Return to Retail Banking and Payments

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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. 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). 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. Moreover, although it is understandable that banks are currently allocating resources to fighting

[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.

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.

Against this background, it is of interest for policy-makers and regulatory and monetary authorities, as well as for expert practitioners and researchers, to further research and understand the attractiveness of payments business for retail banks. The pioneering work in this field todate provides separate perspectives on retail banking and payments.[5] A few related studies have stressed the benefits and potential of SEPA (Schmiedel, 2007; Capgemini and European Commission, 2008; Kemppainen, 2008). At the micro level, other recent important contributions stress the role of payment innovations and services for consumer finance and consumer's spending patterns (Campbell, Jerez, and Tufano, 2009; Lusardi and Tufano, 2009; Scholnick, 2009). This paper makes a 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 banking. Specifically, it examines the linkage between the provisions of retail payment services and performance for EU banks from 2000 to 2007.

Country-level retail payment service data from across 27 EU markets confirm 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

[5] For example, Hirtle and Stiroh (2007) document a "return to retail" for US commercial banks, with managers and analysts emphasising the relative stability of consumer-based business lines.

[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).

payment instruments is associated with enhanced bank performance. Likewise, a higher usage of electronic retail payment instruments seems to stimulate banking business.

The paper proceeds as follows. Section 2 describes related literature and develops a set of hypotheses 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.

2. Related literature and hypotheses

Payment services are an important part of the banking industry, accounting for a significant part of its revenues and operational costs. A number of individual studies on retail banking and payments already exist. According to Boston Consulting Group (2009) 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.[7] In fact, a number of recent academic studies document a "return to retail" for US commercial banks, with managers and analysts emphasising the relative stability of consumer-based business lines (Hirtle and Stiroh, 2007). Retail banking, especially payment services, is the backbone of banking activities and helps to increase the market share of other bank business, e.g. the provision of credit and the evaluation of associated risks.

Moreover, payment services are also important in helping banks to establish long-term relationships with their customers, whether private individuals or corporations. One fundamental characteristic of retail payment services is that they are strongly linked to other banking services, like deposits, because customers prefer to deposit money into a system in which they can obtain a good payment service (Kemppainen, 2003). Against this background, we hypothesize that banks perform better in countries with a more developed retail payments business.

[7] Payments revenues are considered to be any revenue stemming from the movement of money, including fees and spread income earned from funds set aside for payment purposes. Thus, demand deposit account spreads and overdraft fees are deemed to be payment revenues (Boston Consulting Group, 2009).

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).

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. 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.

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). 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). 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 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, as portrayed in Equation 3.1. 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.

$$\begin{aligned} PERFORMANCE\ (EFFICIENCY) = f\ (&Log(number\ of\ transactions \\ &/population), Log(number\ of\ ATMs/population), Control\ Variables) + \varepsilon \end{aligned} \qquad (3.1)$$

Bank performance is measured using two alternative accounting ratios, namely ROA and ROE. Bank efficiency is measured using profit and cost efficiency scores. We use Log (number of transactions/population) to measure the volume of country-level retail payments business. We

use Log (number of ATMs/population) to measure the level of the adoption of retail payment transaction technologies. Log (number of retail payments offices/population), Log (GDP growth) and Euro area country dummy are used in the model estimations as control variables. The standard deviation of ROA (ROE)[8] over the sample period is also used as a control variable to measure bank risk.

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. 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 or GDP in the regressions.[9]

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

[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] 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.

Appendix A. Table 1 reports the distribution of the sample banks across country and by type of banks. 55.16 percent of banks are from Germany. This motivates us to do robustness tests in the sample without German banks.

Table 2 reports the descriptive statistics of the sample. Eighty eight percent of the bank-year observations are from the euro area. Moreover, the European payment landscape can be characterised by substantial variation in the use of retail payment services, as illustrated, for example, by the relatively high standard deviation of the total number of retail payment transactions scaled by the population, of about 416442 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.[10]

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

$$PROFIT_{it}(COST_{it}) = f(X_{it}, Y_{it}, N_{it}) + \varepsilon_{it} \quad (3.2)$$

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:

$$PROFIT_{it}(COST_{it}) = f(X_{it}, Y_{it,}, N_{it}) + v_{it} - u_{it}(v_{it} + u_{it}) \quad (3.3)$$

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 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.

[10] 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).

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 3.

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 3.[11] 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 that is due to inefficiency, $\lambda = \sigma_u^2 / \sigma^2$. Panel B of Table 3 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

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

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 3, 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.[12] This implies that in the EU, a higher degree of adoption of retail payment technology is being used to replace traditional retail branches.

[12] 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.

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.[13] 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 4, 5, 6 and 7. 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 Log (number of transactions/population) enters the estimations as an explanatory variable. The regression coefficients are reported in columns 3 and 4 of Tables 4, 5, 6 and 7. All regression models include dummy variables to account for fixed country-specific and year effects.[14] 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 Log (number of transactions/population) and bank performance, as reported in Table 4. This finding is consistent for alternative model specifications considering both accounting and efficiency measures. The magnitude of the Log (number of transactions/population) coefficient suggests that changes in

[13] The total value of retail payment transactions is inflation-adjusted to the base year 2000.
[14] 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.

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 Log (number of ATMs/Population) coefficient implies that the impact of changes in total number of ATMs 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 Log (number of retail payments offices/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 have higher cost and profit-efficiency rankings.

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 for interaction between log (number of transactions /population) and log (number of ATMs/population). As seen in Table 5, the coefficient of the interaction term 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 Log (Herfindahl index of payment instruments) in the regression. The results, as seen in Table 6, confirm this relationship, since the coefficient of the Log (Herfindahl index for payment instruments) is significantly negative across the four different bank performance measures. The magnitude of the Log (Herfindahl index for payment instruments) 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. Moreover, the significant negative coefficient of the Percentage of paper-based retail payments, reported in Table 7, suggests that greater use of electronic payment instruments can improve bank performance. The magnitude of the Percentage of paper-based retail payments 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.

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 8, both commercial and non-commercial bank performance is higher in countries with a more developed retail payment business. The results also show that retail payment services have a more significant impact on savings and cooperative bank performance. These results suggest that banks with a stronger focus on retail banking business will benefit more from retail payment services.

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 9, 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. The results also show that retail payment services have a more significant impact on net commission and fee income.

4.5 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. We also use this formula to rank banks within a country where efficiency frontiers are based on separate country-level frontiers and thus further adjust for cross-country differences. 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 (elaborate further). 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.

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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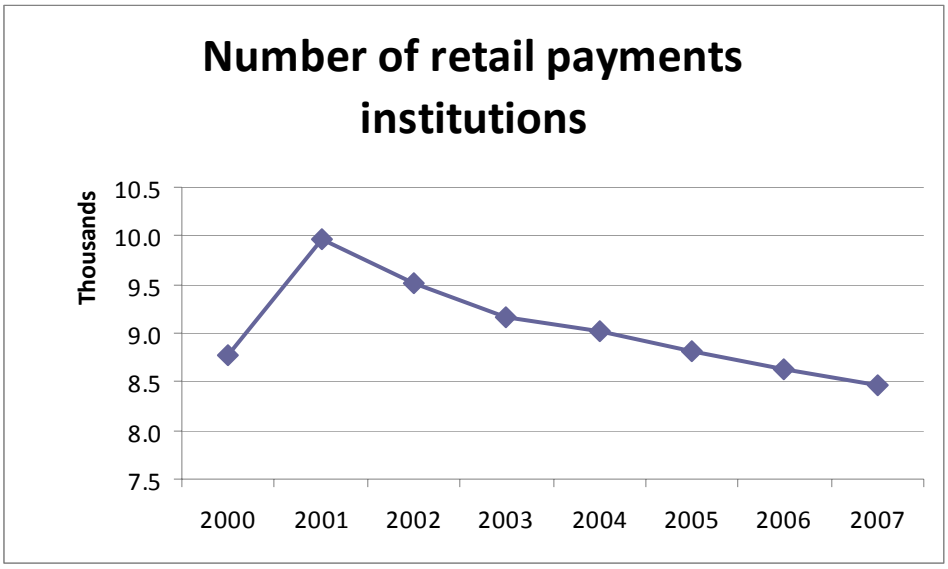
Appendix A: Overview of variables, definitions and data sources

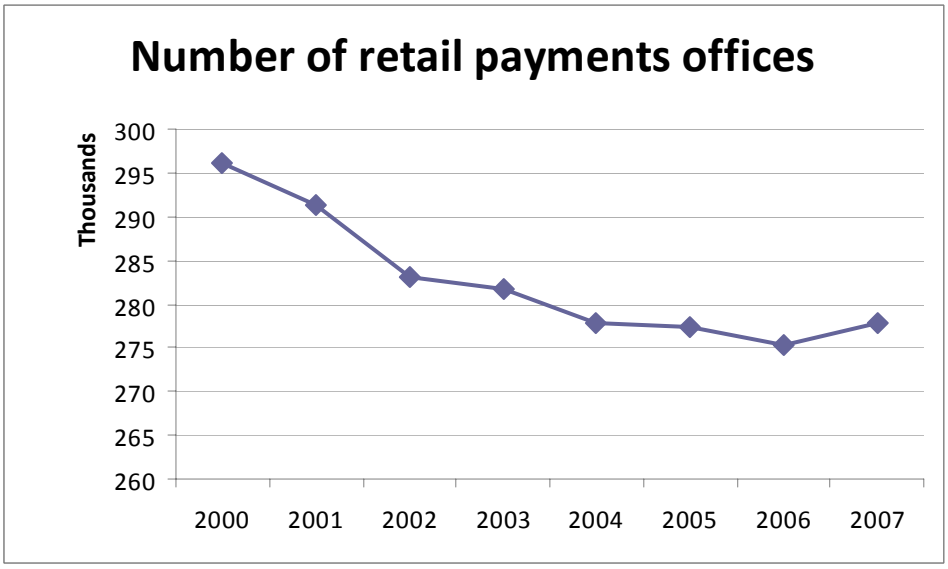
Variables	Definition	Sources
Bank performance measures		
ROA	Return on assets	BankScope
ROE	Return on equity	BankScope
Cost efficiency scores	Distance from bank's cost to best practice	Computed
Profit efficiency scores	Distance from bank's profit to best practice	Computed
Net interest income / average 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	
Retail payments variables		
Number of ATMs	Number of ATMs per country	ECB Statistical Data Warehouse
Number of POS terminals	Number of POS terminals per country	ECB Statistical Data Warehouse
Number of offices	Number of retail payments offices per country	ECB Statistical Data Warehouse
Number of institutions	Number of retail payments institutions per country	ECB Statistical Data Warehouse
Value of transactions	Total value of retail payment transactions per country	ECB Statistical Data Warehouse
Number of transactions	Total number of retail payment transactions per country	ECB Statistical Data Warehouse
Percentage of paper-based retail payments	Total value of cheque-based transactions / total value of retail payment transactions per country	ECB Statistical Data Warehouse
Herfindahl index of payment instruments	Concentration ratio of different payment instruments	Computed
Other variables		
Standard deviation of ROA	Standard deviation of ROA from 2000 to 2007	Computed
GDP growth	GDP growth	WDI
Population	Total population	WDI
Euro area country dummy	Dummy variable takes the value of "1" if bank is located in euro area, "0" otherwise.	ECB website

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.



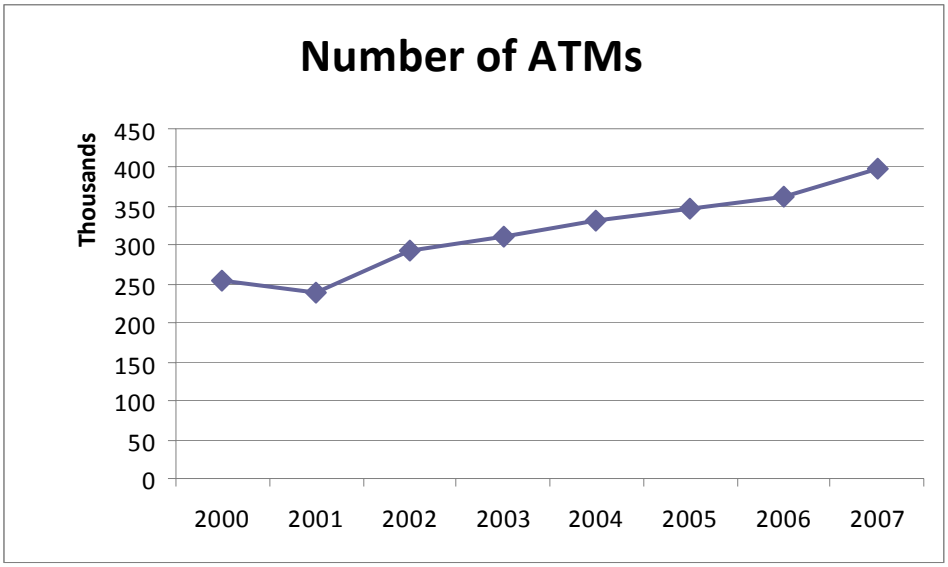
Panel A



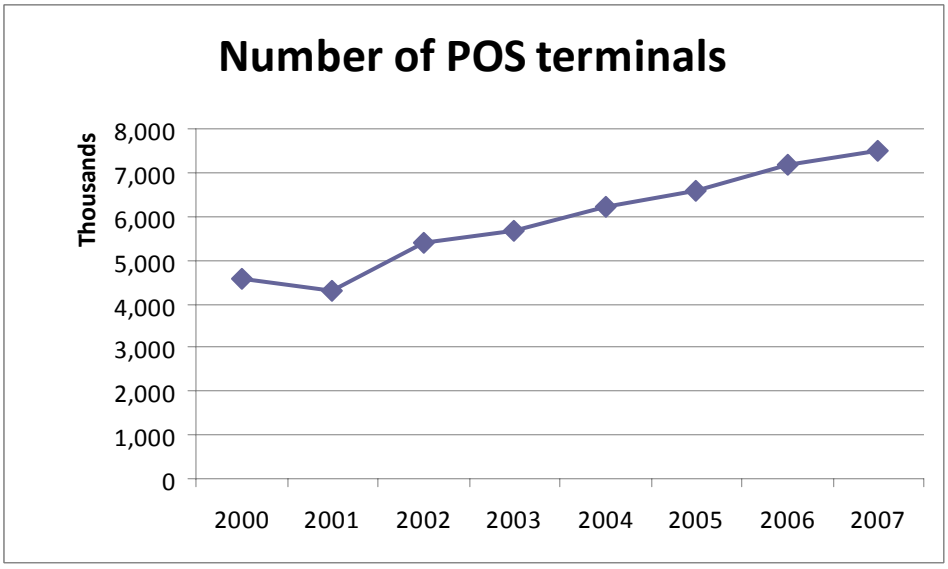
Panel B

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.



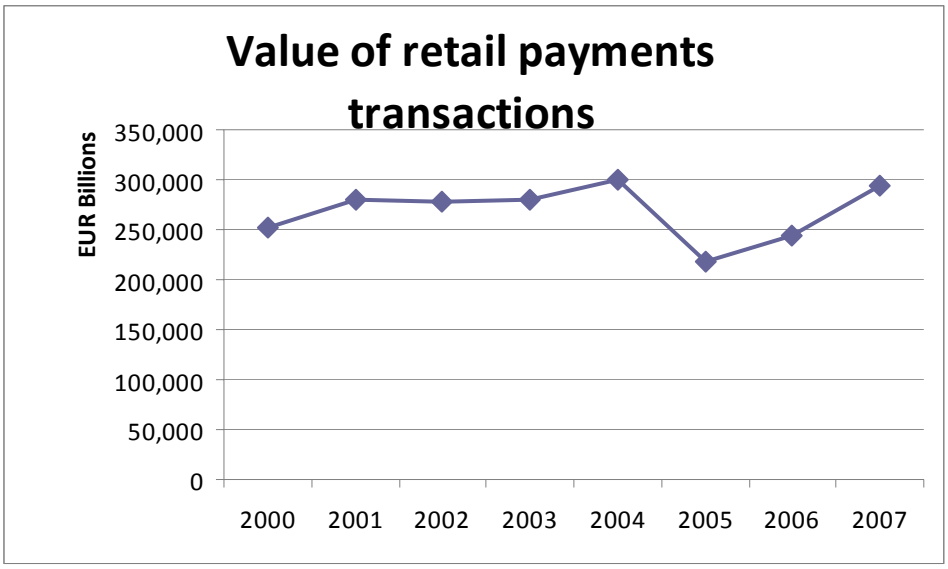
Panel A



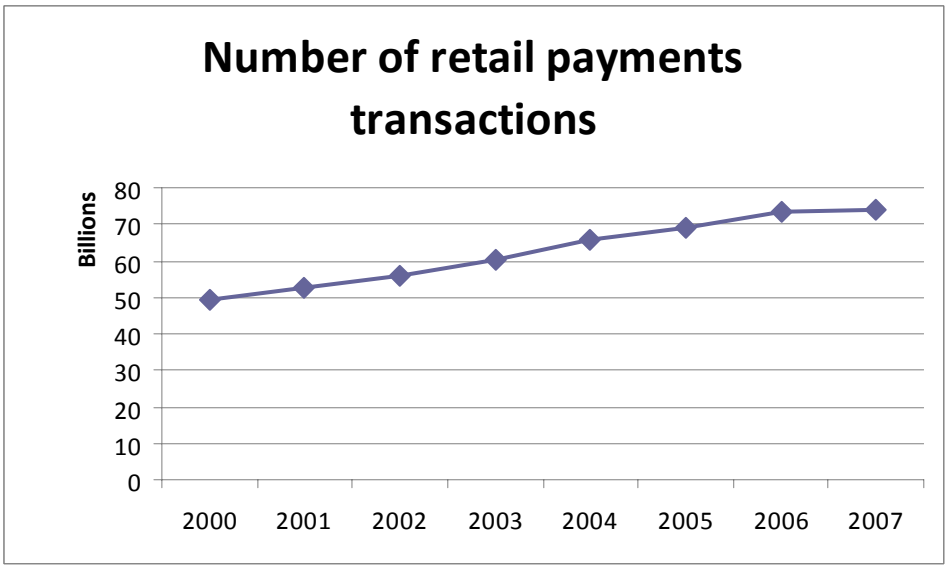
Panel B

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.



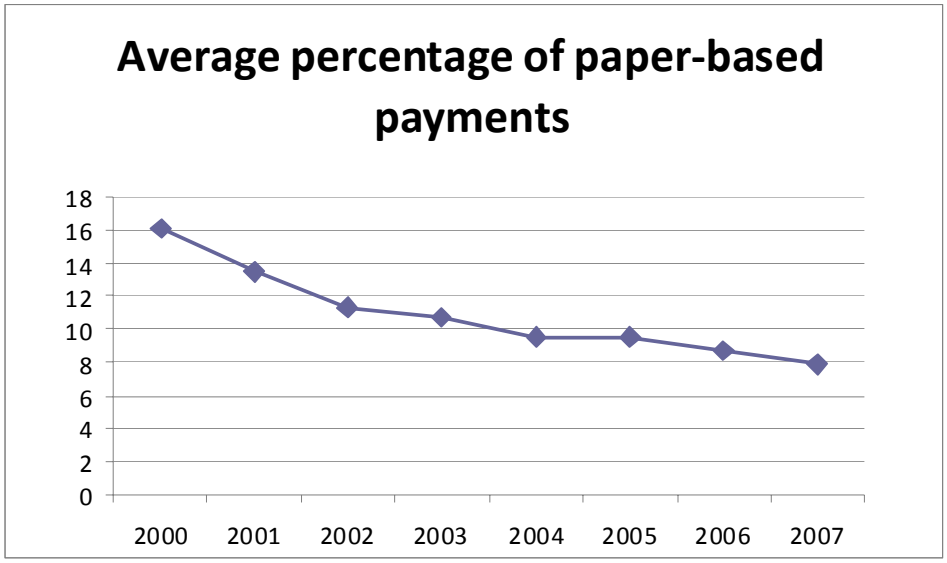
Panel A



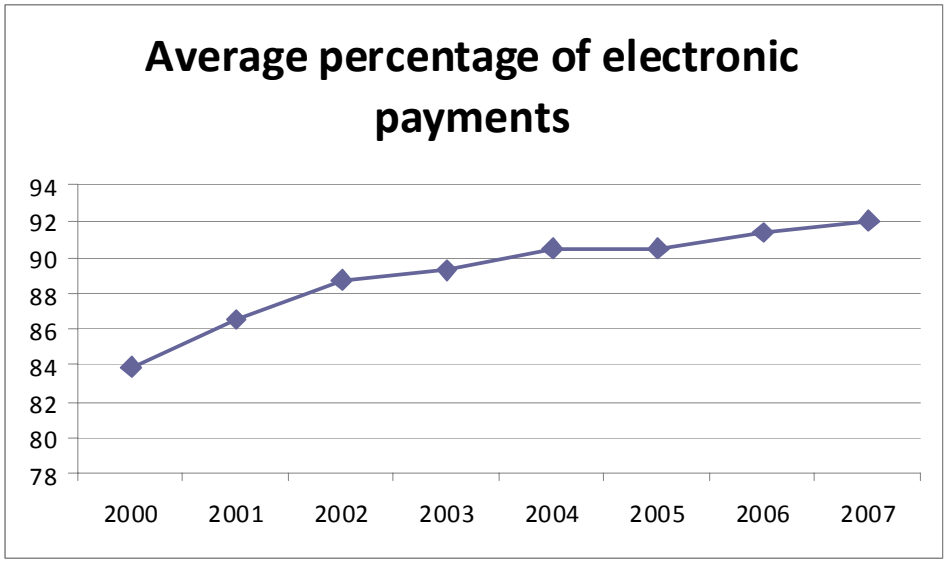
Panel B

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 Number of sample banks by country

This table presents the distribution of the sample banks across country and by type of banks. The sample includes commercial banks, savings banks and cooperative banks with available data in the EU between 2000 and 2007.

Country Name	Commercial Banks	Cooperative Banks	Savings Banks	Total Number	Percentage (%)
AUSTRIA	38	111	63	212	6.29
BELGIUM	29	7	10	46	1.36
BULGARIA	21	1	1	23	0.68
CYPRUS	5	1	1	7	0.21
CZECH REPUBLIC	22	1	0	23	0.68
DENMARK	58	1	39	98	2.91
ESTONIA	3	0	0	3	0.09
FINLAND	4	1	1	6	0.18
FRANCE	5	3	2	10	0.30
GERMANY	159	1,171	529	1,859	55.16
GREECE	8	0	0	8	0.24
HUNGARY	5	0	0	5	0.15
IRELAND	11	0	0	11	0.33
ITALY	121	439	40	600	17.80
LATVIA	16	0	0	16	0.47
LITHUANIA	5	0	0	5	0.15
LUXEMBOURG	42	0	0	42	1.25
MALTA	5	0	0	5	0.15
NETHERLANDS	14	0	0	14	0.42
POLAND	14	0	1	15	0.45
PORTUGAL	17	2	3	22	0.65
ROMANIA	10	0	2	12	0.36
SLOVAK REPUBLIC	7	0	0	7	0.21
SLOVENIA	10	1	0	11	0.33
SPAIN	62	57	47	166	4.93
SWEDEN	20	0	77	97	2.88
UNITED KINGDOM	46	0	1	47	1.39
Total Number	757	1,796	817	3,370	

Table 2 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. The details of the definitions and sources of all the variables are reported in Appendix 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	39.02	16.12	4.87	86.96
Net commission and fee income / average total equity (%)	14,770	12.55	8.86	-1.19	60.00
Standard deviation of ROA (%)	14,987	0.33	0.45	0.01	3.04
Euro area country dummy	14,987	0.88	0.33	0.00	1.00

Panel A

Country-level Variables	No. of country-year observations	Mean	SD	Minimum	Maximum
Number of transactions / Population (per one million persons)	183	180752	416442	838	3499614
Number of ATMs / Population (per one million persons)	183	1040	2101	6	15524
Number of offices / Population (per one million persons)	183	576	299	39	1794
GDP growth (%)	183	3.81	2.49	-0.74	11.93
Percentage of paper-based retail payments (%)	170	9.97	14.83	0.00	61.46
Herfindahl index of payment instruments	124	0.40	0.10	0.22	0.82

Panel B

Table 3 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. 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.

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 A

	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 B

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

Panel C

Table 4 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
Log (number of transactions / population)	0.060***	0.403*	0.005***	0.032***
	(2.867)	(1.894)	(3.437)	(5.548)
Log (number of ATMs / population)	0.072***	0.273***	0.041***	0.006***
	(2.927)	(3.092)	(6.687)	(3.629)
log (number of retail payment offices / population)	0.023	0.023	-0.005	-0.009**
	(0.062)	(0.311)	(-1.254)	(-2.270)
Standard deviation of ROA	0.217***	0.191*	0.033***	0.009***
	(19.756)	(1.704)	(32.295)	(8.681)
Log (GDP growth)	0.076***	0.508*	0.012***	0.009***
	(2.928)	(1.907)	(10.138)	(7.300)
Euro area country dummy	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)
R-squared	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 5 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
Log (number of transactions / population)	0.127***	1.145***	0.037***	0.031***
	(3.375)	(3.211)	(6.484)	(5.887)
Log (number of ATMs / population)	0.253***	1.774*	0.006	0.026***
	(2.785)	(1.913)	(1.456)	(4.447)
log (number of retail payments offices / population)	0.008	0.001	0.033	-0.008**
	(0.053)	(0.220)	(0.066)	(-2.097)
Standard deviation of ROA	0.217***	0.191*	0.014***	0.009***
	(19.760)	(1.706)	(11.358)	(8.573)
Log (GDP growth)	0.072***	0.470*	0.058***	0.010***
	(2.740)	(1.757)	(15.807)	(8.391)
Euro area country dummy	1.882***	1.251***	0.065***	0.049***
	(4.982)	(2.659)	(16.317)	(13.003)
Interaction between log (number of transactions	0.018**	0.153*	0.003***	0.003***
/ population) and log (number of ATMs / population)	(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)
R-squared	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 6 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
Log (number of transactions / population)	0.225***	0.137***	0.033***	0.017***
	(4.556)	(4.373)	(5.636)	(2.881)
Log (number of ATMs / population)	0.323**	0.604***	0.046***	0.018***
	(2.410)	(2.226)	(7.432)	(2.845)
log (number of retail payments offices / population)	0.046	0.009	-0.008*	0.013
	(0.069)	(0.909)	(-1.678)	(0.556)
Standard deviation of ROA	0.247***	0.962***	0.052***	0.015***
	(17.810)	(5.751)	(35.934)	(10.517)
Log (GDP growth)	0.084***	0.082	0.016***	0.020***
	(3.367)	(1.608)	(11.409)	(14.350)
Euro area country dummy	1.342***	1.837**	0.050***	0.076***
	(3.551)	(2.157)	(11.638)	(17.194)
Interaction between log (number of transactions	0.028**	0.086***	0.004***	0.002***
/ population) and log (number of ATMs / population)	(2.033)	(3.349)	(7.278)	(3.962)
log (Herfindahl index of payment instruments)	-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)
R-squared	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 7 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
Log (number of transactions / population)	0.019***	0.733***	0.029***	0.031***
	(2.230)	(3.763)	(5.429)	(5.709)
Log (number of ATMs / population)	0.066***	1.124***	0.036***	0.030***
	(3.837)	(4.192)	(6.149)	(4.900)
Log (number of retail payments offices / population)	0.031	0.001	0.004	-0.003
	(0.049)	(0.385)	(0.965)	(-0.584)
Standard deviation of ROA	0.247***	1.241***	0.052***	0.017***
	(19.371)	(8.190)	(37.571)	(11.516)
Log (GDP growth)	0.072***	0.488*	0.013***	0.011***
	(3.211)	(1.822)	(10.837)	(8.857)
Euro area country dummy	2.728***	1.428***	0.048***	0.044***
	(8.559)	8.030)	(12.641)	(11.146)
Interaction between log (number of transactions	0.020**	0.098***	0.003***	0.003***
/ population) and log (number of ATMs / population)	(2.056)	(3.059)	(5.954)	(6.132)
Percentage of paper-based retail payments	-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)
R-squared	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 8 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
Log (number of transactions / population)	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)
Log (number of ATMs / population)	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)
log (number of retail payments offices / population)	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)
Standard deviation of ROA	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)
Log (GDP growth)	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 area country dummy	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)
R-squared	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 9 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
Log (number of transactions / population)	0.062***	0.349***	0.038***	0.213***
	(4.623)	(8.540)	(3.311)	(7.409)
Log (number of ATMs / population)	0.060***	0.229***	0.035***	0.149***
	(3.873)	(6.486)	(2.587)	(5.403)
log (number of retail payments offices / population)	-0.097	8.381	-0.105	-0.028
	(-1.041)	(0.003)	(-1.268)	(-0.025)
Standard deviation of ROA	0.007***	1.816***	0.236***	1.482***
	(5.036)	(15.084)	(34.040)	(16.221)
Log (GDP growth)	0.088***	0.029	0.030**	0.150
	(5.302)	(0.102)	(2.136)	(0.801)
Euro area country dummy	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)
R-squared	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				