EUROPEAN CENTRAL BANK
EUROSYSTEM

RETAIL PAYMENTS:
INTEGRATION AND INNOVATION

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In 2009 all ECB publications feature a motif taken from the €200 banknote.

1 The views expressed in this paper do not necessarily reflect those of the Bank of Finland or the European Central Bank.
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Retail payments: integration and innovation

"Retail payments: integration and innovation" was the title of the joint conference organised by the European Central Bank (ECB) and De Nederlandsche Bank (DNB) in Frankfurt am Main on 25 and 26 May 2009. Around 200 high-level policy-makers, academics, experts and central bankers from more than 30 countries of all five continents attended the conference, reflecting the high level of interest in retail payments.

The aim of the conference was to better understand current developments in retail payment markets and to identify possible future trends, by bringing together policy conduct, research activities and market practice. The conference was organised around two major topics: first, the economic and regulatory implications of a more integrated retail payments market and, second, the strands of innovation and modernisation in the retail payments business. To make innovations successful, expectations and requirements of retail payment users have to be taken seriously. The conference has shown that these expectations and requirements are strongly influenced by the growing demand for alternative banking solutions, the increasing international mobility of individuals and companies, a loss of trust in the banking industry and major social trends such as the ageing population in developed countries. There are signs that customers see a need for more innovative payment solutions. Overall, the conference led to valuable findings which will further stimulate our efforts to foster the economic underpinnings of innovation and integration in retail banking and payments.

We would like to take this opportunity to thank all participants in the conference. In particular, we would like to acknowledge the valuable contributions of all presenters, discussants, session chairs and panellists, whose names can be found in the enclosed conference programme. Their main statements are summarised in the ECB-DNB official conference summary. Twelve papers related to the conference have been accepted for publication in this special series of the ECB Working Papers Series.

Behind the scenes, a number of colleagues from the ECB and DNB contributed to both the organisation of the conference and the preparation of this conference report. In alphabetical order, many thanks to Alexander Al-Haschimi, Wilko Bolt, Hans Brits, Maria Foskolou, Susan Germain de Urday, Philipp Hartmann, Päivi Heikkinen, Monika Hempel, Cornelia Holthausen, Nicole Jonker, Anneke Kosse, Thomas Lammer, Johannes Lindner, Tobias Linzert, Daniela Russo, Wiebe Ruttenberg, Heiko Schmiedel, Francisco Tur Hartmann, Liisa Väisänen, and Pirjo Väkeväinen.

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Abstract

The European banking industry joined forces to achieve a fully integrated market for retail payment services in the euro area: the Single Euro Payments Area (SEPA). Against this background, the present paper examines the fundamental relationship between retail payment business and overall bank performance. Using data from across 27 European markets over the period 2000-07, we analyse whether the provisions of retail payment services are reflected in improved bank performance, using accounting ratios and efficiency measures. The results confirm that the performance of banks in countries with more developed retail payment service markets is better. This relationship is stronger in countries with a relatively high adoption of retail payment transaction technologies. Retail payment transaction technology itself can also improve bank performance, and evidence shows that heterogeneity in retail payment instruments is associated with enhanced bank performance. Similarly, a higher usage of electronic retail payment instruments seems to stimulate banking business. We also show that retail payment services have a more significant impact on savings and cooperative bank performance although they have a positive influence on the performance of commercial banks. Additionally, findings reveal that impact of retail services on bank performance is dominated by fee income. Finally, an effective payment service market is found to be associated with higher bank stability. Our findings are robust to different regression specifications. The results may also be informative for the industry when reconsidering its business models in the light of current financial market developments.

Keywords: retail payment, bank performance, cost and profit efficiency

JEL classification: G21, G28.

1. Introduction

It is widely recognised that safe and efficient retail payment systems enhance the effectiveness of the financial system, boost consumer confidence and facilitate the functioning of commerce (BIS, 2003). Conceptionally, payment systems are coined as being two-sided markets (Rochet and Tirole, 2006). Virtually every economic transaction involves the use of a payment instrument, such as cheques, electronic funds transfers, etc. (Berger et al., 1996). Over the past decades, the payments business has witnessed important ongoing challenges and opportunities, comprising regulatory changes, increased consolidation and competition and technological advances. As a result, today's banking and payments business differs substantially from that in the past. At present, these developments are being intensified by the current financial market turmoil, which may trigger fundamental changes in the business model for retail banking and payments.

In Europe, the European banking industry joined forces to achieve a fully integrated market for retail payment services in the euro area: the Single Euro Payments Area (SEPA). The realisation of SEPA is important for two reasons. First, it contributes to creating a competitive and integrated European retail payment market, thereby fostering innovation and growth in the retail banking sector. Second, SEPA will also contribute to a smooth and safe underlying payment infrastructure, providing the basis for stable transactions at the retail banking level, and thereby contributing to the safeguarding of financial stability.[3,4]

The importance of retail banking and payments is also likely to revive against the background of the current ongoing financial market turmoil. In particular, at a time when other sources of income for banks are more volatile, payment services will contribute to banks' business as banks can count on the reliable and regular revenues generated by payment services.

[3] With SEPA, there is no difference in the euro area between national and cross-border retail payments. SEPA further aims to turn the fragmented national markets for euro payments into a single domestic one. Thus, SEPA will enable customers to make and receive cashless euro payments throughout the area from and to a single bank account, using a single set of payment instruments.

[4] The SEPA initiative also involves the development of common financial instruments, standards, procedures and infrastructure to enable economies of scale. This should in turn reduce the overall cost to the European economy of making payments. These costs can be quite substantial. See Section 2 for a review of the estimates of such costs.

Moreover, although it is understandable that banks are currently allocating resources to fighting the current crisis, it should not be forgotten that banks ought to prepare for carrying out their core tasks when "normal times" have returned. In this respect, the turmoil may cause banks to reconsider their business models and concentrate on their public role: namely to provide innovative and efficient pan-European payment services, as well as offering current accounts and business and personal loans.

The literature on the topic to date is sparse. The pioneering work in this field concludes separate perspectives on retail banking and payments. Capgemini and European Commission (2008), Kemppainen (2003, 2008), and Schmiedel (2007) have stressed the benefits and potential of SEPA. At the micro level, Campbell et al. (2009), Lusardi and Tufano (2009) and Scholnick (2009) focus on the role of payment innovations and services for consumer finance and consumer's spending patterns.[5] Kahn et al. (2005) show the impact of bank consolidation on consumer loan interest rates. Hirtle and Stiroh (2007) document a "return to retail" for US commercial banks, with managers and analysts emphasizing the relative stability of consumer-based business lines. Most recently, Puri et al. (2009) stress the global nature of commercial banking and find that banking lending patters have changed in response to the financial crisis. Other contributions (DeYoung, 2005; DeYoung and Rice, 2004) emphasize the importance of internet-based business and non-interest income on banks financial performance. None of these studies however are directly linked to retail payment technology, instruments, and practices by financial institutions and their impact on bank performance. As recognised by Kahn and Roberts (2009) empirical work on payments is still in its infancy, while a number of studies has led to interesting theoretical insights and potential policy prescriptions. This is the first systematic attempt to fill this gap in the literature by providing a combined and integrated view of the importance and significance of retail payment services for banks and banking industry.

[5] For a comprehensive review of earlier literature refer to Hancock, D. and D. Humphrey (1998). In addition, see Saunders and Scholnick (2006) and Kahn and Roberts (2009) for an overview of new frontiers and topics relevant to payment and settlement systems.

Specifically, it examines the linkage between the provisions of retail payment services and performance for EU banks from 2000 to 2007.

Based on the country-level retail payment service data from across 27 EU markets, evidence confirms that banks perform better in countries with more developed retail payment services, as measured by accounting ratios and profit and cost efficiency scores.[6] This relationship is stronger in countries with more retail payment transaction equipment, like ATMs and POS terminals. Retail payment transaction technology itself can also improve bank performance and heterogeneity among retail payment instruments is associated with enhanced bank performance. Likewise, a higher usage of electronic retail payment instruments seems to stimulate banking business. We also show that retail payment services have a more significant impact on savings and cooperative bank performance although they have a positive influence on the performance of commercial banks. Additionally, findings reveal that impact of retail services on bank performance is dominated by fee income. Finally, an effective payment service market is found to be associated with higher bank stability.

The paper proceeds as follows. Section 2 outlines the importance of retail payment services and describes how it may impact bank performance and consequently develops a set of research questions to be tested in the paper. Section 3 describes the empirical methodology and summarises the data. Section 4 reports the empirical results. The final section contains a summary and conclusion.

[6] The EU provides a very good testing ground for the link between retail payments and bank performance because the current retail payment infrastructure in the European Union is still fragmented and largely based on traditional national payment habits and characteristics (Kemppainen, 2003 and 2008).

2. Retail payments: New research questions

Payment services are an important part of the banking industry, accounting for a significant part of its revenues and operational costs. It is also considered as the backbone of banking activities as it is significantly associated with increased market share of other bank business, e.g. the provision of credit and the evaluation of associated risks [Boston Consulting Group (BCG), 2009]. BCG also reports that payments business accounts for 30-50 percent of bank revenues, and is actually considered the most attractive element of banking business, in terms of income generation, growth rates, and relatively low capital needs. Hirtle and Stiroh (2007) find a significant link between retail focus by the U.S. banks (retail loan and deposit shares and extent of branching network) and bank stability although such focus also resulted lower return.

We argue that effective payment services are important in helping banks to establish long-term relationships with their customers, both private individuals and corporate clients. These services are strongly linked to other banking services, e.g., deposits, as customers prefer to deposit money into a system in which they can obtain a good payment service (Kemppainen, 2003, 2008). Against this background, we hypothesize that banks perform better in countries with a more developed retail payments business.

From an economic perspective, efficient and safe payment systems are important insofar as they facilitate real and financial transactions in advanced economies. Their production is subject to economies of scale due to the significant investment in infrastructure needed to start the operation (large fixed costs) and the relatively small marginal cost of services provided using the existing infrastructure. Bolt and Humphrey (2007) provide evidence that standardisation of retail payment instruments across the euro area is likely to result in economies of scale in payment services in Europe. Similar economies of scale effects are to be gained in the European payment processing industry (Beijnen and Bolt, 2009).

Berger and DeYoung (2006) show that technological progress has facilitated the geographic expansion of the banking industry. Specifically, ATMs, POS terminals and similar

technologies can potentially reduce the costs of asset convertibility for households over time (Berger et al., 1996). Carlton and Frankel (1995) reported higher volumes and lower costs after the merger of competing ATM systems. Analysing customer switching effects, Massoud et al. (2006) find that higher ATM surcharges result in a greater market share of deposits of larger banks and a lower market share for smaller banks. The distribution network of payment services plays a crucial role as it attracts customers to the bank and generates more revenue in retail banking and other related business lines. At the same time, these retail payment transaction technologies reduce the labour cost for banks and have the potential to reduce the costs of handling cash. Columba (2009) shows that transaction-technology innovation, i.e. the diffusion of ATM and POS technologies, has a negative effect on the demand for currency in circulation, while the overall effect on M1 is positive. In other words, transaction technologies and sophistication, e.g. ATM and POS networks, help banks to improve their overall performance. Amromin and Charkravorti (2009) show that demand for small-denomination currency decreases with greater debit card usage and with greater retail market consolidation.

Besides the direct impact on bank performance, we also predict that retail payment transaction technologies have an intensifying effect on the relationship between retail payment services and bank performance. Advanced retail payment transaction technologies will foster innovation and growth in the retail banking sector. This will further create more value associated with retail payment services for banks. On the other hand, if more retail payment transactions have been done through ATMs or POS instead of retail payments offices, banks can be more cost efficient and obtain more profit. We believe that retail payment services have a larger impact on bank performance in countries with a relatively high adoption of retail payment transaction technologies.

There are several varieties of retail payment instruments, like credit transfers, direct debits, card payments, e-money purchases, cheques, etc. Competition in retail payment markets

has commonly been seen as an important contributor to efficiency (BIS, 2003).[7] In a very competitive retail payment market, consumers have more choices to complete retail payment transactions and to make transactions more quickly and efficiently. Competition among retail payment instruments may also encourage retail payment providers to improve their service. Additionally, a greater variety of retail payment instruments may result in more retail banking innovations. Therefore, we hypothesise that heterogeneity among retail payment instruments helps banks to improve their performance.

The European payments industry has undergone considerable change as electronic payment has increasingly gained popularity. New payment technologies, particularly newer electronic methods for consumer payments that may replace older paper-based methods, can potentially speed up settlement and reduce the financial costs of making payments for bank customers (Berger et al., 1996; Humphrey et al., 2006; Humphrey and Vale, 2004). Intuitively, the total cost of making payments for society might be expected to be high. In an early study, the costs have been estimated to amount to as much as three percent of GDP (Humphrey et al., 2003). A number of recent central bank studies provide more detailed estimates, especially where European countries are concerned. Depending on the chosen approach and methodology, the estimated total costs in connection with the production of payment services are in between 0.49 and 0.74 percent of GDP in 2002 (Brits and Winder, 2005; Banque Nationale de Belgique, 2005; Gresvik and Owre, 2003). These figures clearly show that costs related to payment activities are not negligible. Moreover, in general, there is a positive relationship between the use of electronic payment methods and the efficiency of the payment system.

Significant potential benefits from adopting technological innovations can be expected, but typically there are extraordinary costs associated with the introduction of new payment methods. Humphrey et al. (1996) find that payment instrument choices strongly depend on bank customers' learning costs. In this paper, we examine whether the physical distribution of

[7] Scholnick et al. (2007) provides a survey of the literature on credit cards, debit cards and ATMs.

payment services becomes increasingly less important from a payments perspective with the emergence of electronic payment methods and channels. Specifically, we investigate the possible significant association between the promotion and growth of electronic payment products and services and bank performance.

3. Methodology and data

3.1 Empirical model

As mentioned earlier, the estimation model used in this paper investigates the importance of retail payment services for overall bank performance and efficiency over time and across European countries. To test the above-outlined hypothesis, we employ a series of ordinary least square regressions to capture this potential relationship. We investigate the relationship using a number of multivariate regressions incorporating different control variables that are pertinent to bank performance measures. The baseline model is portrayed in Equation (1).

$$PERFORMANCE = a_0 + b_1 TRANPOP + b_2\, ATMPOP + b_3\, OFFICEPOP + b_4\, STDROA + b_5\, GDPGROWTH + b_6 EURO + \varepsilon_{it} \quad (1)$$

Bank performance (PERFORMANCE) is measured first using two alternative accounting ratios, namely ROA and ROE. We also trace bank efficiency, measured using profit and cost efficiency scores, as alternative performance variables. We use log (number of transactions/population) to measure the volume of country-level retail payments business (*TRANPOP*). We use log (number of ATMs/population) to measure the level of the adoption of retail payment transaction technologies (*ATMPOP*). Log (number of retail payments offices/population), log (GDP growth) and Euro area country dummy are used in the model estimations as control variables (*OFFICEPOP*, *GDPGROWTH*, and *EURO*). The standard

deviation of ROA[8] over the sample period is also used as a control variable (*STDROA*) to measure bank risk and stability. The regression models include dummy variables to account for fixed country-specific and year effects.[9]

To test the moderation effect of retail payment transaction technologies on the relationship between retail payment services and bank performance, we add an interaction term between log (number of transactions/ population) and log (number of ATMs / population) (*TRANATMPOP*) to the equation (1). The estimated equation is:

$$PERFORMANCE = a_0 + b_1 TRANPOP + b_2 ATMPOP + b_3 OFFICEPOP + b_4 STDROA + b_5 GDPGROWTH + b_6 EURO + b_7 TRANATMPOP + \varepsilon_{it} \quad (2)$$

To consider the impact on performance of the heterogeneity of retail payment instruments, we add the Herfindahl index of payment instruments as another control variable (*HERFINDAHLINSTRU*) to equation (2). The estimated equation is:

$$PERFORMANCE = a_0 + b_1 TRANPOP + b_2 ATMPOP + b_3 OFFICEPOP + b_4 STDROA + b_5 GDPGROWTH + b_6 EURO + b_7 TRANATMPOP + b_8 HERFINDAHLINSTRU + \varepsilon_{it} \quad (3)$$

To consider the impact on performance of the percentage of electronic retail payment instruments, we add percentage of paper-based retail payment instruments as another control variable (*PAPERINSTRU*) to equation (2). Because higher percentage of paper-based retail payment instruments means more adoption of cheques and is positively correlated with herfindahl index of payment instruments, we do not control for herfindahl index of payment instruments in the estimation to avoid potential multicoliniarity problems. The estimated equation is:

[8] We report only the results where ROA standard deviations are used as a proxy for risk. Results are similar equally robust if the variable is replaced by the standard deviation of ROE.
[9] Second-stage bank efficiency regressions, when we avoid country and year effects, which have been adjusted for in the first-stage efficiency estimates, produce qualitatively similar results.

$$PERFORMANCE = a_0 + b_1 TRANPOP + b_2 ATMPOP + b_3 OFFICEPOP + b_4 STDROA + b_5 GDPGROWTH + b_6 EURO + b_7 TRANATMPOP + b_8 PAPERINSTRU + \varepsilon_{it} \quad (4)$$

The data used in this study come from a variety of sources. The primary data source for the variables related to the bank balance sheet and income statements, i.e. the Return on Assets (ROA) and Return on Equity (ROE) ratios, is the BankScope database produced by the Bureau van Dijk. Using accounting return data, we calculate bank stability measures such as standard deviation of ROA, standard deviation of ROE, and Z-score. The profit and cost efficiency measures are relative bank performance (estimation methodology is briefly discussed in the next section). Using data on individual payment instruments, i.e. credit transfers, direct debits, card payments, e-money purchases, cheques, and other payment instruments, we calculate the herfindahl index of payment instruments to measure heterogeneity among retail payment instruments. We also calculate percentage of paper-based retail payments, which is the importance of cheque payments relative to the total number of non-cash retail payments.

Macroeconomic data on the general economic situation, i.e. GDP growth, were taken from the World Development Indicators Database. The payment statistics have been collected from the European Central Bank's Statistical Data Warehouse and cover important aspects of payment transactions in EU countries, such as information on payment instruments and the payment transaction channels and technology. For the purposes of comparison, retail payments related variables are scaled by population in the regressions.[10]

The total sample includes 3,370 commercial banks, savings banks and cooperative banks, and 14,987 bank-year observations from 27 European countries for which annual data were available during the period 2000-07. All the data, variables and sources are described in detail in Appendix A. The sample constitutes over 80 percent of total banking assets of all respective

[10] The results reported in this paper are based on retail payment services and transaction technology variables scaled by population. The results using variables scaled by GDP are qualitatively the same and available upon request from the authors.

European countries and incorporate all major and important financial institutions. In the initial estimations, we incorporate all types of financial institutions where commercial banks constituted 23% followed by savings banks 24% and cooperative banks 53%. German banks dominate the sample with 55 percent of the sample observations and therefore we attempt additional robustness tests of our estimations excluding German banks.

Table 1 reports the descriptive statistics of the sample. As shown in Panel A, eighty eight percent of the bank-year observations are from the euro area. The bank performance and stability measures are consistent with those reported in other studies. Moreover, the European payment landscape can be characterised by substantial variation in the use of retail payment services, as illustrated in Panel B, for example, by the relatively high standard deviation of the total number of retail payment transactions scaled by the population, of about 416,442 per one million persons. Similarly, the adoption of retail payment transaction technologies shows relatively strong asymmetries across Europe, as demonstrated by relatively high standard deviations for the numbers of ATMs scaled by the population. The mean value of the relative importance of paper-based payments is about 9.97%, suggesting that electronic retail payment instruments are increasingly used and widely adopted non-cash payment instruments. The mean value of the herfindahl index for the different payment instruments is 0.40. This implies that consumers have a wide range of options as to how to make their retail payments.

3.2 Efficiency estimates

Although the accounting measures are informative and well-established measures of bank performance, we also use relative efficiency measures – profit and cost efficiency using stochastic frontier analysis (SFA) – as alternative performance variables. SFA is considered as the most robust estimates of relative performance compared to other similar statistical methods such as Data Envelope Analysis (Berger and Mester, 1997, Kumbhakar and Lovell, 2000). In this study, efficiency measures are likely to better reflect and capture the effects of retail payment services, such as customer service, product variety, etc. Once estimated, these

efficiency scores are then used as dependent variables to investigate further on the impact of retail payment services on bank performance.

Because the frontier specifications used in this paper are similar to those in the existing literature, we provide only a brief summary of the prominent features as follows.[11]

The empirical model to estimate the efficiency scores is the following:

$$PROFIT_{it}(COST_{it}) = f(X_{it}, Y_{it}, N_{it}) + \varepsilon_{it} \quad (5)$$

where PROFIT (COST) represents total profits (total costs), which are a function of several outputs X, input prices Y and fixed effects for years and countries N. The error term ε_{it} is a random disturbance term that allows the profit (cost) function to vary stochastically. The random disturbance term has two components, v_{it}, which represents the random uncontrollable factors that affect total profits (costs), and u_{it}, which represents the controllable factors, such as the firm's technical and allocative efficiency, that are under the control of the firm's management. Decomposing the error term yields:

$$PROFIT_{it}(COST_{it}) = f(X_{it}, Y_{it,} N_{it}) + v_{it} - u_{it}(v_{it} + u_{it}) \quad (6)$$

We use a similar specification for the profit and cost function, except that under the frontier approach managerial or controllable inefficiencies increase (decrease) costs (profit) above (below) frontier or best practice levels. Therefore, the positive (negative in a profit function) inefficiency term, u_{it}, causes the costs (profit) of each firm to be above (below) the frontier. The v_{it} terms are assumed to be identically and normally distributed, with zero mean and variance equal to δ_v^2. The technical inefficiency u_{it} terms are non-negative random variables that are distributed normally but truncated below zero. We include both country effects and year

[11] For a review of the use of stochastic frontier analysis to estimate bank efficiency, see, for example, Berger et al. (2000), Hasan et al. (2003).

effects in the estimation of the efficiency frontier, because banking efficiency may be influenced by differences in structural conditions in the banking sector and in general macroeconomic conditions across countries and over time. Following the existing efficiency literature, we employ a translog specification for the profit and cost function and make standard symmetry and homogeneity assumptions.

The primary source of data on bank balance sheets and income statements is the BankScope database. We measure total profit as the net profit earned by the bank. To avoid having a negative net profit for any bank observation, we add a constant amount to profit in all cases. Total costs are measured as the sum of interest and non-interest costs. While there continues to be debate about how to define the inputs and outputs used in the function, we follow the traditional intermediation approach of Sealey and Lindley (1977). The output variables, *X*, are total loans, total deposits, liquid assets and other earning assets. The input variables, *Y,* are interest expenses divided by total deposits and non-interest expenses divided by fixed assets. To make sure that our estimates are not biased by outliers, all the variables are winsorised at the 1st and 99th percentiles. The descriptive statistics for the basic variables used in the profit and cost efficiency estimations are reported in Panel A of Table 2.

Following Berger and Mester (1997), cost, profit and input prices are normalised by non-interest expenses divided by fixed assets to impose homogeneity. Cost, profit and output quantities are normalised by total earning assets, because the variance of the inefficiency term might otherwise be strongly influenced by bank size. Normalisation also facilitates interpretation of the economic model.

The summary statistics for the stochastic frontier efficiency estimates are given in Panel B of Table 2.[12] These statistics include the ratio of the standard deviation of the inefficiency component of the disturbance to that of the random component (σ_u / σ_v), the standard deviation of the composite disturbance (σ), and the proportion of the variance in the overall disturbance

[12] The estimates of the cost and profit function coefficients are available upon request from the authors.

that is due to inefficiency, $\lambda = \sigma_u^2 / \sigma^2$. Panel B of Table 2 indicates that most of the variation in the disturbance of best practice is due to technical inefficiency rather than random error. The mean cost efficiency of 0.74 suggests that about 26% of costs are wasted on average relative to a best-practice firm. The mean profit efficiency of 0.68 implies that about 32% of the potential profits that could be earned by a best-practice firm are lost to inefficiency. These figures are well within the observed range from other efficiency studies. The standard deviation of the profit efficiencies is about 11.5 percentage points, suggesting that efficiencies are quite dispersed. The cost efficiencies are distributed with a standard deviation of 11.4 percentage points. In Panel C of Table 2, When we see the cost efficiency score and profit efficiency score by euro area and non euro area, we find that banks in euro area on average are more cost and profit efficient than those in non euro area. We also find that efficiencies of banks in non euro area are more dispersed than those in euro area.

4. Results

In this section, we first outline recent trends in retail payment systems in the EU. Then we report the results for the impact of retail payment services on bank performance.

4.1 Trends in retail payment systems

Over the past decade, a number of important trends have affected retail payment systems in the EU. One such trend is the rapid consolidation of banks providing retail payment services. Figure 1 shows that the number of retail payments institutions and the number of offices declined during the sample period, from 2000 to 2007. This suggests that retail payments providers are consolidating as they seek economies of scale. Given a relatively high pair-wise correlation between the numbers of retail payments institutions and offices, we only control for the number of offices in our regression. The results do not qualitatively change when the number of retail payments institutions is used instead. Moreover, as seen in Figure 2, the total numbers of different retail payment equipments, like ATMs and POS terminals, are increasing over time

with a similar trend.[13] This implies that in the EU, a higher degree of adoption of retail payment technology is being used to replace traditional retail branches.

As seen in Figure 3, the total value and total number of retail payment transactions increased constantly, with an average annual growth rate of about 6% over the entire sample period.[14] This suggests that retail payment services have substantial growth opportunities and business potential. Another important trend is the shift from paper to electronic payment. As seen in Figure 4, consumers' use of electronic payments has grown significantly in recent years, while paper-based retail payments, i.e. cheque payments, have declined sharply as a proportion of total non-cash payment volumes.

4.2 The impact of retail payments on bank performance

In the empirical estimations, we use the ROA and ROE ratios as dependent variables to examine the importance of retail payment services on bank performance. The estimation parameters are shown in columns 1 and 2 of Tables 3, 4, 5 and 6. To investigate the effect of retail payment systems on bank efficiency, we take the cost and profit efficiency scores for each bank observation as the dependent variables in regressions. The *TRANPOP*, as measured by Log (number of transactions/population), enters the estimations as an explanatory variable. The regression coefficients are reported in columns 3 and 4 of Tables 3, 4, 5 and 6. All regression models include dummy variables to account for fixed country-specific and year effects.[15] For simplicity in the reporting, the coefficients of these variables are suppressed. Standard errors are clustered at the country-level to capture the potential correlation of bank performance within the same country.

As an overall result, we observe a positive relationship between total number of transactions to population and bank performance, as reported in Table 3. This finding is

[13] We only control, in our regression, for the number of ATMs. There is no qualitative change in the results when the number of POS terminals is used instead. The latter results are available upon request.
[14] The total value of retail payment transactions is inflation-adjusted to the base year 2000.
[15] Second-stage bank efficiency regressions, when we avoid country and year effects, which have been adjusted for in the first-stage efficiency estimates, produce qualitatively similar results.

consistent for alternative model specifications considering both accounting and efficiency measures. The magnitude of the *TRANPOP* coefficient suggests that changes in total number of retail payments transactions have a significant effect on bank performance. For instance, a 10% increase in the number of retail payments transactions to population implies a 1.08% increase in ROA, a 0.56% increase in ROE, a 0.06% increase in cost efficiency and a 0.45% increase in profit efficiency. Retail payments technology, as measured by Log (number of ATMs/Population), has a positive effect on bank performance. The magnitude of the *ATMPOP* coefficient implies that the impact of changes in total number of ATMs to population on bank performance is economically significant. For instance, a 10% increase in the number of ATMs to population implies a 1.29% increase in ROA, a 0.38% increase in ROE, a 0.53% increase in cost efficiency and a 0.08% increase in profit efficiency. There is no clear relationship between number of retail payments offices to population and bank performance. Bank risk, as measured by standard deviation of ROA, is positively associated with accounting measures of bank performance and efficiency measures. Another interesting result is that banks based in the euro area appear to perform better.

To examine whether the relationship between retail payment services and bank performance is stronger in countries that have widely adopted retail payments technologies, we incorporate in the estimation model a term (*TRANATMPOP*) for interaction between *TRANPOP* and *ATMPOP*. As seen in Table 4, the coefficient of the interaction term *TRANATMPOP* is significantly positive for all different bank performance measures. This suggests that retail payment technologies can facilitate retail banking innovations and add more value to retail payment services.

To investigate whether competition and an improved choice of retail payment instruments translates into improved bank performance, we incorporate the *HERFINDAHLINSTRU*, as measured by log (Herfindahl index of payment instruments), in the regression. The results, as seen in Table 5, confirm this relationship, since the coefficient of the *HERFINDAHLINSTRU* is significantly negative across the four different bank performance

measures. The magnitude of the *HERFINDAHLINSTRU* coefficient suggests that changes in heterogeneity in retail payments instruments have a significant effect on bank performance. For instance, a 10% increase in Herfindahl index for payment instruments implies a 0.34% decline in ROA, a 0.16% decline in ROE, a 0.03% decline in cost efficiency and a 0.10% decline in profit efficiency. Chakravorti and Roson (2006) study competition among payment networks providing different payment instruments and find similar results.

Moreover, the significant negative coefficient of the *PAPERINSTRU*, reported in Table 6, suggests that greater use of electronic payment instruments can improve bank performance. The magnitude of the *PAPERINSTRU* coefficient implies that the impact of changes in percentage of electronic payment instruments is economically significant. For instance, a 10% decline in the percentage of paper-based retail payments implies a 5.66% increase in ROA, a 2.06% increase in ROE, a 1.35% increase in cost efficiency and a 1.47% increase in profit efficiency.[16]

4.3 Commercial bank and non-commercial bank sub-samples

Commercial banks are relatively large and are able to conduct the full range of banking activities. However, they tend to specialise in investment banking, asset management and trust business. Savings and cooperative banks tend to be concentrated in their home area, where they compete with commercial banks. They focus more on retail banking and their market share of retail business is higher. In this section, we examine whether our previous results are influenced by the difference between commercial and non-commercial banks.

We split our sample into a commercial bank sub-sample and a non-commercial bank sub-sample. As seen in Table 7, both commercial and non-commercial bank performance is higher in countries with a more developed retail payment business. However, the coefficient of *TRANPOP*

[16] This finding is also supported by earlier studies. For example, Bolt et al. (2008) provide evidence that given the large resource cost of a country's payments system, shifting from paper to electronic payments can entail substantial cost savings and social benefits. Similarly, Humphrey et al (2006) and Humphrey and Vale (2004) report that banks' average cost has been affected by the on-going shift from expensive paper-based payment instruments (checks, paper giro transactions) to lower cost electronic payment substitutes (debit cards, electronic giro payments).

in the regressions for savings and cooperative banks is about twice as that in the regressions for commercial banks. These results imply that retail payment services have a more significant impact on savings and cooperative bank performance, which have a stronger focus on retail banking business.

4.4 Interest income and non-interest income

In this section, we examine through which specific channel payment services contribute to bank performance. Banks' income arises mainly from two sources: lending and non-interest activities. Retail payment services have a direct impact on banks' non-interest income, such as fee income arising from payment services and bank account management. Non-interest income has a very important impact on bank performance. In Europe, non-interest income increased from 26% to 41% of total income between 1989 and 1998 (ECB, 2000). Retail payment services also have some impact on banks' lending business by attracting more deposits. Banks can earn interest income on debit and credit balances arising in relation to services and products for making payments. When borrowers obtain financing from banks they also worry about how to repay it. A convenient retail payment service can facilitate repayment and attract more customers to borrow money from banks. In addition, interest income may be correlated with non-interest income because of possible cross-selling of different products to the same customer (Stiroh, 2004; Stiroh and Rumble, 2006).

As seen in Table 8, we re-run our baseline regression using net interest income scaled by average total assets (average total equity) and net commission and fee income also scaled by average total assets as dependent variables. The evidence shows that the relationships between retail payment services and net interest income and between retail payment services and net commission and fee income are both significantly positive. However, the coefficient of *TRANPOP* in the regressions with net commission and fee income as dependent variables is about one hundred percent larger than that in the regressions with net interest income as

dependent variables. These results suggest that retail payment services have a more significant impact on net commission and fee income.

4.5 The impact of retail payments on bank stability

The conventional wisdom argues that retail payments business is less volatile than other forms of banking activities like trading or underwriting. Usually, high-risk activities will demand a premium in the form of higher returns, although the link between risk and return has not been as tight as theory predicts in practice (Fama and French, 2004). In this section, we want to examine the impact of retail payments business on bank stability. The estimated model is as below:

$$RISK = a_0 + b_1 AVETRANPOP + b_2\ AVEATMPOP + b_3\ AVEOFFICEPOP + b_4\ AVETOTALASSET + b_5 AVEGDPGROWTH + b_6 EURO + \varepsilon_{it} \quad (7)$$

Three standard measures of risks, based on accounting data and determined for each bank throughout the period, are used as dependent variables in the regression: Standard deviation of ROA, standard deviation of ROE, and Z-score, which represents the probability of failure of a given bank and higher values of Z-scores imply lower probabilities of failure (See Boyd and Graham, 1986 for details)[17]. We obtain average values of number of transactions / population, number of ATMs / population, number of offices / population, and GDP growth for each country throughout of the period. The logarithms of these average values are used as independent variables (*AVETRANPOP, AVEATMPOP, AVEOFFICEPOP*, and *AVEGDPGROWTH*). We also calculate mean values of total assets for each bank throughout of the period. The logarithm of this mean value is used as another control variable (*AVETOTALASSET*). Euro zone country dummy (*EURO*) is included in the regression. The regression models include dummy variables

[17] Z-score= (100+ average ROE)/ Standard deviation of ROE where ROE and Standard deviation of ROE are expressed in percentage.

to account for fixed country-specific effects. The results in Table 9 show that banks in the countries with more developed retail payments business present a lower level of risk. More adoptions of ATMs have a positive impact on banks' stability. So is the higher number of retail payments offices per capita. These results suggest that retail payments business offers a more attractive risk/return combination and create more stable revenue than other bank business lines.

4.6 Robustness tests

We also run a set of robustness checks on the effects of retail payment business on bank performance, which are not shown for the sake of brevity. Specifically, we run bank performance regressions on the sample without German banks to ensure that our results are not biased by the large number of German cooperative and saving banks in our sample. The results are similar to the reported results, i.e., we observe a significant positive relationship between retail payment services and bank performance.

We also use an efficiency ranking based on an ordering of the banks' efficiency levels for each of the sample years (Berger et al. 2004). The ranks are converted to a uniform scale of 0-1 using the formula $(order_{it}-1)/(n_t-1)$, where $order_{it}$ is the place in ascending order of the i^{th} bank in the t^{th} year in terms of its efficiency level and n_t is the number of banks in year t. Although efficiency levels are more accurate than rankings, efficiency rankings are more comparable across time because the rankings for each year follow the same distribution, whereas the distributions of efficiency levels might vary over time. Our estimates show that our main results still hold, i.e. banks are more efficient in countries with a more developed retail payments business. Further, we re-estimate all the profit and cost efficiencies using non-interest expenses disaggregated into separate prices for labour and capital and find that our results are not significantly changed. These robustness checks are available upon request from the authors.

5. Conclusion

The EU is undergoing a dramatic change in its retail payment system with the creation of a unified payment zone. This study is the first, to our knowledge, to provide a combined and integrated view of the importance and significance of retail payments for bank performance, which can help to better understand the drivers and the impact of the Single Euro Payments Area.

Using country-level retail payment service data across 27 EU markets, we conclude that, in countries with more developed retail payment services, banks perform better, in terms of both their accounting ratios and their profit and cost efficiency. This relationship is stronger in countries with higher levels of retail payment transaction equipment, like ATMs and POS terminals. Retail payment transaction technology itself can also improve bank performance. In addition, we find that competition in retail payment instruments is associated with better bank performance, as is greater use of electronic retail payment instruments. We also show that retail payment services have a more significant impact on savings and cooperative bank performance and banks' non-interest income although they have a positive influence on the performance of commercial banks and banks' interest income. Finally, the evidence shows that retail payment services generate a stable revue for banks and decrease their risk.

Our paper also has policy implications. Our results can be regarded as providing strong support for the Single Euro Payments Area (SEPA) initiative. Our paper also suggests that EU regulators and supervisors should not only endeavour to enlarge the scale of payment systems, but also to develop various retail payment instruments simultaneously, especially electronic payment instruments.

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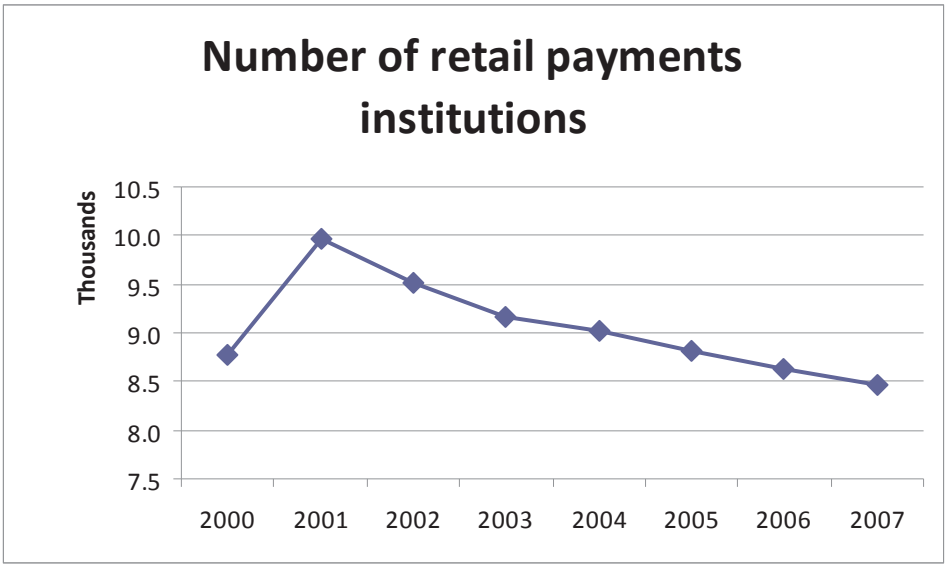
Appendix A: Overview of variables, definitions and data sources

Variables	Definition	Sources
Bank performance measures		
ROA	Return on average total assets	BankScope
ROE	Return on average total equity	BankScope
Cost efficiency scores	Distance from bank's cost to best practice	Computed
Profit efficiency scores	Distance from bank's profit to best practice	Computed
Net interest income / average total assets	(Interest income - interest expense) / average total assets	Computed
Net commission and fee income	(Commission and fee income - commission and fee	Computed
/ average total assets	Expense) / average total assets	
Net interest income / average total equity	(Interest income - interest expense) / average total equity	Computed
Net commission and fee income	(Commission and fee income - commission and fee	Computed
/ average total equity	expense) / average total equity	
Bank stability variables		
Standard deviation of ROA	Standard deviation of ROA for each bank throughout the sample period	Computed
Standard deviation of ROE	Standard deviation of ROE for each bank throughout the sample period	Computed
Z-score	Z-score= (100+ average ROE)/ Standard deviation of ROE where ROE and Standard deviation of ROE are expressed in percentage. Higher values of Z-scores imply lower probabilities of failure	Computed
Other bank-level variables		
Total assets	Total assets	BankScope
AVETOTALASSET	We calculate the mean value of total assets for each bank throughout the sample period and then take the logarithm of it.	Computed
Total profits	Net profit earned by the bank.	BankScope
Total costs	The sum of interest and non-interest costs.	BankScope
Total loans	Total loans	BankScope
Total deposits	Total deposits	BankScope
Liquid assets	Liquid assets	BankScope
Other earning assets	Other earning assets	BankScope
Unit interest cost of deposits	Interest expenses / total deposits	BankScope
Unit price of physical inputs	Non-interest expenses / total fixed assets	BankScope
Retail payments variables		
Number of ATMs	Number of ATMs in a given country	ECB Statistical Data Warehouse
Number of POS terminals	Number of POS terminals in a given country	ECB Statistical Data Warehouse

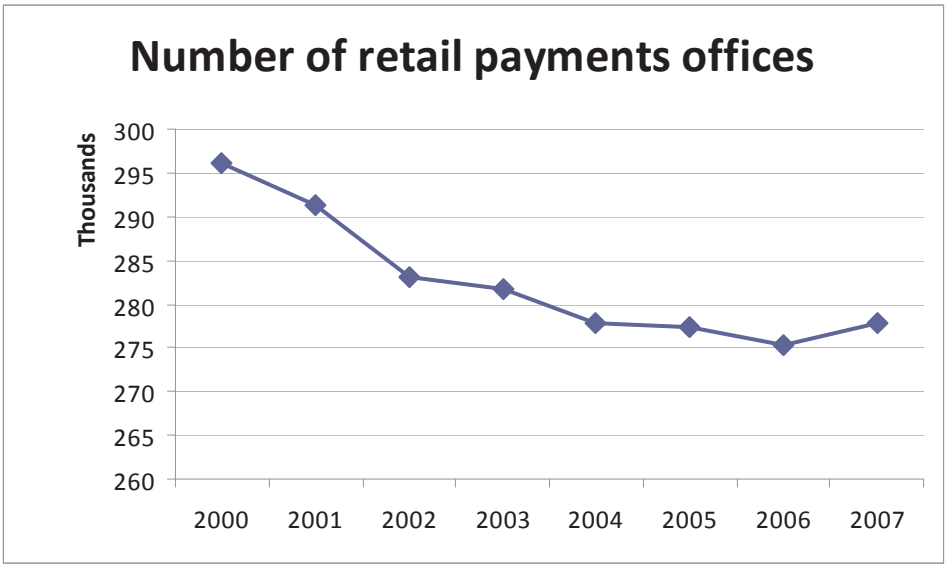
Number of offices	Number of retail payments offices in a given country	ECB Statistical Data Warehouse
Number of institutions	Number of retail payments institutions in a given country	ECB Statistical Data Warehouse
Value of transactions	Total value of retail payment transactions in a given country	ECB Statistical Data Warehouse
Number of transactions	Total number of retail payment transactions in a given country	ECB Statistical Data Warehouse
PAPERINSTRU	Total value of cheque-based transactions / total value of retail payment transactions in a given country	ECB Statistical Data Warehouse
HERFINDAHLINSTRU	Logarithm of concentration ratio of different payment instruments	Computed
TRANPOP	Logarithm of number of transactions scaled by population	Computed
ATMPOP	Logarithm of number of ATMs scaled by population	Computed
OFFICEPOP	Logarithm of number of offices scaled by population	Computed
TRANATMPOP	The interaction term between ATMPOP and OFFICEPOP	Computed
AVETRANPOP	We calculate the mean value of number of transactions scaled by population for each country throughout the sample period and then take the logarithm of it.	Computed
AVEATMPOP	We calculate the mean value of number of ATMs scaled by population for each country throughout the sample period and then take the logarithm of it.	Computed
AVEOFFICEPOP	We calculate the mean value of number of offices scaled by population for each country throughout the sample period and then take the logarithm of it.	Computed
Other variables		
GDPGROWTH	Logarithm of GDP growth	WDI
EURO	Dummy variable takes the value of "1" if bank is located in euro area, "0" otherwise.	ECB website
AVEGDPGROWTH	We calculate the mean value of GDP growth for each country throughout the sample period and then take the logarithm of it.	Computed
Population	Total population in a given country	WDI

Figure 1 Retail payments providers

Panel A presents total number of retail payments institutions in the EU by year. Panel B presents total number of retail payments offices in the EU by year.



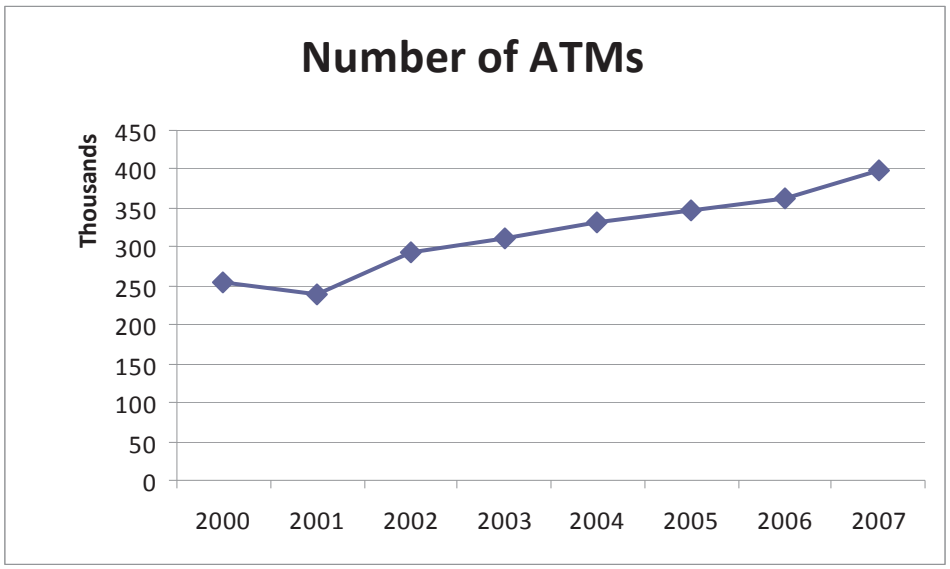
Panel A



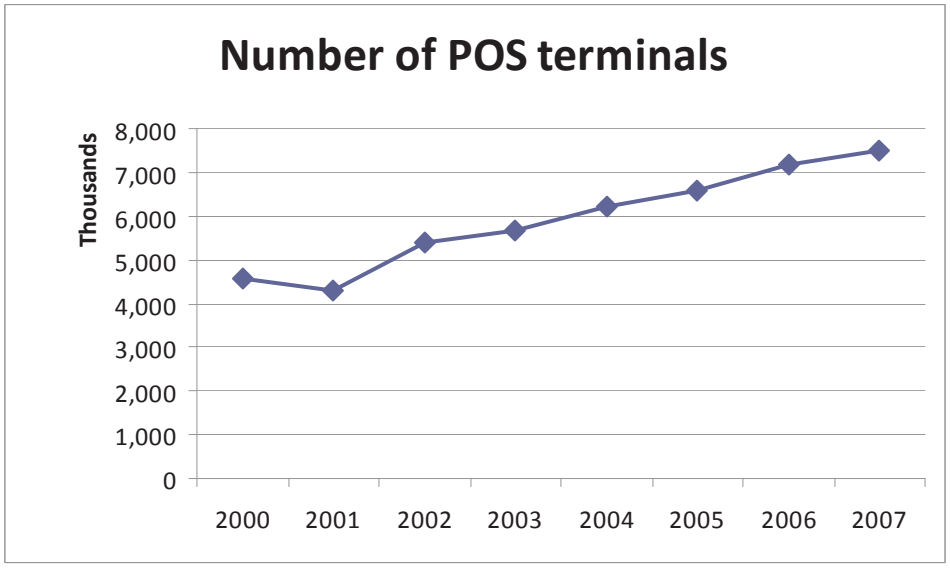
Panel B

Figure 2 Retail payment transaction technology

Panel A presents the total number of ATMs in the EU by year. Panel B presents the total number of POS terminals in the EU by year.



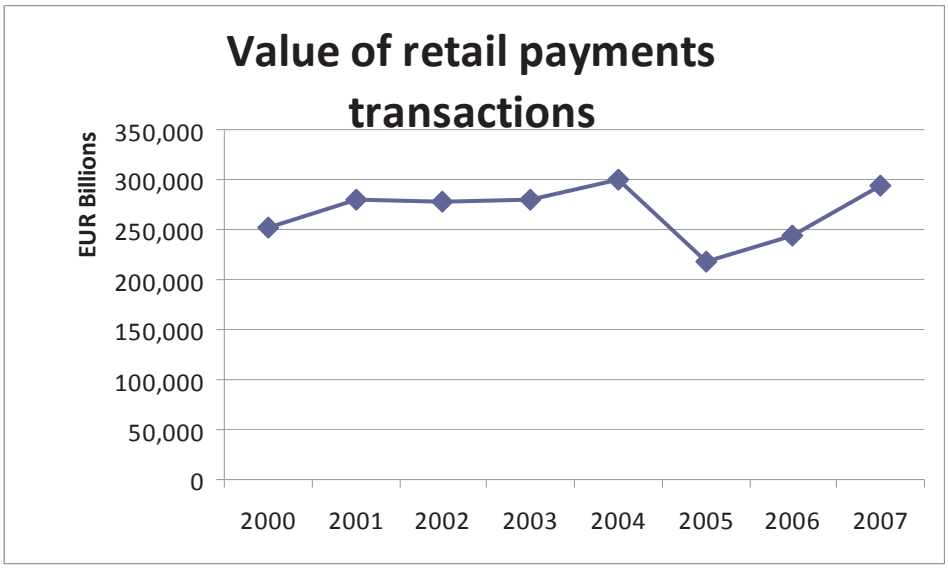
Panel A



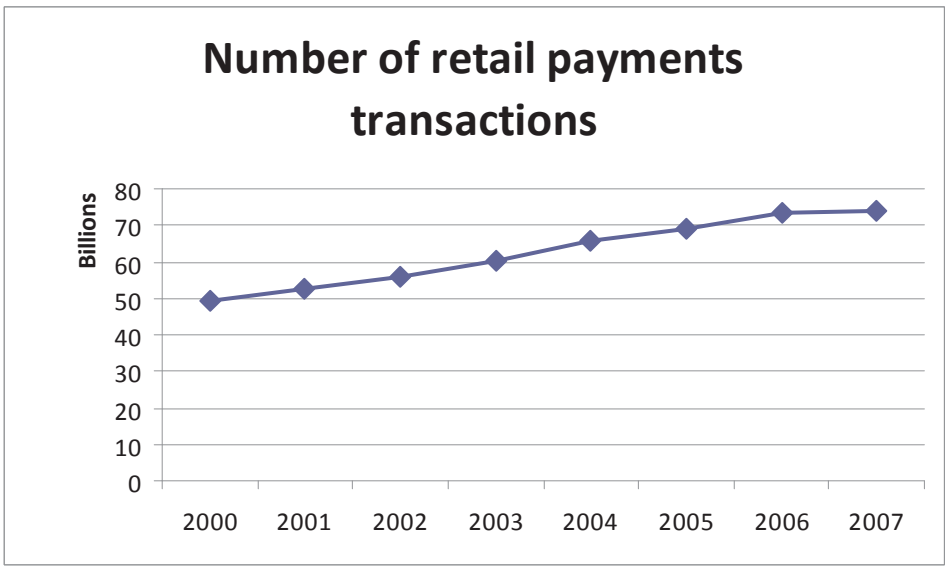
Panel B

Figure 3 Retail payment business

Panel A presents the total value of retail payment transactions in the EU by year. Panel B presents the total number of retail payment transactions in the EU by year. The value of retail payment transactions is inflation-adjusted to the base year 2000.



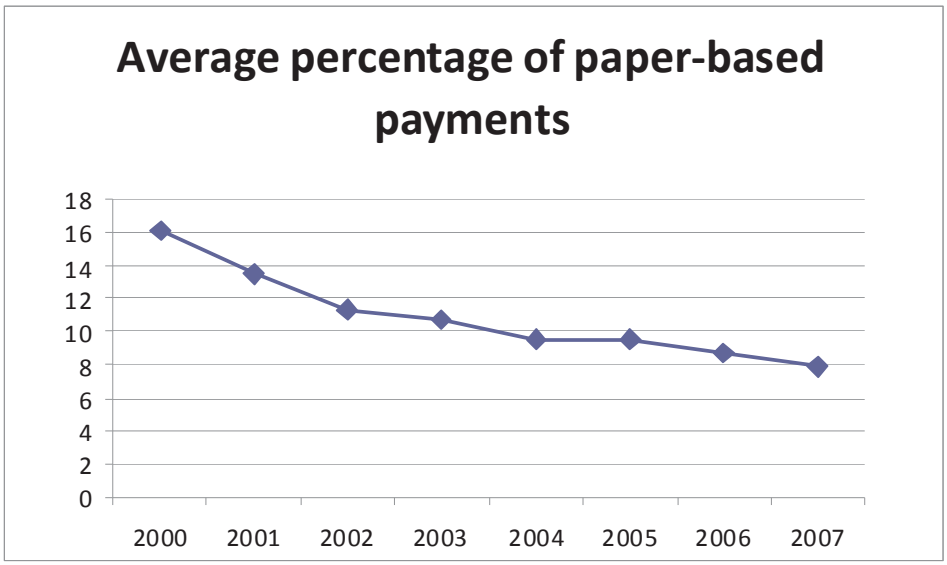
Panel A



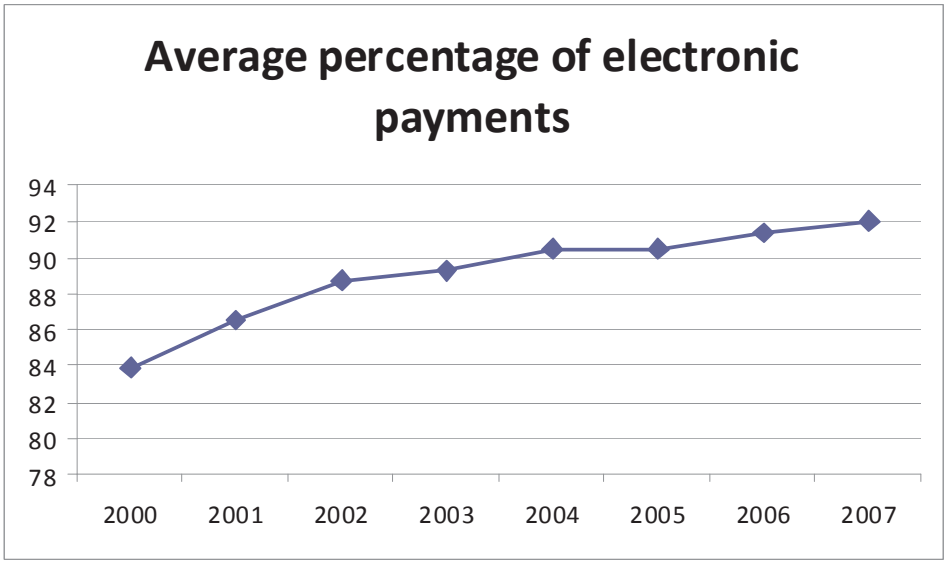
Panel B

Figure 4 Retail payment instruments

Panel A presents the country average percentage of paper-based retail payments in the EU by year. Panel B presents the average percentage of electronic retail payments in the EU by year.



Panel A



Panel B

Table 1 Summary statistics

Panel A of This table presents summary statistics of the firm-level variables for the sample banks. The number of firm-year observations, mean, standard deviation and minimum and maximum values of the variables are reported for the full sample. Panel B of This table presents summary statistics of the country-level variables for the sample banks. The number of country-year observations, mean, standard deviation and minimum and maximum values of the variables are reported for the full sample. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. All financial values are inflation-adjusted to the base year 2000 and winsorised at the 1st and 99th percentiles. The details of the definitions and sources of all the variables are reported in Appendix A.

Panel A

Firm-level Variables	No. of firm-year observations	Mean	SD	Minimum	Maximum
ROA (%)	14,987	0.53	0.91	-10.23	9.26
ROE (%)	14,987	6.78	6.88	-18.82	34.91
Net interest income / average total assets (%)	14,978	2.56	0.87	0.33	5.70
Net commission and fee income / average total assets (%)	14,770	0.84	0.68	-0.08	4.91
Net interest income / average total equity (%)	14,978	11.02	3.62	5.64	18.96
Net commission and fee income / average total equity (%)	14,770	6.55	3.68	-0.68	16.00
Standard deviation of ROA (%)	14,987	0.33	0.45	0.01	3.04
Standard deviation of ROE (%)	14,987	4.41	5.48	0.08	37.22
Z-score	14,987	77.96	153.63	3.07	1246.76
Total assets (EUR billions)	14,987	3.96	14.88	0.05	114.83
EURO	14,987	0.88	0.33	0.00	1.00

Panel B

Country-level Variables	No. of country-year observations	Mean	SD	Minimum	Maximum
Number of transactions / Population (per one million persons)	183	180,752	416,442	838	3,499,614
Number of ATMs / Population (per one million persons)	183	1,040	2101	6	15,524
Number of offices / Population (per one million persons)	183	576	299	39	1,794
GDP growth (%)	183	3.81	2.49	-0.74	11.93
PAPERINSTRU (%)	170	9.97	14.83	0.00	61.46
HERFINDAHLINSTRU	124	0.40	0.10	0.22	0.82

Table 2 Summary of stochastic efficiency estimates

Panel A shows the descriptive statistics for the basic variables used in the profit and cost efficiency estimations. In our translog-based estimations of profit (cost) efficiency levels, the output variables considered are total loans, total deposits, liquid assets and other earning assets, and the input variables are interest expenses divided by total deposits and non-interest expenses divided by total fixed assets. The outputs are normalised by total earning assets. All financial values are inflation-adjusted to the base year 2000 and winsorised at the 1st and 99th percentiles. The details of the definitions and sources of all the variables are reported in Appendix A. Panel B presents summary statistics for the stochastic efficiency estimates. Frontiers were estimated with 14,987 bank observations containing all the data needed for the estimation. σ_u and σ_v are the standard deviations of the composite of the inefficiency and random components of the disturbance, respectively. σ is the standard deviation of the overall disturbance. λ is the proportion of the variance in the overall disturbance that is due to inefficiency. Panel C presents summary statistics of cost and profit efficiency by Euro and Non-Euro areas.

Panel A

Key Variables	Mean	SD	Minimum	Maximum
Profit (cost) (EUR billions)				
Total profits	0.029	0.118	-0.009	0.929
Total costs	0.185	0.679	0.003	5.390
Output quantities (EUR billions)				
Total loans	2.102	7.995	0.017	63.897
Total deposits	2.859	10.737	0.035	86.877
Liquid assets	0.918	4.087	0.005	33.794
Other earning assets	1.407	5.813	0.010	48.362
Input Prices				
Unit interest cost of deposits	0.031	0.012	0.010	0.092
Unit price of physical inputs	1.252	2.045	0.200	15.000

Panel B

	Cost efficiency	Profit efficiency
Log likelihood	-17,245.43	-22,071.18
σ_u / σ_v	3.83	2.38
σ	1.32	0.58
λ	0.93	0.85
Mean efficiency	0.74	0.68
Standard deviation	0.114	0.115

Panel C

Area	Variable	Mean	Std. Dev.	Min	Max
Non euro area	Cost efficiency	0.70	0.17	0.03	0.94
	Profit efficiency	0.63	0.19	0.01	0.94
Euro area	Cost efficiency	0.75	0.10	0.02	0.94
	Profit efficiency	0.69	0.10	0.01	0.93

Table 3 Retail payment services (technologies) and bank performance

We include, but do not report, the coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent Variable	ROA	ROE	Cost efficiency	Profit efficiency
TRANPOP	0.060***	0.403*	0.005***	0.032***
	(2.867)	(1.894)	(3.437)	(5.548)
ATMPOP	0.072***	0.273***	0.041***	0.006***
	(2.927)	(3.092)	(6.687)	(3.629)
OFFICEPOP	0.023	0.023	-0.005	-0.009**
	(0.062)	(0.311)	(-1.254)	(-2.270)
STDROA	0.217***	0.191*	0.033***	0.009***
	(19.756)	(1.704)	(32.295)	(8.681)
GDPGROWTH	0.076***	0.508*	0.012***	0.009***
	(2.928)	(1.907)	(10.138)	(7.300)
EURO	1.935***	1.695***	0.052***	0.055***
	(5.135)	(2.781)	(14.538)	(15.174)
Constant	8.885***	15.262***	0.709***	0.549***
	(8.018)	(8.247)	(24.094)	(18.194)
Adjusted R^2	0.114	0.057	0.094	0.035
No of observations	14,987	14,987	14,987	14,987
* p<0.10, ** p<0.05, *** p<0.01				

Table 4 Moderation Effect of Retail payment transaction technologies on the relationship between retail payment services and bank performance

We include, but do not report, the coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent Variable	ROA	ROE	Cost efficiency	Profit efficiency
TRANPOP	0.027***	0.145***	0.037***	0.031***
	(3.375)	(3.211)	(6.484)	(5.887)
ATMPOP	0.053***	0.774***	0.006	0.026***
	(2.785)	(3.913)	(1.456)	(4.447)
OFFICEPOP	0.008	0.001	0.033	-0.008**
	(0.053)	(0.220)	(0.066)	(-2.097)
STDROA	0.217***	0.191*	0.014***	0.009***
	(19.760)	(1.706)	(11.358)	(8.573)
GDPGROWTH	0.072***	0.470*	0.058***	0.010***
	(2.740)	(1.757)	(15.807)	(8.391)
EURO	1.882***	1.251***	0.065***	0.049***
	(4.982)	(2.659)	(16.317)	(13.003)
TRANATMPOP	0.018**	0.153*	0.003***	0.003***
	(2.074)	(1.681)	(6.550)	(5.680)
Constant	10.522***	16.802***	0.360***	0.859***
	(7.735)	(7.693)	(5.931)	(13.777)
Adjusted R^2	0.114	0.057	0.097	0.038
No of observations	14,987	14,987	14,987	14,987
* p<0.10, ** p<0.05, *** p<0.01				

Table 5 Heterogeneity in retail payment instruments and bank performance

We include, but do not report, the coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent variable	ROA	ROE	Cost efficiency	Profit efficiency
TRANPOP	0.025***	0.137***	0.033***	0.017***
	(4.556)	(4.373)	(5.636)	(2.881)
ATMPOP	0.023**	0.604***	0.046***	0.018***
	(2.410)	(2.226)	(7.432)	(2.845)
OFFICEPOP	0.046	0.009	-0.008*	0.013
	(0.069)	(0.909)	(-1.678)	(0.556)
STDROA	0.247***	0.962***	0.052***	0.015***
	(17.810)	(5.751)	(35.934)	(10.517)
GDPGROWTH	0.084***	0.082	0.016***	0.020***
	(3.367)	(1.608)	(11.409)	(14.350)
EURO	1.342***	1.837**	0.050***	0.076***
	(3.551)	(2.157)	(11.638)	(17.194)
TRANATMPOP	0.028**	0.086***	0.004***	0.002***
	(2.033)	(3.349)	(7.278)	(3.962)
HERFINDAHLINSTRU	-0.019***	-0.116***	-0.002***	-0.007***
	(-4.131)	(-4.332)	(-2.240)	(-3.932)
Constant	11.202***	16.216***	0.293***	0.977***
	(6.137)	(7.091)	(4.200)	(13.684)
Adjusted R^2	0.110	0.048	0.114	0.057
No of observations	13,994	13,994	13,994	13,994
* p<0.10, ** p<0.05, *** p<0.01				

Table 6 Type of retail payment instruments and bank performance

We include, but do not report, coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent variable	ROA	ROE	Cost efficiency	Profit efficiency
TRANPOP	0.019***	0.733***	0.029***	0.031***
	(2.230)	(3.763)	(5.429)	(5.709)
ATMPOP	0.066***	1.124***	0.036***	0.030***
	(3.837)	(4.192)	(6.149)	(4.900)
OFFICEPOP	0.031	0.001	0.004	-0.003
	(0.049)	(0.385)	(0.965)	(-0.584)
STDROA	0.247***	1.241***	0.052***	0.017***
	(19.371)	(8.190)	(37.571)	(11.516)
GDPGROWTH	0.072***	0.488*	0.013***	0.011***
	(3.211)	(1.822)	(10.837)	(8.857)
EURO	2.728***	1.428***	0.048***	0.044***
	(8.559)	8.030)	(12.641)	(11.146)
TRANATMPOP	0.020**	0.098***	0.003***	0.003***
	(2.056)	(3.059)	(5.954)	(6.132)
PAPERINSTRU	-0.003***	-0.014***	-0.001***	-0.001***
	(-5.271)	(-4.467)	(-2.944)	(-3.432)
Constant	9.434***	17.012***	0.436***	0.912***
	(6.583)	(7.454)	(6.674)	(13.445)
Adjusted R^2	0.134	0.060	0.119	0.043
No of observations	14,909	14,909	14,909	14,909
* p<0.10, ** p<0.05, *** p<0.01				

Table 7 Retail payment services and bank performance in the commercial and non-commercial bank sub-samples

We include, but do not report, coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

	Commercial Banks					Savings and cooperative banks			
Dependent variable	ROA	ROE	Cost efficiency	Profit efficiency		ROA	ROE	Cost efficiency	Profit efficiency
TRANPOP	0.020***	0.238***	0.003***	0.010***		0.069***	0.449***	0.007***	0.041***
	(3.308)	(4.480)	(5.417)	(2.667)		(4.554)	(5.580)	(4.432)	(7.202)
ATMPOP	0.070***	0.135***	0.002*	0.016***		0.040**	0.422***	0.007***	0.026***
	(4.067)	(3.271)	(1.766)	(4.244)		(2.347)	(6.313)	(4.110)	(8.943)
OFFICEPOP	0.928	10.143	-0.002	0.008		0.441	21.044	-0.019	0.019
	(0.085)	(0.093)	(-0.272)	(1.001)		(0.008)	(0.173)	(-0.003)	(0.049)
STDROA	0.245***	0.004***	0.029***	0.004*		0.119***	1.199***	0.019***	0.002***
	(10.234)	(6.023)	(14.784)	(1.893)		(9.063)	(4.879)	(10.852)	(6.911)
GDPGROWTH	0.043	0.191	0.026***	0.007*		0.128***	0.929***	0.011***	0.009***
	(0.493)	(0.290)	(6.607)	(1.820)		(8.298)	(3.231)	(11.688)	(9.267)
EURO	2.426***	24.529***	0.017*	0.018**		2.127***	54.180***	0.022***	0.074***
	(2.835)	(3.745)	(1.933)	(2.134)		(6.508)	(8.884)	(5.789)	(17.806)
Constant	10.415***	13.555***	0.655***	0.732***		5.300***	24.660***	0.931***	0.471***
	(3.047)	(4.341)	(10.293)	(11.678)		(4.554)	(9.422)	(28.248)	(12.956)
Adjusted R^2	0.096	0.075	0.080	0.009		0.223	0.055	0.046	0.049
No of observations	3,161	3,161	3,161	3,161		11,826	11,826	11,826	11,826
* p<0.10, ** p<0.05, *** p<0.01									

Table 8 Retail payment services and bank interest and non-interest income

We include, but do not report, coefficients for year and country indicators. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent Variable	Net commission and fee income / average total assets	Net commission and fee income / average total equity	Net interest income / average total assets	Net interest income / average total equity
TRANPOP	0.062***	0.349***	0.038***	0.213***
	(4.623)	(8.540)	(3.311)	(7.409)
ATMPOP	0.060***	0.229***	0.035***	0.149***
	(3.873)	(6.486)	(2.587)	(5.403)
OFFICEPOP	-0.097	8.381	-0.105	-0.028
	(-1.041)	(0.003)	(-1.268)	(-0.025)
STDROA	0.007***	1.816***	0.236***	1.482***
	(5.036)	(15.084)	(34.040)	(16.221)
GDPGROWTH	0.088***	0.029	0.030**	0.150
	(5.302)	(0.102)	(2.136)	(0.801)
EURO	0.912***	19.212***	0.390*	9.023***
	(4.158)	(5.139)	(1.717)	(3.011)
Constant	2.385***	13.086***	-0.398	5.173
	(2.737)	(8.291)	(-0.627)	(0.619)
Adjusted R^2	0.250	0.368	0.118	0.100
No of observations	14,978	14,978	14,770	14,770
* p<0.10, ** p<0.05, *** p<0.01				

Table 9 Retail payment services and bank stability

The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007. The details of the definitions and sources of all the variables are reported in Appendix A. All independent variables except Euro zone country dummy are average values throughout the period. The table reports coefficients, with t-statistics in brackets. In computing standard errors, we cluster by country.

Dependent Variable	Standard Deviation of ROA	Standard Deviation of ROE	Z-score
AVETRANPOP	-0.012***	-0.111***	16.806***
	(-4.514)	(-5.379)	(4.587)
AVEATMPOP	-0.101***	-0.134***	18.096*
	(-4.213)	(-4.456)	(1.709)
AVEOFFICEPOP	-0.073*	-0.803*	44.876**
	(-1.835)	(-1.652)	(2.560)
AVETOTALASSET	-0.022***	0.034	10.070***
	(-4.536)	(0.569)	(4.630)
AVEGDPGROWTH	-0.020	-1.361***	36.614***
	(-0.728)	(-3.974)	(2.966)
EURO	-0.301***	-0.199	29.473*
	(-8.470)	(-0.457)	(1.875)
Constant	1.069***	-0.730	163.175
	(3.194)	(-0.177)	(1.100)
Adjusted R^2	0.046	0.012	0.016
N. of observations	3370	3370	3370
* p<0.10, ** p<0.05, *** p<0.01			

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