |
| Card Penetration Euro | | -0.237 | | | |
| Cheque Penetration Nn Euro | | | 0.328*** | | |
| Cheque Penetration Euro | | | 0.0165 | | |
| Cr Transf Penetration Nn Euro | | | | 0.0365 | |
| Cr Transf Penetration Euro | | | | 0.00144 | |
| Dir Debits Penetration Nn Euro | | | | | -0.0106 |
| Dir Debits Penetration Euro | | | | | 0.000120 |
| SEPA | -0.0137 | -0.0102 | -0.0232 | 0.00769 | -0.00554 |
| Pers Income Nn Euro (-1) | 0.112 | 0.0503 | 0.0349 | 0.0706 | 0.0794 |
| Pers Income Euro (-1) | 0.221** | 0.217*** | 0.162*** | 0.192** | 0.189** |
| Inflation | -1.879 | -1.580** | -2.458*** | -3.397* | -3.153* |
| Intercept | 7.193*** | 7.335*** | 7.860*** | 7.589*** | 7.618*** |
| Number of Observations | 256 | 244 | 218 | 228 | 227 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **IV** | | | | | |
| Cash Penetration Nn Euro | -0.0104*** | | | | |
| Cash Penetration Euro | -1.015** | | | | |
| Card Penetration Nn Euro | | 8.861*** | | | |
| Card Penetration Euro | | -0.297 | | | |
| Cheque Penetration Nn Euro | | | 0.336*** | | |
| Cheque Penetration Euro | | | 0.0154 | | |
| Cr Transf Penetration Nn Euro | | | | 0.0539** | |
| Cr Transf Penetration Euro | | | | 0.00180* | |
| Dir Debits Penetration Nn Euro | | | | | 0.00331 |
| Dir Debits Penetration Euro | | | | | 0.0000351 |
| SEPA | -0.0247 | -0.0333 | -0.0694 | -0.0553 | -0.0520 |
| Pers Income Nn Euro (-1) | 0.109*** | 0.0496*** | 0.0498** | 0.0843*** | 0.0723*** |
| Pers Income Euro (-1) | 0.234*** | 0.227*** | 0.180*** | 0.210*** | 0.201*** |
| Inflation | -2.668*** | -1.433** | -2.257*** | -2.794*** | -2.859*** |
| Intercept | 7.261*** | 7.253*** | 7.708*** | 7.407*** | 7.519*** |
| Number of Observations | 257 | 243 | 221 | 232 | 230 |
| Adjusted $R^2$ | 0.819 | 0.889 | 0.880 | 0.817 | 0.813 |

*LN Fin Cons PC,* logarithm of final household consumption expenditures per capita (Eurostat); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Pers Income*, lagged personal disposable income per capita, (World Bank); *Inflation,* CPI inflation (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel d – Consumption on leisure goods: System GMM and IV Estimation

| GMM | (1) LN Leisure Cons PC | (2) LN Leisure Cons PC | (3) LN Leisure Cons PC | (4) LN Leisure Cons PC | (5) LN Leisure Cons PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | -0.0214* | | | | |
| Cash Penetration Euro | 0.788 | | | | |
| Card Penetration Nn Euro | | 11.05*** | | | |
| Card Penetration Euro | | -0.991 | | | |
| Cheque Penetration Nn Euro | | | 0.436*** | | |
| Cheque Penetration Euro | | | -0.0222 | | |
| Cr Transf Penetration Nn Euro | | | | -0.0300 | |
| Cr Transf Penetration Euro | | | | -0.00201 | |
| Dir Debits Penetration Nn Euro | | | | | -0.0163 |
| Dir Debits Penetration Euro | | | | | -0.000237 |
| SEPA | 0.0584 | 0.0695 | 0.0805** | 0.104 | 0.0919* |
| Pers Income Nn Euro (-1) | 0.134 | 0.0206 | 0.0745 | 0.0342 | 0.0493 |
| Pers Income Euro (-1) | 0.242** | 0.214*** | 0.219** | 0.157 | 0.155 |
| Inflation | -4.513** | -4.515*** | -4.660*** | -6.968** | -6.641*** |
| Intercept | -0.762 | -0.333 | -0.453 | 0.217 | 0.219 |
| Number of Observations | 257 | 245 | 221 | 228 | 227 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **IV** | | | | | |
| Cash Penetration Nn Euro | -0.0228*** | | | | |
| Cash Penetration Euro | 0.218 | | | | |
| Card Penetration Nn Euro | | 13.49*** | | | |
| Card Penetration Euro | | -0.452 | | | |
| Cheque Penetration Nn Euro | | | 0.455*** | | |
| Cheque Penetration Euro | | | -0.0231 | | |
| Cr Transf Penetration Nn Euro | | | | -0.0175 | |
| Cr Transf Penetration Euro | | | | -0.00277* | |
| Dir Debits Penetration Nn Euro | | | | | -0.0112 |
| Dir Debits Penetration Euro | | | | | -0.000291 |
| SEPA | 0.0493 | 0.0616 | 0.0709* | 0.0721 | 0.0788 |
| Pers Income Nn Euro (-1) | 0.128*** | 0.0206 | 0.0739* | 0.0260 | 0.0366 |
| Pers Income Euro (-1) | 0.236*** | 0.230*** | 0.219*** | 0.151*** | 0.147*** |
| Inflation | -6.318*** | -4.137*** | -5.210*** | -6.946*** | -6.987*** |
| Intercept | -0.608 | -0.538* | -0.426 | 0.302 | 0.325 |
| Number of Observations | 247 | 236 | 212 | 221 | 220 |
| Adjusted $R^2$ | 0.721 | 0.830 | 0.825 | 0.684 | 0.682 |

*LN Leisure Cons PC,* logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (Eurostat); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Pers Income*, lagged personal disposable income per capita, (World Bank); *Inflation,* CPI inflation (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Table 4 – Difference GMM and OLS Estimation.

| | LN GDP PC | | LN Trade PC | | LN Fin Cons PC | | LN Leisure Cons PC | |
|---|---|---|---|---|---|---|---|---|
| | **Difference GMM** | **OLS** | **Difference GMM** | **OLS** | **Difference GMM** | **OLS** | **Difference GMM** | **OLS** |
| Card Penetration Nn Euro | 2.137 | 12.02*** | 1.395 | 8.547* | -0.00989*** | 9.344*** | -0.00801* | 13.55*** |
| Card Penetration Euro | -0.837 | 1.812* | -13.96 | 5.401*** | -0.78 | -0.117 | -2.214 | -0.614* |
| SEPA | 0.191*** | 0.194* | 0.272 | -0.0611*** | 0.00228 | -0.0215** | -0.00441 | -0.0343*** |
| Cash Penetration Nn Euro | -0.00329* | 0.000428 | -0.0127 | 0.00630* | 4.507** | -0.00917** | 4.778** | -0.0193*** |
| Cash Penetration Euro | -7.881* | -2.412** | -10.53 | -3.892** | 1.092 | -0.663 | 1.856 | -0.0484 |
| SEPA | 0.105 | 0.170* | 0.0806 | -0.0871*** | 0.00687 | -0.00702 | 0.00311 | -0.0560*** |
| Cheque Penetration Nn Euro | -0.148** | 0.276*** | -0.497 | 0.303*** | -0.0962** | 0.341*** | -0.0541 | 0.459*** |
| Cheque Penetration Euro | 0.110 | 0.0550* | 0.142 | 0.0312 | -0.0962** | | 0.0597 | -0.00507 |
| SEPA | 0.179*** | 0.137 | 0.207*** | -0.0898*** | 0.0506 | 0.0262* | 0.039* | -0.0641*** |
| Cr Transf Penetration Nn Euro | 0.0283* | 0.0624** | 0.0327 | 0.135*** | -0.00510 | -0.0338*** | 0.0274* | -0.0353 |
| Cr Transf Penetration Euro | -0.00688* | 0.00656* | -0.00564 | 0.00898 | 0.0290** | 0.0397** | -0.00177 | -0.000490 |
| SEPA | 0.137*** | 0.210* | 0.139*** | -0.0788*** | -0.00204 | 0.00252** | 0.00334 | -0.0728*** |
| Dir Debits Penetration Nn Euro | 0.00220 | 0.00000616 | 0.00888 | 0.00309 | 0.0109 | -0.0281*** | 0.00404 | -0.0124 |
| Dir Debits Penetration Euro | 0.000703 | 0.000396 | 0.000516 | -0.000133 | 0.00350 | 0.00270 | -0.0000874 | -0.0000226 |
| SEPA | 0.181*** | 0.202* | 0.225*** | -0.0835*** | -0.000339 | 0.000140 | 0.00741 | -0.0746*** |
| Intercept | no | yes | no | yes | no | yes | no | yes |
| Hansen-p | [ 1.00 ] | - [-.99- 2.29] | [ 1.00 ] | - | [ 1.00 ] | - | [ 1.00 ] | - |
| AR1 Test | | - | [-.39- 2.35] | - | [-0.73 - 1.29] | - | [-.03- 1.49] | - |
| Adjusted $R^2$ | | [0.62-0.77] | - | [0.34 - 0.46] | - | [0.79-0.82] | - | [0.70-0.83] |
| Number of Observations | [219-258] | [256-299] | [ 220-258] | [254-341] | [190 - 215] | [219-278] | [ 191-226] | [219-267] |

*LN GDP PC,* logarithm of GDP per capita (World Bank); *Trade,* logarithm of trade per capita (World Bank); *LN Fin Cons PC,* logarithm of final household consumption expenditures per capita (Eurostat); *LN Leisure Cons PC,* logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (Eurostat); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted. *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Table 5 - Cards Devices: ATMs and POSs

| | LN GDP PC | | LN Trade PC | | LN Fin Cons PC | | LN Leisure Cons PC | |
|---|---|---|---|---|---|---|---|---|
| ATM Nn Euro | 0.649*** | | 0.638*** | | 0.374*** | | 0.677*** | |
| ATM Euro | 0.672*** | | 0.652*** | | 0.387*** | | 0.703*** | |
| SEPA | 0.146* | | | 0.319*** | | 0.226*** | | 0.348** |
| POS Nn Euro | | 0.351*** | | 0.341** | | 0.244*** | | 0.383** |
| POS Euro | | 0.382*** | 0.189* | 0.242** | -0.024 | -0.023 | 0.023 | 0.011 |
| SEPA | | 0.190*** | 0.157 | 0.153* | 0.059 | 0.051 | 0.024 | 0.028 |
| Constant | 13.164*** | 9.899*** | 12.584*** | 9.221*** | 10.576*** | 8.895*** | 5.544** | 1.928* |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| AR1 Test | 1.89 | 3.13 | 2.13 | 1.80 | 2.20 | 2.69 | 1.60 | 1.96 |
| Number of Observations | 268 | 267 | 267 | 266 | 259 | 258 | 260 | 258 |

*ATM* number of ATM terminals in a country per capita (SDW); *POS,* number of POS terminals in a country per capita (SDW); *SEPA*, Dummy equals 1 if SEPA instruments are adopted. *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## ROBUSTNESS CHECKS

**Table 6 Panel a – GDP**

| GMM | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | **LN GDP PC** | **LN GDP PC** | **LN GDP PC** | **LN GDP PC** | **LN GDP PC** |
| Cash Penetration Nn Euro | 0.00764 | | | | |
| Cash Penetration Euro | -2.208 | | | | |
| Card Penetration Nn Euro | | 7.083* | | | |
| Card Penetration Euro | | 4.838*** | | | |
| Cheque Penetration Nn Euro | | | -0.0769 | | |
| Cheque Penetration Euro | | | 0.0436 | | |
| Cr Transf Penetration Nn Euro | | | | 0.131*** | |
| Cr Transf Penetration Euro | | | | 0.00288 | |
| Dir Debits Penetration Nn Euro | | | | | 0.0135 |
| Dir Debits Penetration Euro | | | | | 0.000485 |
| SEPA | 0.137 | 0.215*** | 0.174** | 0.217*** | 0.189*** |
| Bank Pr Credit/GDP Nn Euro | 1.009*** | 0.712** | 1.150*** | 1.217*** | 1.188*** |
| Bank Pr Credit/GDP Euro | 0.166 | -0.0780 | -0.0305 | 0.0963 | 0.107 |
| LN GDP PC Nn Euro (-1) | -0.0886 | -0.271** | -0.154* | -0.205* | -0.202* |
| LN GDP PC Euro (-1) | 0.0270* | 0.0160 | 0.0278** | 0.0276 | 0.0245 |
| Interest Rate | -0.0416** | -0.0417*** | -0.0551*** | -0.0422*** | -0.0433*** |
| Tot Curr Expenditure Euro | 0.00270 | -0.0106* | -0.000282 | -0.00426 | -0.00330 |
| Tot Curr Expenditure Nn Euro | -0.0211 | 0.0145 | -0.00451 | 0.00000921 | -0.00276 |
| Intercept | 9.949*** | 10.10*** | 10.01*** | 10.02*** | 10.02*** |
| Number of Observations | 293 | 263 | 254 | 253 | 251 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

*LN GDP PC,* logarithm of GDP per capita; *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Bank Pr Credit/GDP,* bank credit to the private sector, (Beck *et al*,. 2010); *LN GDP PC (-1)*, lagged GDP per capita (World Bank); *Interest Rate*, rate paid by commercial or similar banks for demand, time, or savings deposits (World Bank); *Tot Curr Expenditure*, total current public expenditures in euro (Eurostat). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel b- Trade

| GMM | (1) LN Trade PC | (2) LN Trade PC | (3) LN Trade PC | (4) LN Trade PC | (5) LN Trade PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | 0.0153 | | | | |
| Cash Penetration Euro | -0.379 | | | | |
| Card Penetration Nn Euro | | 2.158 | | | |
| Card Penetration Euro | | 9.692** | | | |
| Cheque Penetration Nn Euro | | | 0.124 | | |
| Cheque Penetration Euro | | | -0.0281 | | |
| Cr Transf Penetration Nn Euro | | | | 0.196*** | |
| Cr Transf Penetration Euro | | | | 0.00109 | |
| Dir Debits Penetration Nn Euro | | | | | 0.0182 |
| Dir Debits Penetration Euro | | | | | -0.000192 |
| SEPA | 0.0584 | 0.156 | 0.0966 | 0.180 | 0.203 |
| Bank Pr Credit/GDP Nn Euro | 0.658* | 0.644 | 0.426 | 0.922** | 0.897** |
| Bank Pr Credit/GDP Euro | 0.532 | 0.0872 | 0.215 | 0.414 | 0.435 |
| LN GDP PC Nn Euro (-1) | 0.116 | -0.0900 | 0.0661 | -0.114 | -0.0732 |
| LN GDP PC Euro (-1) | 0.0515* | 0.0356 | 0.0478* | 0.0593 | 0.0484 |
| Inflation | -5.841** | -6.014*** | -6.069** | -7.050** | -5.516** |
| Tot Curr Expenditure Euro | -0.0114 | -0.0259* | -0.00398 | -0.0146 | -0.0122 |
| Tot Curr Expenditure Nn Euro | -0.0510 | -0.00619 | -0.0363 | -0.00435 | -0.0191 |
| Intercept | 9.634*** | 9.746*** | 9.606*** | 9.758*** | 9.724*** |
| Number of Observations | 290 | 261 | 253 | 251 | 249 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

*Trade,* logarithm of trade per capita; *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Bank Pr Credit/GDP,* bank credit to the private sector, ( Beck *et al*,. 2010); *LN GDP PC (-1)*, lagged GDP per capita (World Bank); *Inflation,* CPI inflation (World Bank); *Tot Curr Expenditure*, total current public expenditures (Eurostat). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel c – Final Total Household Consumption

| GMM | (1) LN Fin Cons PC | (2) LN Fin Cons PC | (3) LN Fin Cons PC | (4) LN Fin Cons PC | (5) LN Fin Cons PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | -0.000942 | | | | |
| Cash Penetration Euro | -1.807* | | | | |
| Card Penetration Nn Euro | | 3.689 | | | |
| Card Penetration Euro | | 1.544* | | | |
| Cheque Penetration Nn Euro | | | -0.0660 | | |
| Cheque Penetration Euro | | | 0.00616 | | |
| Cr Transf Penetration Nn Euro | | | | 0.0634* | |
| Cr Transf Penetration Euro | | | | 0.00266 | |
| Dir Debits Penetration Nn Euro | | | | | 0.00738 |
| Dir Debits Penetration Euro | | | | | 0.0000418 |
| SEPA | 0.0186 | 0.0484* | 0.0291 | 0.0553 | 0.0350 |
| Bank Pr Credit/GDP | -0.139 | -0.164 | -0.179 | -0.123 | -0.118 |
| Pers Income Nn Euro (-1) | 0.0463 | 0.0251 | -0.00509 | 0.0254 | 0.0294 |
| Pers Income Euro (-1) | 0.216*** | 0.204** | 0.197* | 0.202** | 0.231*** |
| Inflation | -2.878** | -2.574** | -2.403** | -3.904** | -3.147** |
| Lab Productivity Nn Euro | 0.0000233 | -0.000140 | 0.00296 | -0.000406 | 0.00140 |
| Lab Productivity Euro | 0.00339 | -0.000476 | 0.00126 | 0.000546 | 0.000951 |
| Intercept | 7.317*** | 7.493*** | 7.566*** | 7.495*** | 7.202*** |
| Number of Observations | 227 | 224 | 200 | 209 | 208 |
| Hansen-p | 1 | 1 | 1 | 1 | 1 |

*LN Fin Cons PC,* logarithm of final household consumption expenditures per capita (Eurostat); *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Pers Income* (-1), lagged personal disposable income per capita, (World Bank); *Inflation,* CPI inflation (World Bank); *Lab Productivity,* hourly labour productivity index (Eurostat). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel d – Consumption on leisure goods

| GMM | (1)<br>LN Leisure Cons PC | (2)<br>LN Leisure Cons PC | (3)<br>LN Leisure Cons PC | (4)<br>LN Leisure Cons PC | (5)<br>LN Leisure Cons PC |
|---|---|---|---|---|---|
| Cash Penetration Nn Euro | -0.0160* | | | | |
| Cash Penetration Euro | -1.802 | | | | |
| Card Penetration Nn Euro | | 15.45*** | | | |
| Card Penetration Euro | | -0.538 | | | |
| Cheque Penetration Nn Euro | | | 0.474*** | | |
| Cheque Penetration Euro | | | -0.0734** | | |
| Cr Transf Penetration Nn Euro | | | | -0.0624 | |
| Cr Transf Penetration Euro | | | | -0.00125 | |
| Dir Debits Penetration Nn Euro | | | | | -0.0251 |
| Dir Debits Penetration Euro | | | | | -0.000665* |
| SEPA | 0.0143 | 0.0341 | 0.0454 | 0.0444 | 0.0826 |
| Bank Pr Credit/GDP | 0.724** | 0.578** | 0.482* | 0.816** | 0.799** |
| Pers Income Nn Euro (-1) | 0.0814 | 0.164* | -0.00675 | 0.0535 | 0.0118 |
| Pers Income Euro (-1) | 0.159 | 0.402*** | 0.186 | 0.223 | 0.160 |
| Inflation | -8.104* | -4.097* | -8.310** | -8.493** | -5.778*** |
| Lab Productivity Nn Euro | -0.00171 | 0.0105 | 0.00876 | 0.00942 | -0.00685 |
| Lab Productivity Euro | 0.00301 | 0.00167 | 0.000996 | 0.00154 | -0.000389 |
| Intercept | 0.126 | -2.374** | -0.113 | -0.507 | 0.236 |
| Number of Observations | 225 | 201 | 208 | 207 | 223 |
| Hansen-p | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

*LN Leisure Cons PC,* Logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (Eurostat); *Cards Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cr Transf Penetration,* value of credit transfers transactions over real GDP; *Dir Debits Penetration,* value of direct debits transactions over real GDP; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *Pers Income (-1)*, lagged personal disposable income per capita (World Bank); *Inflation,* CPI inflation (World Bank); *Lab Productivity,* hourly labour productivity index (Eurostat). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Table 7 Panel a – GDP and Trade

| | (1) | (2) | (1) | (2) |
|---|---|---|---|---|
| | **LN GDP PC** | **LN GDP PC** | **LN Trade PC** | **LN Trade PC** |
| Card Penetration Nn Euro | 9.258** | 10.60** | 12.22** | 14.70** |
| Card Penetration Euro | 3.144** | 2.952* | 2.006* | 1.302 |
| Cash Penetration Nn Euro | | 0.00302 | | 0.00672* |
| Cash Penetration Euro | | 0.138 | | 0.155 |
| Cash*Cards Nn Euro | 0.192* | 0.117 | -0.111 | -0.280* |
| Cash*Cards Euro | -28.82*** | -27.56* | -25.55*** | -22.06* |
| SEPA | -0.0300 | -0.0274 | 0.0129 | 0.0242 |
| LN GDP PC Nn Euro (-1) | -0.189*** | -0.200*** | -0.202*** | -0.222*** |
| LN GDP PC Euro (-1) | -0.00300 | -0.00503 | 0.00845 | 0.00870 |
| Interest Rate | -2.983*** | -2.771** | | |
| Inflation | | | -5.904*** | -5.350*** |
| Intercept | 9.495*** | 9.500*** | 1.713*** | 1.717*** |
| Number of Observations | 247 | 247 | 246 | 246 |
| Hansen-p | 1 | 1 | 1 | 1 |

*LN GDP PC,* logarithm of GDP per capita; *Trade,* logarithm of trade per capita; *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Card Penetration,* value of transactions using payment cards over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cash*Cards*, interaction variable between and penetration and cash; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *LN GDP PC (-1)*, lagged GDP per capita (World Bank); *Interest Rate*, rate paid by commercial or similar banks for demand, time, or savings deposits (World Bank); *Inflation,* CPI inflation (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.

## Panel b – Consumption

| | (1) LN Fin Cons PC | (2) LN Fin Cons PC | (1) LN Leisure Cons PC | (2) LN Leisure Cons PC |
|---|---|---|---|---|
| Card Penetration Nn Euro | 9.258** | 10.60** | 12.22** | 14.70** |
| Card Penetration Euro | 3.144** | 2.952* | 2.006* | 1.302 |
| Cash Penetration Nn Euro | | 0.00302 | | 0.00672* |
| Cash Penetration Euro | | 0.138 | | 0.155 |
| Cash*Cards Nn Euro | 0.192* | 0.117 | -0.111 | -0.280* |
| Cash*Cards Euro | -28.82*** | -27.56* | -25.55*** | -22.06* |
| SEPA | -0.0300 | -0.0274 | 0.0129 | 0.0242 |
| LN GDP PC Nn Euro (-1) | -0.189*** | -0.200*** | -0.202*** | -0.222*** |
| LN GDP PC Euro (-1) | -0.00300 | -0.00503 | 0.00845 | 0.00870 |
| Inflation | -2.983*** | -2.771** | -5.904*** | -5.350*** |
| Intercept | 9.495*** | 9.500*** | 1.713*** | 1.717*** |
| Number of Observations | 247 | 247 | 246 | 246 |
| Hansen-p | 1 | 1 | 1 | 1 |

*LN Fin Cons PC,* logarithm of final household consumption expenditures per capita (Eurostat); *LN Leisure Cons PC,* logarithm of final household consumption expenditures per capita on personal goods, newspaper, cultural services, restaurants and hotels, personal care, clothing and footwear (Eurostat); *Cards Penetration,* value of transactions using payment cards over real GDP; *Cash Penetration,* value of cash withdrawals from ATMs over real GDP; *Cheque Penetration,* value of cheque transactions over real GDP; *Cash*Cards,* interaction variable between card penetration and cash; *SEPA*, Dummy equals 1 if SEPA instruments are adopted; *LN GDP PC (-1)*, lagged GDP per capita; *Inflation,* CPI inflation (World Bank). *Euro* and *NN Euro* refer to euro area countries and non euro area countries.