A COST-BENEFIT ANALYSIS OF A TWO-SIDED CARD MARKET

SANTIAGO CARBÓ VALVERDE
DAVID B. HUMPHREY
JOSÉ MANUEL LIÑARES ZEGARRA
FRANCISCO RODRIGUEZ FERNANDEZ

FUNDACIÓN DE LAS CAJAS DE AHORROS
DOCUMENTO DE TRABAJO
Nº 383/2008

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

La serie **DOCUMENTOS DE TRABAJO** incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
Las opiniones son responsabilidad de los autores.

A Cost-Benefit Analysis of a Two-Sided Card Market*

Santiago Carbó Valverde
University of Granada and FUNCAS

David B. Humphrey
Florida State University and
Payment Cards Center, Federal Reserve Bank of Philadelphia

José Manuel Liñares Zegarra
University of Granada and FUNCAS

Francisco Rodriguez Fernandez
University of Granada and FUNCAS

Abstract:

Payment cards have increasingly replaced cash and checks for point-of-sale transactions in Spain and other countries. Due to how banks price card transactions--involving both the consumer and the merchant sides of the market--controversy exists over how well these prices may match the benefits as well as the underlying costs. We present information on the costs and benefits (income) of cards and other payment instruments in Spain. The detailed nature of the data makes it possible to approximate the apparent profitability of card issuers and merchant acquirers in Spain, an additional area of controversy. Finally, since payment costs can fall with increases in transaction volume, we estimate payment scale economies in Spain to illustrate how payment costs may fall in the future if processing operations were consolidated across borders in Europe, as envisioned by SEPA. (136 words)

* Research support was provided by the Fundación de las Cajas de Ahorros (Funcas). The authors are solely responsible for views expressed.

A Cost-Benefit Analysis of a Two-Sided Card Market

1. Introduction.

This study presents detailed information on the cost and benefits of payments in Spain, with a focus on card payments. Card markets are frequently organized as two sided-markets since banks may charge both the consumer and the merchant sides of the market for a card transaction. The main aim of this study is to estimate the cost incurred and income generated for the four parties to a payment transaction: banks, merchants, consumers, and the central bank. The detailed nature of the dataset for Spain permits, for the first time to our knowledge, an accounting of the separate costs and income of card issuing and merchant acquiring banks. In summary, the information collected is used to: (a) approximate the distribution of payment costs and benefits (income) among banks, merchants, the government, and consumers; (b) assess the profitability of card issuing and merchant acquiring banks; (c) derive the net benefits of different payment instruments in Spain; and (d) determine cost economies associated with payment volume growth (and thus possible future cost reductions). The payment information presented here is based on expert opinions and judgment as well as internal cost accounting analyses. It illustrates the expenses incurred by banks in providing different payment services and incurred by merchants and consumers in using them.

Historically, banks developed and promoted payment cards because they have lower costs than supplying and processing checks and cash for depositors. Consumers find that cards often are a more convenient way of making point-of-sale transactions while merchants experience lower fraud expenses and faster access to funds than accepting checks. Merchants have also been told that cards can expand their sales and market share. Banks may charge both the consumer and the merchant sides of the market for a card transaction. Hence the phrase "two-sided card market".

As card transactions have grown, however, merchants argue that their share of card costs (the discount fee) exceed both the costs of accepting other payment instruments and the benefits of a higher market share when all or almost all their competitors accept the same cards. Card issuing banks argue that interchange fees are needed to compensate their processing expenses as well as merchant acquiring banks for their expenses.

The detailed nature of our data allows us to approximate the apparent profitability of card issuers and merchant acquirers in Spain as well as contrast the time pattern of

interchange fees with apparent changes in underlying processing costs as volume has expanded over time. Indeed, due to strong payment scale economies estimated here for Spain, the cost savings from electronic payments can be magnified if currently national electronic payment processing operations are consolidated across borders. This outcome for the Single Euro Payments Area (SEPA) is being promoted by the European Commission and the European Central Bank in conjunction with developing an integrated, efficient, and more competitive pan-European market.

In what follows, two-sided market theory is applied in Section 2 to outline the justification for card interchange fees and the bank-merchant controversy concerning them in Spain and elsewhere. Section 3 describes the reactions to this controversy in Spain and Australia. Estimates of the costs and benefits of debit cards, credit cards, cash, and checks in Spain are presented in Section 4. These are based on expert opinions and internal cost accounting analyses of banks and merchants in 2006. Payment scale economies are estimated in Section 5 using a bank cost function model. These estimates suggest additional savings in electronic payment costs could be realized with cross-border consolidation, as envisioned in SEPA. Our main results are summarized in Section 6.

2. Payment Policy Issues and Two-Sided Markets.

2.1 Two-Sided Card Market: Policy Concerns.

Non-cash payments, such as checks, cards, and giro transactions, can be considered a two-sided market since banks that supply these transaction services rely on consumers to demand and use them and on merchants and billers to accept them. Banks attempt to indirectly recover expenses from consumers by paying no or low interest rates on transaction deposits, charging a monthly account maintenance fee and, in certain countries, requiring a minimum deposit balance, or (at times) assessing a direct fee per transaction. On the other side of the market, merchants and billers are more likely to pay a direct bank fee per transaction since the variance of their payment volumes differs far more than do consumers', inhibiting the use of (say) an average balance requirement for all merchant accounts to cover payment expenses.

Considering both bank fees and internal merchant expenses, accepting a credit card for payment can cost merchants significantly more than accepting cash or (in some countries) check payments. Being forbidden in the past (or currently) from assessing a surcharge on card use to offset extra expenses compared with accepting other

instruments, merchants fold all payment costs into their prices. As a result, consumers who use cash and checks could effectively cross-subsidize card users if card costs were significantly higher than for other instruments. While card transactions may lower bank expenses compared to supplying cash and checks and improve consumer convenience, these two benefits may be offset by increased merchant costs and so affect the distribution of payment benefits and welfare among these three parties to the transaction. In addition, the setting of card prices to merchants along with the no surcharge rule and honor all cards rule that ties acceptance of an issuer's credit or debit card to acceptance of other cards from the same issuer, has in some countries raised antitrust concerns. The lack of data and empirical evidence on the bank and merchant sides of the payment market have limited the ability of participants and authorities to determine just how important these issues may be in practice.

2.2 Two-Sided Card Market: Analysis of the Policy Issues.

In a two-sided market, (at least) two parties interact on a "platform" and the typical vertical model of a bank supplying payment instruments to only consumer users is expanded to include merchant acceptors. Banks interact with consumers to issue cards for their use and with merchants to have them accept the cards when used. This is also true of cash and checks: consumers have to demand cash and checks from banks and merchants have to accept these instruments for transactions to occur.

The difference is that cards are a new way to make payments and banks wish to expand card volume as cards can lower their payment expenses and/or expand their income compared to providing cash or checks. As this is not the case, cards can lower bank costs while the indirect methods used to recoup payment expenses (low or no interest paid on transaction deposits, etc.) remain unchanged so the lower payment costs flow directly into profits or reduce losses banks may incur if they offer payment services below full cost.

The more that cards replace cash and checks, the lower bank payment cost may be. This would explain the emphasis in the card literature on the importance of network effects. That is, the more merchants that accept a payment card, the more valuable it is to consumers since it can be used in more places. At the same time, the more consumers that use a payment card, the more merchants will be willing to install point of sale (POS) terminals to accept them. In order to more rapidly expand card usage, banks may offer "reward points" to consumers for card use. The incentive for merchants to

accept cards is the notion that cards increase consumers' willingness to purchase (especially for credit cards) and this may correspondingly increase sales, market share, and profits (Wright, 2005).

The advantages for banks to develop and for merchants to accept different payment cards is dependent on the type of card employed. Some surveys for the US suggest that while debit cards are often significantly cheaper than cash to produce for banks (once ATM and branch costs are included), credit cards are a relatively more expensive payment instrument for merchants to accept. Similarly, the substitutability of credit cards for cash is dependent on pricing to consumers, on national cultural attitudes towards credit, and the desire to shift consumption forward in time (Chakravorti and To, 2000). As credit card fees--when monthly balances are paid in full--are largely borne by retailers, consumers perceive credit cards to be a low-cost delayed payment substitute for cash or debit card settlements.

Most of the recent controversies and payment policy discussion has focused on card interchange and service fees. Since many card schemes involve numerous banks, as opposed to just one institution that handles both card issuing and merchant acquiring functions, interchange fees are usually determined collectively (Baxter, 1983; Small and Wright, 2001). However, antitrust authorities typically claim that collective determination of interchange fees can be anticompetitive. Recent analysis, however, suggests that under perfect competition among issuers and among acquirers, the socially optimal interchange fee is non-zero. Consequently, it is argued that collective determination should not be banned since it is unclear whether negotiating separate agreements among the numerous issuers and acquirers would lead to lower or higher interchange fees (Gans and King, 2003; Guerin-Calvert and Ordover, 2005; Rochet and Tirole, 2006). Assuming that competition is already strong among card issuers and acquirers, antitrust intervention in setting card prices and interchange fees may not be justified. Going further, it is suggested that there is no evidence of market failure in the provision of either credit or debit cards that would otherwise recommend regulatory intervention. Also, analysis suggests that when merchants compete and consumers are fully informed whether merchants accept particular cards or not, the profit and welfare maximizing fees coincide for a non-trivial set of cases (Wright, 2005). Thus this issue seems to turn on the degree of competition in the card market, a conclusion for which the various parties find it difficult to agree upon and for others to measure.

Other analyses have modeled incentives in an imperfectly competitive payment card industry. The goal was to permit a comparison between privately optimal and socially optimal interchange fees (Rochet and Tirole, 2002). It concluded that there are no incentives to achieve socially non-optimal interchange fees with collective determination even in an imperfectly competitive card market. The existence of network externalities and bank card cost savings implies that any weakening of one side of this two-sided market will also reduce demand from the other side. That is, if merchant fees are set "too high" so merchant acceptance does not grow, this limits the ability of consumers to expand card use and hence the potential level of bank cost savings or income expansion. Similarly, if consumer card fees are set "too high", this limits cardholder growth as well as bank benefits. Thus, even if consumer and merchant fees are set collectively and market power exists due to imperfect competition, the incentive for banks is to not set either fee too high since this will limit their benefits.

This way of looking at the interchange fee suggests that it is not an ordinary market price where imperfect competition can lead to prices that are set "too high" for a buyer, but rather a way of balancing consumer and merchant fees--the two sides of the card market--to best promote the growth of card payment volume (Schmalensee, 2002). Balancing the two sides of the market is an important insight but, due to the no surcharge rule, merchants directly face some charges or discount fees while consumers are not charged for transactions at the point of sale. Similarly, while consumers receive rewards for using cards and respond by expanding card volume, merchants may also benefit from a higher card use and an additional increase in sales. From this perspective, the interchange fee is seen as not only affecting the price banks charge consumers and merchants to promote card use but also the distribution of the benefits realized by banks.

The distribution of the benefits is important since economies of scale exist for card and other electronic payments. These economies are presented in Section 5 below using new data for Spain but have been demonstrated for 12 European countries (Humphrey, et al., 2006b) as well as in an earlier study for Spain (Carbó, et al., 2006). As a result, one might expect that the fees banks charge consumers and merchants may tend to fall somewhat over time and still play their balancing role as opposed to being stable over time, which is what they usually have been in Spain and other countries. Reductions in discount fees, when they have occurred, have resulted from merchant

complaints and pressure from regulatory authorities, not a greater realization of scale economies in card processing.

3. Actions Affecting Interchange Fees.

As noted by Weiner and Wright (2005) interchange arrangements vary considerably across countries, and while existing economic theory provides some insight into fee levels and movements, much remains to be explained. The structure of the markets depends on many interrelated factors, and many of the country-specific factors that play a role in interchange developments. In this section, three relevant international experiences (European Union, Australia and Spain) are shown to analyze the main regulatory developments regarding interchange fees and their impact. In the Australian case, The controversy over payment card pricing and interchange fees has led to direct intervention by the Australian central bank. While the safety and soundness of payment systems is a primary concern of central banks everywhere, in Australia recent legislation made the central bank directly responsible for its efficiency as well. More limited interventions have been implemented in Spain, for cross-border transactions in Europe, the UK and in the U.S. One way or another, the goal has been to lower interchange fees.

3.1 The Actions of the European Commission and some international comparisons

A cost-based approach for interchange fees, although limited in application, was adopted by the European Commission (EC) in 1992 for cross-border card transactions. At that time, the EC examined Visa's European cross-border interchange fees and accepted the view that the collective determination of interchange fees can lead to efficiency gains compared to the cost of negotiating bilateral agreements among all the separate bank and merchant participants. To date, the EC has not become involved in determining a benchmark cost for interchange fees; it limits itself to monitoring whether the underlying cost calculations are acceptable.

Interchange fee levels in the U.S. are also a source of merchant complaints and groups of merchants have taken legal action on the collective manner these fees were determined (an indirect way for merchants to influence the level of the interchange fee itself). Merchants also challenged in court the requirement to accept an issuer's debit card (and its associated interchange fee) if it accepts the same issuer's credit card.

Known as the Wal-Mart case, this tying arrangement was found to be anticompetitive and the court declared it illegal and awarded merchants' that brought the suit billions of dollars in damages from Visa and MasterCard. Afterwards, in order to induce some large merchants to accept their debit card in addition to their credit card, some debit card interchange fees were reduced. This was done through market competition rather than regulation, but the effect did not trickle down to smaller merchants with lower payment volumes.

In contrast to Australia or Europe, neither the U.S. central bank nor competition authorities have evidenced any interest in regulating the level of interchange fees. The focus instead has been on requiring that more information be given to consumers on the rates they are charged on revolving credit card balances, the late payment and other penalty fees they may face, and the implications for extended indebtedness if they only pay the required minimum amount due each month--an educationally-focused approach having little to do with interchange fees. In particular, in the the US case, a study undertaken by the Senate (GAO, 2006) shows that the penalties for late payments or other behaviors involving card use have risen significantly in recent years and card issuers note that their use of risk-based pricing structures with multiple interest rates and fees has allowed them to offer credit cards to cardholders at costs that are commensurate with the risks presented by different types of customers, including those who previously might not have been able to obtain credit cards.

3.2 Restrictions on Card Interchange Fees in Australia.

In Australia, it was argued that credit cards were more expensive than other payment instruments, that the way in which consumers and merchants were rewarded or charged for credit card use artificially inflated their demand, and that these arrangements and network rules then in force stifled competition from other payment methods and suppliers. After an extended period of collecting card payment cost information and consultation with system operators, merchants, and consumer representatives, card interchange fees were markedly reduced. For the future, card networks can only consider a narrow set of expenses in setting their interchange fees so these fees will be primarily cost-based rather than open ended. In related actions, merchants are now allowed to surcharge card use, the honor all cards rule no longer applies, and non-banks are permitted to offer credit cards and use existing clearing procedures. These

restrictions were challenged in court by one of the card networks but the authority of the central bank was upheld and the restrictions were implemented in 2003.

Before restrictions were imposed, credit card interchange fees in Australia averaged 0.95 percent times the value of a payment while for the average value of a debit card transaction it was A$ 0.44.[1] Today, the credit card interchange fee is around 0.50 percent while for the average value of a debit card transaction it is under A$ 0.12. Both of these reductions are substantial and in part reflect reductions in underlying processing cost as volume has expanded.

Australian merchants have benefited from lower interchange fees due to the new cost-based regulation where card issuing banks and merchant acquiring banks were different--a so-called four-party system. However, three-party card networks such as Amex--where a single bank is both a card issuer and a merchant acquirer--are not affected by the interchange fee restrictions. Banks can decide to join and participate in a three-party card network and offer reward programs without regulatory caps on interchange fees since these "fees" are now internal to the bank and no longer an external "price".

As would be expected in a two-sided market, lower discount fees in four-party card networks led issuers to find other sources of income thereby increasing some consumer fees. Reportedly, between 30 and 40 percent of the loss of interchange revenue has been recovered (Chang, et al., 2005). On the merchant side, the benefit from reduced fees has apparently not been passed through to consumers since the per-transaction price at the point of sale has not changed significantly. This could be due to merchants not raising their prices as other costs rise currently or in the future, using the reduced interchange fee as an offset. Or the interchange fee reduction was added to current profits.

3.3 Bank-Merchant Interchange Agreement in Spain.

The long-standing debate on the level of interchange fees in Spain ended in 2005 with an agreement between card networks and merchant associations. Specifically, from January 2006 until December 2008, the maximum level for an interchange fee would be progressively reduced. For merchants with an annual amount

[1] As occurs in other countries, credit card interchange fees are paid to the card issuing bank by the merchant acquiring bank in Australia. The acquiring bank, in turn, receives it from the merchant (as when a merchant is paid less than the full value of a consumer's purchase--a so-called merchant discount). For

of point of sale card payments less than €100 million, the credit card interchange fee is decreased from €1.40 per transaction in 2006 to €0.35 in 2009 while for debit cards the reduction should be from €0.53 per transaction to €0.35.

The Agreement also provided that from 2009 onwards each of the card networks would audit their operations and provide a cost-based analysis for debit and credit cards. These cost studies would be used to establish the maximum interchange fee for each of the networks, an arrangement similar to the interchange "benchmarks" used in Australia. The agreement also noted that price differences between debit and credit cards and intra- and inter-system operations should be progressively reduced.

The Bank of Spain has already provided data on the actual levels of interchange fees in 2006. To date, card networks have reduced interchange fees below the maximum levels established in the Agreement. Current interchange fees for credit cards were found to be €1.31 per transaction (the upper limit was €1.40) and the average interchange for debit cards was €0.40 (the upper limit was €0.53). In this regard, Spanish banks are moving toward a convergence of their interchange fees with other European countries. As the Agreement allowed for the creation of a common fund of €3 million by all networks with the aim of fostering the use of cards in Spain, card volume is expected to continue to expand and increasingly replace cash and the few checks that are left over time.

---

debit cards, the movement of interchange monies is reversed in Australia (but nowhere else) as the issuing bank pays the acquiring bank (c.f., Reserve Bank of Australia, 2000).

4. Payment Costs and Benefits: Spain and Other Countries.

There is broad recognition that electronic payments typically reduce bank and merchant transaction costs at the point of sale or for bill payments. The primary source of (public) bank cost information comes from the decade long series of bank cost surveys in Norway, the results of which are now published annually by the central bank (Robinson and Flatraaker, 1995; Gresvik and Øwre, 2002). Estimates of merchant cost savings in accepting electronic payments exist in the form of (infrequent) cost surveys in various countries at different points in time for Australia, Germany, the Netherlands, Sweden, and the U.S. Overall, there is little doubt that electronic payments can save costs for banks and (credit cards excepted in some countries) for merchants as well.

There are only a few studies that attempt to sort out and determine the costs and the benefits for banks and merchants of using a range of different payment instruments in a country. Recent studies have been done for the U.S. (Swartz, et al., 2006), the Netherlands (Brits and Winder, 2005), Belgium (Quaden, 2005), and Australia (Simes, et al., 2006). This is a difficult task because the necessary information on bank, merchant, and (sometimes) consumer costs and benefits, corrected for double counting, is not readily available and has to be gathered on a piecemeal basis from many sources. However, obtaining this information for Spain would more clearly indicate the distribution of costs and benefits accruing to banks, merchants, and consumers from electronic payments and allow a more accurate assessment of the prices which may be charged.

Fortunately, the manner in which different payment instruments are produced by banks and accepted by merchants (the production function) is basically the same across countries. For debit cards, for example, regardless of the country considered, cards need to be manufactured, supplied to consumers, and at times replaced. As well, merchants need a card-reading terminal and a telecommunication link to the card processor (whether on-line or in batch mode). The card processor needs specialized software and computers to handle the processing and a way of communicating the payment information to the banks which hold the customer and merchant accounts for the funds transfer and settlement to occur. Similar production functions exist across countries for credit cards, for checks, and cash transactions.

The major difference in unit payment costs across countries is that transaction volumes may differ. It is this difference--not differences in the production function--which will have the greatest effect. This means that once payment costs and income from one

country are collected and ordered by the different stages of production and use, bank and payment industry experts in another country--using their experience and access to cost accounting information at their own firms--will have a good idea on how these values should be changed to reflect costs and income for the same payment instrument in their own country. After an initial round of adjustments, the new cost and income estimates are circulated again to the same experts and the adjustment process is repeated until a basic consensus emerges. This was the procedure used to develop the payment cost data presented below for Spain. This iterative process is known as the Delphi method and is based on expert opinions backed up where necessary with available internal cost accounting information and other sources. The data presented below were made available to us by industry sources and the experts involved in the estimation process. More information on the data collection process is provided in Appendix A.

4.1 Bank Payment Costs and Benefits (Income): Spain.

The cost incurred and income generated for the four parties to a payment transaction--banks (including processors), merchants, consumers, and the central bank--are covered in the analysis below. The detailed nature of the data permits, for the first time to our knowledge, an accounting of the separate costs and income of card issuing and merchant acquiring banks. Table 1 shows the estimated costs and income for these banks in Spain for credit cards, debit cards, cash, and checks. Cost and income for all banks together is noted at the bottom of the table.

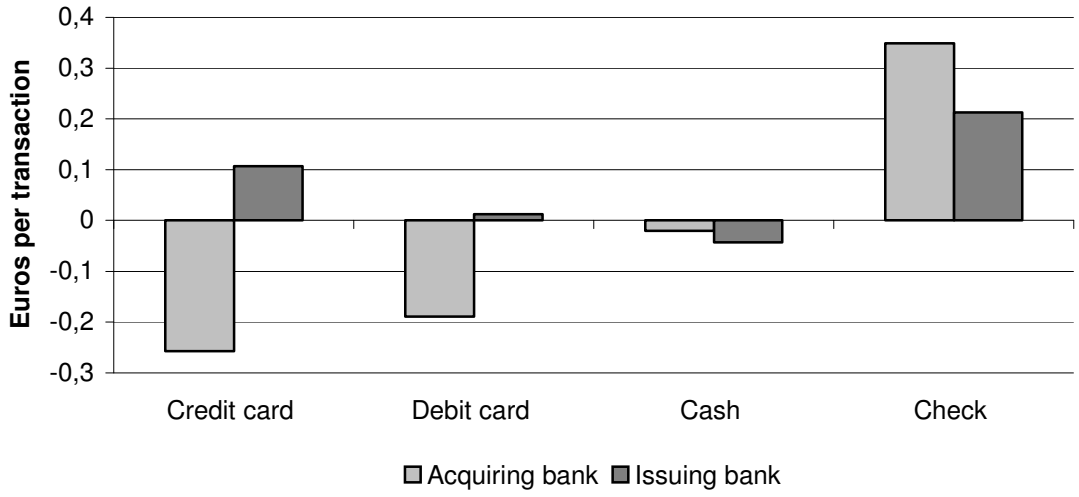
For an acquiring bank, the cost of a credit card sums to €-1.206 per transaction while the income sums to €0.948, giving a net position of €-0.257. The various sources of these costs (processing, production, interchange fees) and incomes (merchant fees, other fees, etc.) are detailed in column 1 of the table. For an issuing bank, these three values are, respectively, €-1.119, €1.227, and €0.107. For credit cards, acquiring banks appear to incur a significant loss (€-0.257) per transaction while issuing banks generate a slight gain (€0.107). Although smaller, acquiring banks also incur a net loss on debit cards per transaction while issuing banks generate a small net gain. In contrast, both types of banks incur a net loss on cash transactions and both generate a net gain with checks.

Table 1. Unit Cost and Income for Representative Acquiring and Issuing Banks

Agent	Cost/Income	Concept	Credit card (€ / tr)	Credit card (%)	Debit card (€ / tr)	Debit card (%)	Cash (€ / tr)	Cash (%)	Check (€ / tr)	Check (%)
Acquiring Bank	Cost	Other services and costs	-0.249	-0.393	-0.249	-0.555		0.000		0,000
		Processing	-0.164	-0.260	-0.164	-0.367	-0.020	-0.133	-1.151	-1.151
		Production	-0.097	-0.154	-0.097	-0.218		0.000		0.000
		Interchange fees	-0.695	-1.100	-0.350	-0.782		0.000		0.000
	Total Cost		**-1.206**	**-1.907**	**-0.860**	**-1.921**	**-0.020**	**-0.133**	**-1.151**	**-1.151**
	Income	Other fees	0.000	0.000	0.000	0.000		0.000		0.000
		Merchant discount fees	0.948	1.500	0.672	1.500	0.000	0.000	1.500	1.500
		Income from related services	0.000	0.000	0.000	0.000		0.000		0.000
	Total Income		**0.948**	**1.500**	**0.672**	**1.500**	**0.000**	**0.000**	**1.500**	**1.500**
	Total Acquiring Bank		**-0.257**	**-0.407**	**-0.189**	**-0.421**	**-0.020**	**-0.133**	**0.349**	**0.349**
Issuing Bank	Cost	Financing	-0.026	-0.041	0.000	0.000		0.000		0.000
		Guaranty of payment	-0.421	-0.666	-0.043	-0.096	0.000	0.000	0.000	0.000
		Other services and costs	0.000	0.000	0.000	0.000		0.000		0.000
		Processing	-0.285	-0.451	-0.278	-0.621	0.000	0.000	-0.378	-0.378
		Production	-0.166	-0.263	-0.139	-0.310	0.000	0.000	-0.010	-0.010
		Fidelity programs	-0.221	-0.350	-0.090	-0.200		0.000		0.000
		ATM withdrawals		0.000		0.000	-0.086	-0.576		0.000
	Total Cost		**-1.119**	**-1.770**	**-0.550**	**-1.227**	**-0.086**	**-0.576**	**-0.388**	**-0.388**
	Income	Other fees	0.531	0.840	0.211	0.472			0.600	0.600
		Operative income: Cardholder fees in ATM (on-us)					0.043	0.289		0.000
		Interchange fees	0.695	1.100	0.350	0.782				
	Total Income		**1.227**	**1.940**	**0.561**	**1.254**	**0.043**	**0.289**	**0.600**	**0.600**
	Total Issuing Bank		**0.107**	**0.170%**	**0.012**	**0.026**	**-0.043**	**-0.287**	**0.213**	**0.213**
Total Bank: Acquiring + Issuing										
	Total Cost		**-2.325**		**-1.410**		**-0.106**		**-1.539**	
	Total Income		**2.175**		**1.233**		**0.043**		**2.100**	
	Total Net Position		**-0.150**		**-0.177**		**-0.063**		**0.561**	

As illustrated in Figure 1, acquiring banks appear to incur a net loss on credit cards (where the loss is highest) with losses as well for debit cards and cash. The net gain received by acquiring banks for checks, while large, is insufficient to offset the losses on the other three instruments. If all four instruments each expanded by only one transaction, the net loss would be €-0.117 overall. The fact that credit and debit card volumes are expanding more rapidly than cash and check transactions in Spain means that the total losses incurred by acquiring banks (i.e., net cost/income times payment volume for all four instruments) are larger still. Doing the same computation for issuing banks, where the per transaction net positions are summed, yields a net gain of €0.288 which, of course, is larger still if account is taken of the relative volumes of the four instruments. The payment activity for acquiring banks seems to be run at a loss while that for issuing banks generates a net gain.

Figure 1. Net Income of Acquiring and Issuing Banks by Payment Instrument



Adding the net cost and income positions for representative acquiring and issuing banks yields Figure 2 for both classes of banks together. The "all bank" cost and income values are shown at the bottom of Table 1. It appears that banks on balance incur losses on their card and cash operations but gain on checks. If each of the four payment activities (neglecting giro payments which are not included here) expanded by one transaction, the overall net gain for banks would be €0.171 per transaction (the sum of the net positions for acquiring and issuing banks shown in Table 1 and Figure 2).

Figure 2. Bank Net Income by Payment Instrument (both types of banks together)

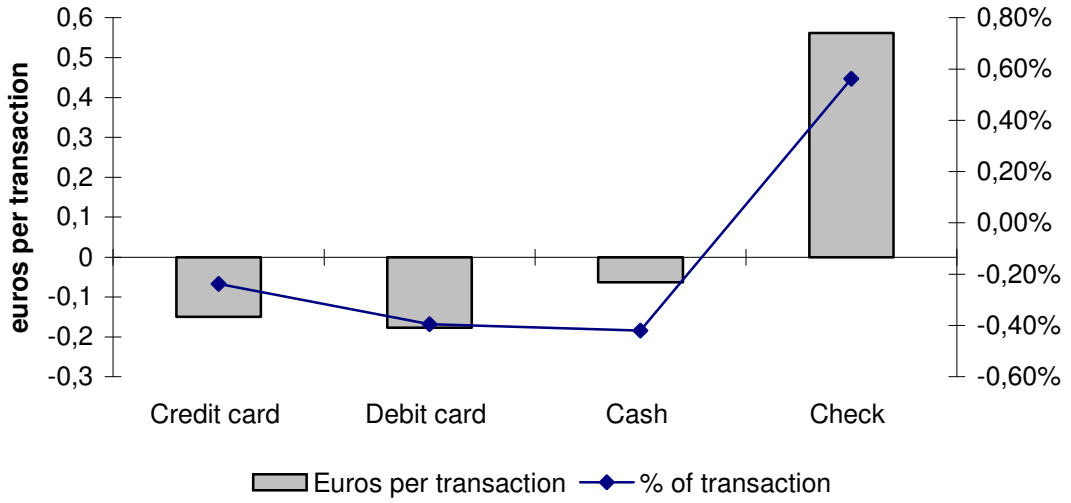


Table 2. Unit Cost and Income for Merchants

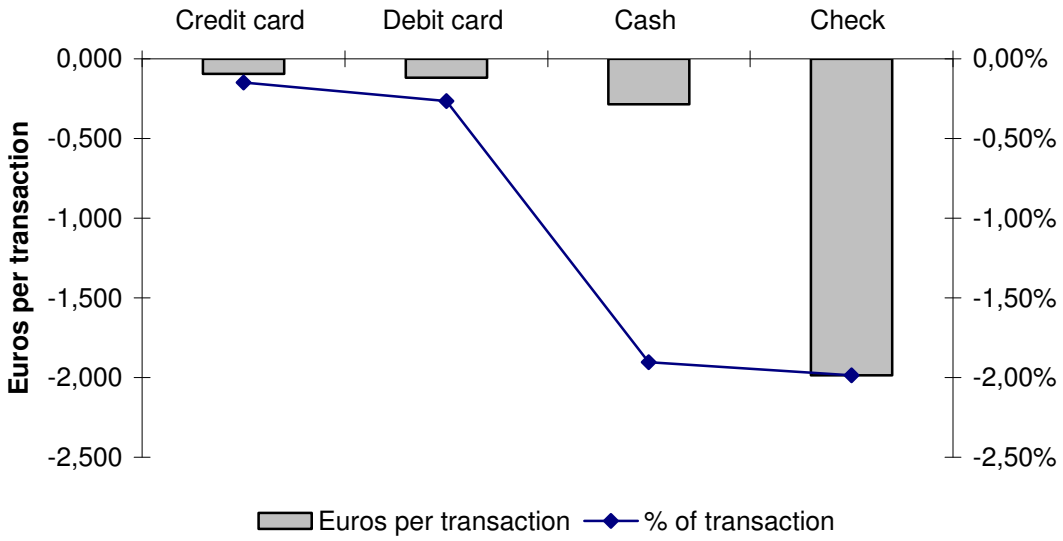
Agent	Cost/Income	Concept	Credit card (€/tr)	Credit card (%)	Debit card (€ / tr)	Debit card (%)	Cash (€ / tr)	Cash (%)	Check (€ / tr)	Check (%)
Merchants	Cost	Operational problems	-0.003	-0.004	-0.002	-0.005	-0.083	-0.554	-0.125	-0.125
		Float	-0.007	-0.011	-0.005	-0.011	-0.003	-0.022	-0.044	-0.044
		Fraud	0.000	0.000	0.000	0.000	-0.030	-0.200	-0.50	-0.050
		Infrastructure	-0.050	-0.079	-0.050	-0.112	0.000	0.000	0.000	0.000
		Deposit cash into accounts	0.000	0.000	0.000	0.000	-0.083	-0.554	-0.066	-0.066
		Bank fees	-0.948	-1.500	-0.672	-1.500	0.000	0.000	-1.500	-1.500
		Time to make payment	-0.129	-0.204	-0.129	-0.288	-0.086	-0.574	-0.201	-0.201
		Total Cost	**-1.137**	**-1.798**	**-0.858**	**-1.916**	**-0.286**	**-1.904**	**-1.986**	**-1.986**
	Income	Increase in sales	0.948	1.500	0.672	1.500	0.000	0.000	0.000	0.000
		Other services and costs	0.095	0.150	0.067	0.150	0.000	0.000	0.000	0.000
		Total Income	**1.043**	**1.650**	**0.739**	**1.650**	**0.000**	**0.000**	**0.000**	**0.000**
		Total Merchants	**-0.094**	**-0.148**	**-0.119**	**-0.266**	**-0.286**	**-1.904**	**-1.986**	**-1.986**

4.2 Merchant Payment Costs and Benefits (Income): Spain.

The main sources of cost and income for merchants accepting different payment instruments are shown in Table 2. Merchant costs of debit and credit cards (float,

infrastructure, fees, etc.) are virtually the same with the single exception of bank fees since credit card costs such as screening or fraud are mainly faced by banks. Bank fees are by far the largest merchant cost (at €-0.948 and €-0.672 per transaction for credit and debit cards, respectively, and equal bank merchant fee income for acquiring banks in Table 1). Nevertheless, bank fees as a percentage of the average transaction value are quite similar for both types of cards (at around 1.5%). Apparently, the rise in merchant income from increased sales associated with card use is the same as the bank fees. Other results in Table 2 suggest that the cost of fraud for merchants is zero for cards but not for cash or checks. And for cash, it takes less time to make a payment (and therefore less opportunity cost at €-0.086) than it does for credit and debit cards (€-0.129) or for checks (€-0.201).

Figure 3. Net Income for Merchants



Merchant net income across payment instruments are shown in Figure 3. Cash is the cheapest instrument to accept, followed by debit and then credit cards, with checks being the most expensive in Spain (Table 2). Once income is taken into account, especially imputed sales income from cards, cards have the smallest net loss, followed by cash, with checks having the largest.

4.3 Central Bank Payment Costs and Benefits (Income): Spain.

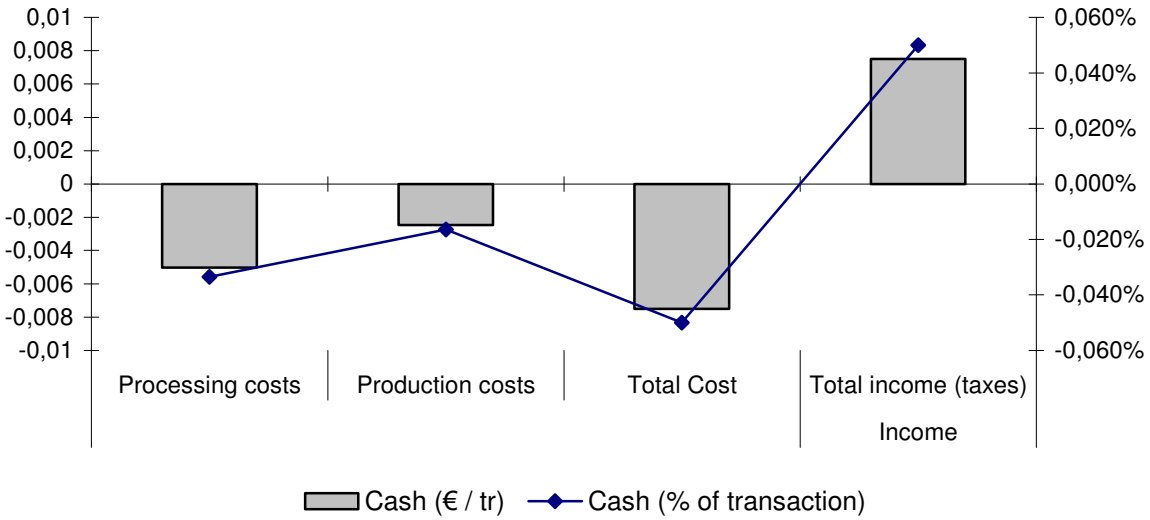
The costs and benefits of the government and central bank are shown in Table 3. The only source of cost or revenues in this case is cash since, other than settlement

(which has a de minimis cost and is typically not priced in Europe), there is no real involvement by the central bank in card or check activities. The central bank is responsible for issuing notes and coins and, in return, obtains seigniorage revenues (an indirect tax) which is the value of an interest free loan equal to the difference between the face value of money issued and its cost of production, including distribution and replacement costs as currency wears out. As Figure 2 indicates, the total cost of cash is €-0.007 per transaction while income is valued at €0.008, so the net position is approximately zero.

Table 3. Unit Cost and Income of the Government and Central Bank

Agent	Cost/Income	Concept	Credit card ()	Debit card ()	Cash (€ / tr)	Cash ()	Check (€ / tr)	Check ()
Government and Central Bank	Cost	Process	0.000	0.000	-0.005	-0.034	0.000	0.000
		Production	0.000	0.000	-0.002	-0.017	0.000	0.000
	Total Cost		**0.000**	**0.000**	**-0.007**	**-0.050**	**0.000**	**0.000**
	Income	Taxes	0.000	0.000	0.008	0.050	0.000	0.000
	Total Income		**0.000**	**0.000**	**0.008**	**0.050**	**0.000**	**0.000**
Total Government and Central Bank			**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Figure 4. Distribution of Costs and Income for Government and Central Bank



4.4 Consumer Payment Costs and Benefits (Income): Spain.

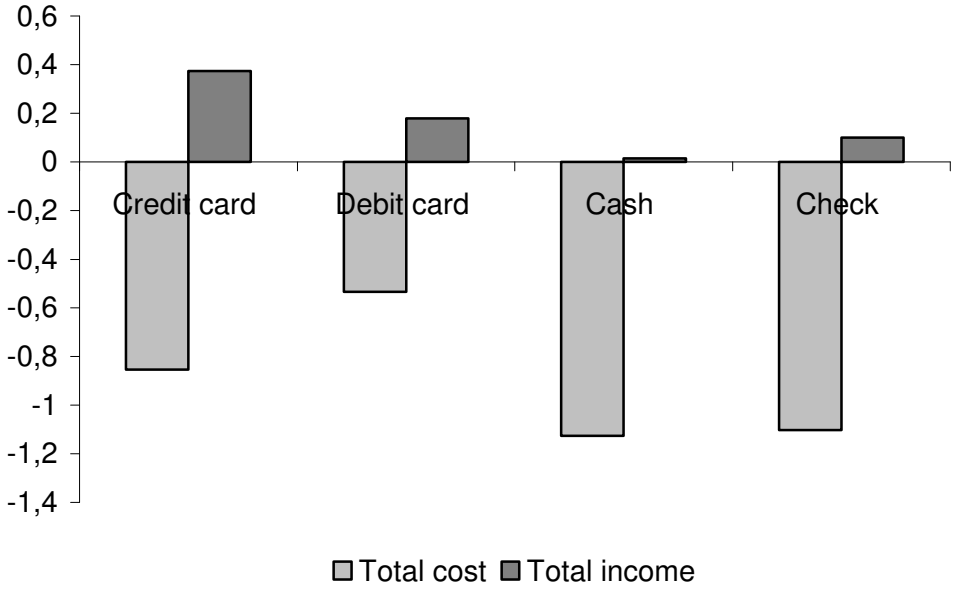
Consumer costs and benefits are shown in Table 4 and summarized in Figure 5. For cards and checks, the main consumer cost is the bank fee since the no-surcharge

rule does not impose any direct cost on the consumer for transactions at the point of sale. This is €-0.531 per transaction for credit cards, less than half this amount for a debit card, but €-0.600 for checks. For cash, the largest cost is the opportunity cost of the time to withdraw cash from an ATM (including travel costs) which is €-0.861 per transaction.

Table 4. Cost and Benefits (Imputed Income) for Consumers

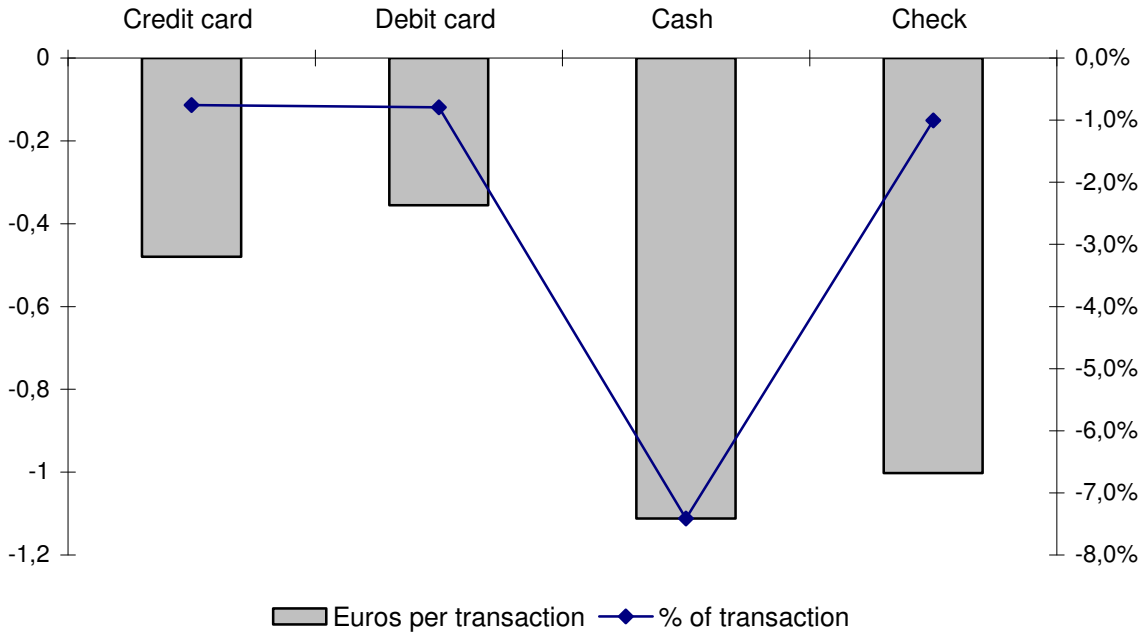
Agent	Cost/Income	Concept	Credit card (€/tr)	Credit card ()	Debit card (€ / tr)	Debit card ()	Cash (€ / tr)	Cash ()	Check (€ / tr)	Check ()
Cardholder	Cost	Other non explicit costs		0.000		0.000	-0.008	-0.050	0.000	0.000
		Bank rates	-0.531	-0.840	-0.211	-0.472	-0.043	-0.289	-0.600	-0.600
		Waiting time	-0.161	-0.255	-0.161	-0.360	-0.108	-0.717	-0.251	-0.251
		Time of make a payment	-0.161	-0.255	-0.161	-0.360	-0.108	-0.717	-0.251	-0.251
		Time of a cash withdrawal from an ATM		0.000		0.000	-0.861	-5.739		0.000
		Total Cost	**-0.854**	**-1.351**	**-0.534**	**-1.193**	**-1.127**	**-7.513**	**-1.102**	**-1.102**
	Income	Control of payments (security)	0.063	0.100	0.045	0.100	0.000	0.000	0.100	0.100
		Free financing	0.026	0.041	0.000	0.000	0.000	0.000	0.000	0.000
		Privacy		0.000		0.000	0.015	0.100		0.000
		Rewards (fidelity)	0.221	0.350	0.090	0.200	0.000	0.000	0.000	0.000
		Other services	0.063	0.100	0.045	0.100	0.000	0.000	0.000	0.000
		Total Income	**0.374**	**0.591**	**0.179**	**0.400**	**0.015**	**0.100**	**0.100**	**0.100**
Total Cardholder/Consumer			**-0.480**	**-0.759**	**-0.355**	**-0.793**	**-1.112**	**-7.413**	**-1.002**	**-1.002**

Figure 5. Cost and Benefits for Consumers (euros per transaction)



On the imputed income side, most of the benefits are associated with credit and debit card use. Reward programs, at €0.221 per transaction for credit cards and €0.090 for debit cards, are the most important. The only identified benefit for cash is privacy and for checks it is control of payments or, sometimes, security. As shown in Figure 6, none of the payment instruments are by themselves "profitable" for consumers but the net costs of both card instruments are lower than the net costs of cash and checks.

Figure 6. Net Benefits for Consumers



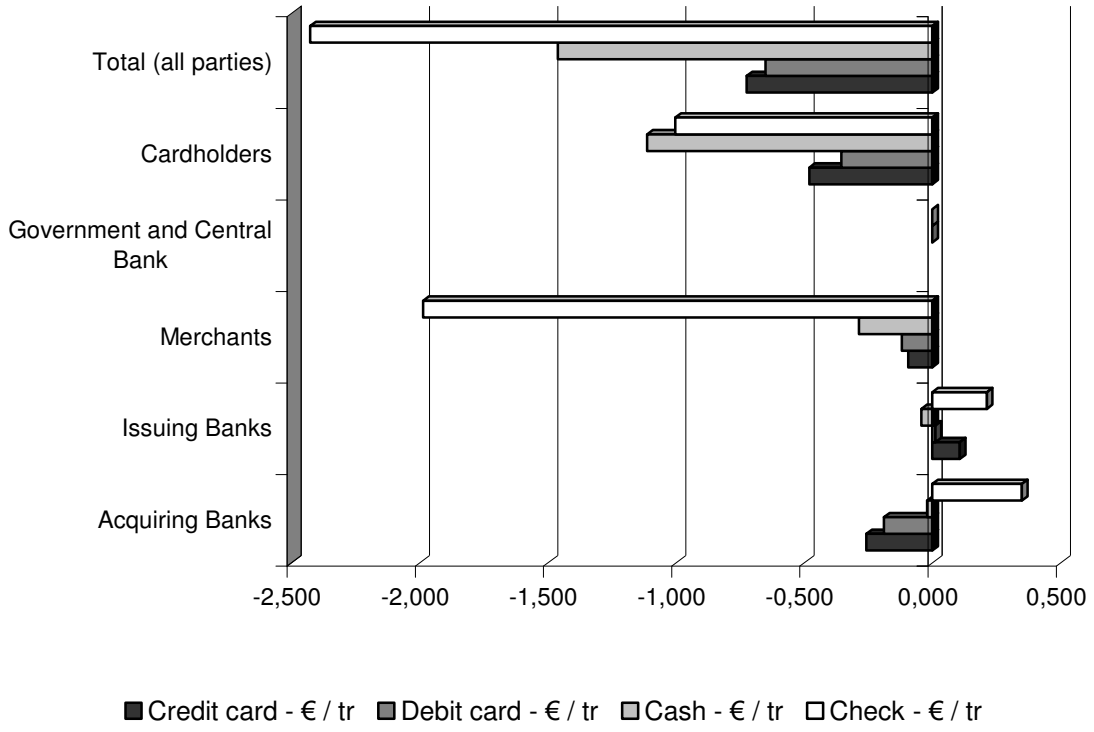
The net cost (income minus costs) of the four payment instruments across all parties--banks, merchants, central bank, and consumers--is illustrated in Figure 7. Overall, checks are found to be most expensive as their net cost is €-2.426 per transaction. Cash is the next most expensive at €-1.461 per transaction followed by credit cards at €-0.724. The cheapest instrument is a debit card at €-0.651 per transaction.

4.5 Costs and Benefits (Income): Other Countries.

Although most of the payment cost and benefit data for other countries are often fragmented, the usable data that does exist is presented for comparison purposes in Table 5. Some estimates from these countries were used in the initial rounds of the iterative Delphi procedure to generate cost and income estimates for Spain. This helps

in identifying differences between Spain and other country payment costs. As very few studies provide any income or benefit estimates, only the cost estimates of the payment instruments are shown in the Table 5 for banks, merchants, and central banks.

Figure 7. Net Cost for Each Participant (income – costs per transaction)



The estimated per transaction payment costs in Table 5 are sometimes similar and at other times quite different from the cost estimates presented above for Spain. As noted earlier, this is due primarily to differences in transaction volumes among the different countries--since payment scale economies exist for all four instruments--but the production functions for each instrument separately are very similar. Overall, there is greater similarity between Spain and other country cost estimates for credit and debit cards but less for cash and checks. Again, scale effects are likely to dominate here since the U.S. uses about half as much cash per person as does Europe but writes vastly more checks. European countries more similar in size with Spain evidence a closer correspondence in their card and cash costs than for checks. This is because

check use in some countries in Europe is very close to zero (so fixed cost per transaction are large).

Table 5. Estimated Payment Costs in Different Countries (euros/transaction)

Country/Year:		Check	Paper Giro	Credit Card	Electronic Giro/ACH	Debit Card	Cash
		BANK COSTS					
Norway (*)	**2.001 (€)**	3.08	1.03	-	0.62 - 0.69	0.34	1.03-1.16
Spain(*)	**2.001 (€)**	0.27	-	-	0.08	0.07	-
U.S. (*)	**1993 ($)**	0.15 - 0.43	-	-	0.12 – 0.44	-	-
Netherlands (**)	**2005 (€)**	-	-	3.348	-	0.250	0.126
Belgium (*****)	**2004 (€)**	-	-	2.07	-	0.27	0.26
Australia (issuing) (****)	**2000 (€)**	-	-	0.60-1.47 (0.88-1.34)	-		-
Australia (acquiring) (****)		-	-	0.15-0.36 (0.86-1.75)	-	0.10-0.37 (0.18)	0.08 (0.11)
		MERCHANT COSTS					
Australia(*)	**2001 ($)**	0.28	-	0.59 - 1.14	-	0.10 - 0.23	0.07
Germany(*)	**1.999 (€)**	0.50 - 0.71	-	-	0.68	0.87	0.09- 0.15
Netherlands(*)	**2.002 (€)**	-	-	3.40	-	0.27	0.15
Sweden(*)	**2.001 (€)**	-	-	1.54	-	0.23	-
U.S. (*)	**2000 ($)**	0.36	-	0.72	0.24	0.34	0.12
U.S. (*)	**1993 ($)**	1.25	-	-	0.23	-	-
Netherlands (**)	**2005 (€)**	-	-	0.239	-	0.236	0.164
Netherlands (***)	**2004 (€)**	-	-	-	-	0.14	0.9
Belgium (*****)	**2004 (€)**	-	-	0.56	-	0.28	0.27
Belgium (retail trade) (*****)	**2.004(€)**	-	-	3.544	-	0.453	0.267
Belgium (hotels and catering) (*****)	**2.004 (€)**	-	-	3.620	-	0.756	0.619
Belgium (Gas Station) (*****)	**2.004(€)**	-	-	3.729	-	0.743	0.585
Netherlands – 2002 (2nd. HBD study) (******)	**Excluded front office costs**	-	-	3.213	-	0.186	0.082
	Include front office costs	-	-	3.401	-	0.274	0.146
		CENTRAL BANKS					
Netherlands (**)	**2005 (€)**	-	-	-	-	-	0.010
		AVERAGE COSTS PER TRANSACTION (TOTAL)					
Netherlands (**)	**2005 (€)**	-	-	3.587	-	0.486	0.300
Belgium (*****)	**2004 (€)**	-	-	2.62	-	0.55	0.53

(*) Source: Humphrey, D, Willesson, M., Lidblom, T. and G. Bergendahl (2006a), "What does it Cost to Make a Payment?" *Review of Network Economics*. 2: 159-174
Note: In Euros and U.S. dollars: € 1 = $1.027
(**) Source: Brits H., and Carlo Winder (2005). "Payments are no free lunch", De Nederlandsche Bank (DNB) - Occasional Studies. Vol.3/Nr.2.
Note: the transaction sizes are eur 9.37 (cash), eur 44.13 (debit card), eur 2.72 (e-purse) and eur 115.22 (credit card).
(***) Source: Raa, T. and V. Shestalova (2004) "Empirical evidence on payment media costs and switch points". *Journal of Banking & Finance* 28, 203–213
(****) Source: Debit and credit card Schemes in Australia. A study of interchange fees and access. Reserve Bank of Australia. October 2000.
Note: A $ 1 = $ 0.565. Revenues in parenthesis.
(*****) Source: Costs, advantages and disadvantages of different payment methods. Governor of the Belgian National Bank, December 2005. The Costs of Payments Survey on The Costs involved In POS Payment Products. Working Group on Costs of POS Payment Products March 2004. National Forum on the Payments System.
Note: Include the total macroeconomic costs – i.e. for the financial sector, the issuing institutions (National Bank of Belgium and the Belgian Royal Mint) and the points of sale.
(******) Source: Van Hove, L. (2004), "Cost – based pricing of payment instruments: the state of the debate". *De Economist* 152, 79-100. Cost study commissioned by *Hoofdbedrijfschap Detailhandel* (HBD), a Dutch retail organization.

5. Scale Economies in Spanish Payments.[2]

The study of costs and income associated with different payment instruments in Spain has revealed that there are significant potential social benefits of replacing cash and check with cheaper card payment instruments. However, the extent to which this benefit can be effectively realized depends on the existence of incentives for financial institutions to produce and distribute payment cards on a large scale. In European countries, these potential benefits and scale economies may also find a new path for development within the framework of the so-called Single European Payments Area (SEPA). This section deals with both the estimation of these scale economies in Spain and the likely implications of the SEPA in the near future. For empirical purposes, we employ a sample of Spanish banks with available information on the different sources of costs for the card and other payment services supplied.

Costs in banking are primarily incurred by providing payment processing, deposit safekeeping, cash access, and loan initiation and monitoring services through a geographically diversified set of general and specialized branch offices as well as ATMs. While deposit safekeeping and loan services are specific to branch offices, ATMs substitute with branches for cash withdrawal, balance inquiry, and account transfer services.[3] All of these services involve labor, physical capital, and materials operating expenses and our purpose is to determine statistically the association of operating costs to the processing of check, giro, and card payment transactions as well as the use of ATMs and branch offices. Interest rates on deposits and loans do not really affect the production of payment services and ATMs but can influence the tradeoff between the use of branch offices to collect (typically lower cost) deposit funds and sell/service mutual funds relative to (more expensive) interbank purchased monies over the interest rate cycle. For Spain, this effect is minor: the aggregate ratio of produced deposits plus mutual funds to assets was very stable over 1992-2005 consistent with little substitution.

The common approach taken in academic studies regarding scale economies in

[2] The analysis in this section follows closely an earlier effort to determine the cost of payment activities for Spain (Carbo, Humphrey, and Lopez, 2006). It extends an earlier data set covering 1992-2000 to 2005, derives more accurate payment scale economy values using predicted average costs over time rather than relying on derivatives evaluated at the mean of the data, and presents payment scale/cost data from other studies that support results reported here for Spain.

[3] Some initial payment processing may occur at branch offices but most is incurred in separate dedicated facilities associated with the bank or outsourced to non-bank processors. The initial contact for consumer and some business loans typically involves a customer's local branch office but further processing of loan documents, loan origination, and monitoring services are often handled by larger and more specialized branches or dedicated loan production offices in centralized locations in larger cities.

banking does not directly measure the actual flow of payment or other services as we try to do here. Rather, it is assumed that this service flow is proportional to the value of the stock of bank deposits, securities, and loans in the balance sheet. Inferences on how costs may vary by scale of operation and from changing technology are obtained by relating total operating and interest expenses across banks and over time to the value of their deposits, loans, and security holdings (or some other combination of balance sheet positions).[4]

Our approach directly relates bank operating (not interest) costs to measurable physical characteristics of banking output associated with payment processing and service delivery levels and mix. Thus changes in the mix of electronic to paper-based transactions or in the mix of ATMs to branches over time, along with improvements in their associated technology, represent an alternative and more specific way to identify the cost effect of payment activities and the ATM and branch delivery of services to users.

5.1 Estimating Payment Scale Economies in Spain.

Our data consist of an unbalanced panel of 93 commercial and savings banks over 1992-2005 in Spain observed at 6-month intervals (giving 2,282 observations).[5] Bank-specific information on operating cost, numbers of ATMs, branch offices, and labor and capital input prices were combined with aggregate (national) data on the number of check, giro, and card payments and used in a non-linear, functionally separable, composite cost function.[6] The composite model can approximate better the scope-type joint cost effects that are associated with altering how payments are processed and how

[4] As information does not normally exist regarding the adoption of specific technical and other cost-saving innovations in banking, the default is to assume that unknown technical change occurs linearly (or quadratically) with the passage of time and/or is somehow associated with (embodied in) the value of particular inputs.

[5] The panel includes all savings banks, all but the very smallest commercial banks (which were excluded due mostly to missing ATM data), but no cooperative banks (who also had missing data). This accounts for 77% (80%) of all assets (operating cost) in the Spanish banking system in 1992 and 91% (90%) in 2005. The excluded cooperative banks only account for five percentage points of the banking system's operating costs while the excluded commercial banks account for the remaining five percentage points in 2005.

[6] Use of a balanced panel by (a) backward aggregation of merging institutions before they actually merge or (b) including only acquiring banks could bias our results. With (a), combining data on banks before they merge and realize possibly lower costs associated with their larger post-merger size would tend to understate scale benefits in pre-merger years. With (b), the sample would exclude acquired banks before they merged and distort measured cost/payment volume relationships over time. For these reasons we use an unbalanced panel.

banking services are delivered. This is because the level of banking output in a composite function is not in logs, although input prices are. By keeping output in absolutes, we specify a direct relationship between output and operating costs that is likely more accurate--for prediction purposes when one or more outputs are small--than if the log of output is related to the log of operating cost.[7] As well, by specifying the log of input prices, it is possible to impose the theoretical condition of linear homogeneity in input prices in estimation.

The composite cost function (1), in its output/input price separable quadratic form, is estimated jointly with n-1 cost share equations. The Box-Cox (1964) transformation is represented by a superscripted parameter in parenthesis (ϕ) where $OC^{(\phi)} = (OC^{(\phi)}\text{-}1)\ \phi$ for $\phi \neq 0$ and $OC^{(\phi)} = lnOC$ for $\phi = 0$ in:

$$
\begin{aligned}
OC^{(\phi)} &= f^{(\phi)}(\underline{Q}, \underline{\ln P}) \\
&= \{[\alpha_0 + \sum_{i=1}^{5} \alpha_i Q_i^{'} + 1/2 \sum_{i=1}^{5}\sum_{j=1}^{5} \alpha_{ij} Q_i^{'} Q_j^{'}] \bullet \exp[\beta_0 \\
&\quad + \sum_{k=1}^{2} \beta_k \ln P_k + 1/2 \sum_{k=1}^{2}\sum_{m=1}^{2} \beta_{k,m} \ln P_k \ln P_m]\}^{(\phi)} \\
S_k &= \beta_k + \sum_{m=1}^{2} \beta_{k,m} \ln P_m
\end{aligned}
\qquad (1)
$$

where:

OC = total operating expenses, composed of labor, capital, and materials costs;[8]

$Q_{i,j}^{l}$ i,j = five output characteristics composed of three payment processing alternatives the number of checks ($CHECK$), giro payments ($GIRO$), and debit and credit card transactions ($CARD$)--along with two service delivery alternatives--automated teller machines (ATM) and bank branches (BR).[9] Service delivery data are available by bank but payment transactions data are not (so data for all banks are used instead). In (1), $Q^{l} = Q - 1$;

$P_{k,m}$ k,m = two input prices referring to the average labor cost per employee and an approximation to the price of physical capital and materials represented

[7] As illustrated in Pulley and Braunstein (1992), this can occur when one or more outputs are small. This occurs for ATMs (as a percent of ATMs plus branches) for some banks early in our sample and for checks (as a percent of check, giro, and card transactions) for some later years.

[8] OC is in nominal terms. The specification of bank-specific input prices accounts for inflation effects on costs more accurately than use of standard inflation indicators (e.g., cost-of-living index or GDP deflator).

[9] Giro transfers are electronic in Spain and debit cards accounted for about 55% of all card transactions (a share that has fallen by about 1 percentage point a year over 2001-2005 as credit card use has expanded).

by capital depreciation expenditures divided by the value of physical capital; and

S_k = the cost share for the labor input (the capital/materials input share is deleted to avoid singularity).

It is expected that operating costs not directly associated with the type of payment or mode of service delivery will be represented in the intercept term. The composite function is non-linear and is estimated iteratively. Following Pulley and Braunstein (1992), let $\underline{D} = \underline{0}$ and $GM^{\phi-1}$ be the geometric mean of operating cost OC, then the separable quadratic form of the composite model is estimated from the pseudo model:[10]

$$
\begin{aligned}
D &= [-(OC^{(\phi)} / GM^{\phi-1}) + f^{(\phi)}(\underline{Q}, \underline{\ln P}) / GM^{\phi-1}] \\
&= [-\{(OC^{\phi} - 1) / \phi GM^{\phi-1}\} + (\{[\alpha_0 + \sum_{i=1}^{5} \alpha_i Q_i^{'} \\
&\quad + 1/2 \sum_{i=1}^{5}\sum_{j=1}^{5} \alpha_{ij} Q_i^{'} Q_j^{'}] \bullet \exp[\beta_0 + \sum_{k=1}^{2} \beta_k \ln P_k \\
&\quad + 1/2 \sum_{k=1}^{2}\sum_{m=1}^{2} \beta_{k,m} \ln P_k \ln P_m]\}^{\phi} - 1) / \phi GM^{\phi-1}] \\
S_k &= \beta_k + \sum_{m=1}^{2} \beta_{k,m} \ln P_m
\end{aligned}
\qquad (2)
$$

5.2 Falling Average Operating Costs.

Predicted unit operating cost from the composite function for 93 savings and commercial banks over 1992-2005 is shown in Figure 8 for three separate years.[11] While the levels and mix of check, giro, and card payment volumes and numbers of ATMs and branch offices are allowed to vary, input prices are held constant at their mean values. As ϕ in the composite form is .21, the estimated model is closer to a specification which includes the log of output as well as input prices (when $\phi = 0.0$) than it is to a specification with output in absolutes and prices in logs (when $\phi = 1.0$).[12] Even

[10] Pulley and Braunstein (1992) note that it is generally not feasible to estimate both α_0 and β_0 intercepts. As we are more interested in output than input prices, we set $\beta_0 = 0$ and retain α_0 in estimation.

[11] Unit operating cost is the ratio of operating cost to asset value and is a measure of average operating cost. The estimated parameters of the composite function underlying this figure are presented in Appendix B. Likelihood ratio tests setting the 15 parameters associated with check, giro, and card payment transactions or the 11 parameters associated with ATM and branch variables equal to zero indicated that these two separate sets of variables are jointly significant.

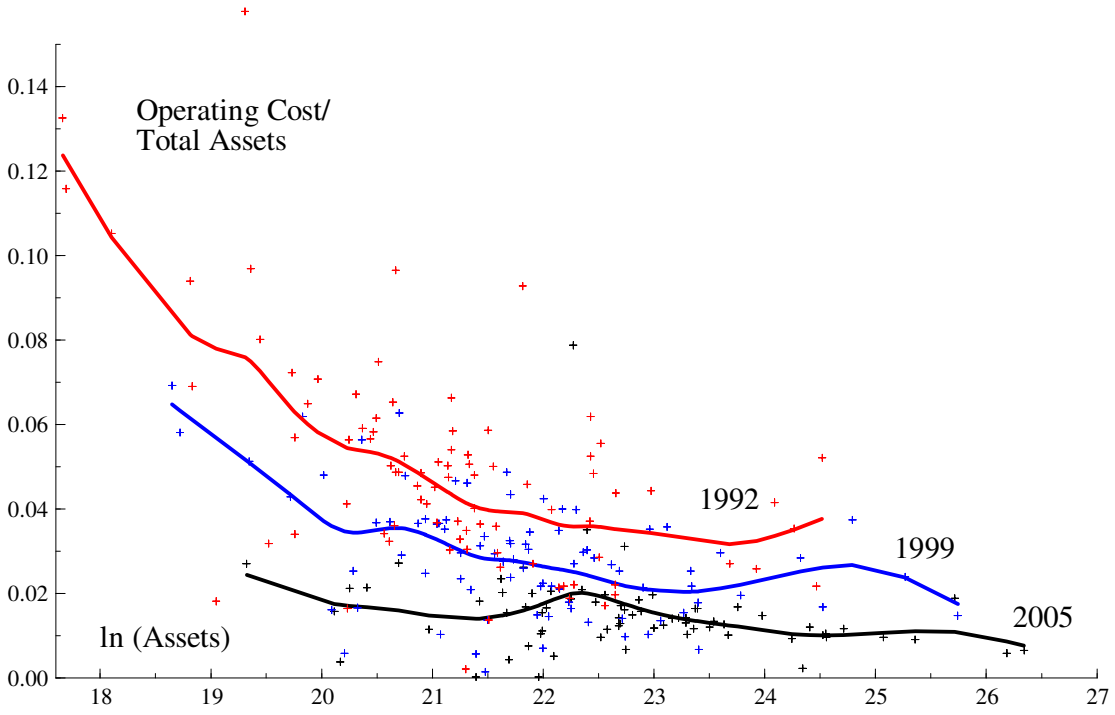
[12] For more on these two alternative specifications which depend on the value of ϕ, see Pulley and Braunstein (1992) or Pulley and Humphrey (1993).

so, the estimated model is significantly different from either of these alternatives since ϕ is significantly different from zero or one.

The curves fitted to the scattergram in Figure 1 are cubic splines and illustrate how unit operating cost generally varies by bank asset size for specific years and over time.[13] Scale economies exist since unit cost falls as (the log of) asset size increases on the X-axis. As well, the operating cost curves shift down over time showing that unit operating expenses are falling as technical change progresses with the substitution of ATMs for branch offices and the replacement of checks (and cash) with giro and card electronic payments.

Figure 8

Predicted Unit Operating Cost by Log of Bank Asset Value
(evaluated holding input prices constant at their mean value)



Looking at all banks together where unit operating cost reflects the ratio of the sum of observed operating expense across all banks divided by the sum of observed

[13] Bank size on the X-axis is indicated by the natural log of asset value. Taking the log improves comparability among the numerous smaller and less numerous very large banks. As ATMs and the production functions for processing payments are essentially identical across types of financial institutions, use of a single cost function covering both savings and commercial banks is justified. This accords well with our purpose of illustrating the efficiency gains from the shift to electronic payments and ATMs for the entire

asset values, this aggregate ratio is .030, .021, and .013, respectively, for 1992, 1999, and 2005 indicating a 57% reduction.[14] As the operating cost of our sampled banks in 1992 was € 11.0 billion, this suggests that operating expenses would have been € 6.3 billion higher (.57 times € 11.0 billion) in 2005 than they were if there were no scale effects or technical change to reduce operating costs from their ratio to assets in 1992.[15] This savings equals 0.7 % of GDP in 2005 and is equivalent to having unit operating cost at banks fall by about 4% a year over this 14 year period due to changes in payment costs and service delivery arrangements.

Table 6

Estimated Payment Scale Economies for Spain

	Scale Economy	Volume Weighted Average Scale Economy 1992-2005
1992-1996	.18	
1996-2000	.42	.33
2000-2005	.31	

5.3 Payment Scale Economies.

Predicted payment processing costs represent operating expenses associated with the level and composition of check, giro, and card transactions, holding ATMs, branch offices, and input prices constant at their mean values. These predicted payment costs, divided by the total number of check, giro, and card transactions made each year, give unit payment costs that fall both over time (top of Figure 2) and by total payment volume (bottom of Figure 2). Predicted unit payment cost fell by 60% between 1992 and 2005 while overall payment volume rose by 134%.[16] This implies that average payment

banking sector (rather than a subset of the industry).

[14] These aggregate ratios (ratios of sums) give a greater weight to larger banks who typically have lower unit operating cost. This is more representative of overall banking industry costs than if all banks are given an equal weight (an average of ratios). With equal weights, the operating cost/total asset ratio for the same three years is, respectively, .035, .026, and .017 (a 51% reduction over 1992-2005).

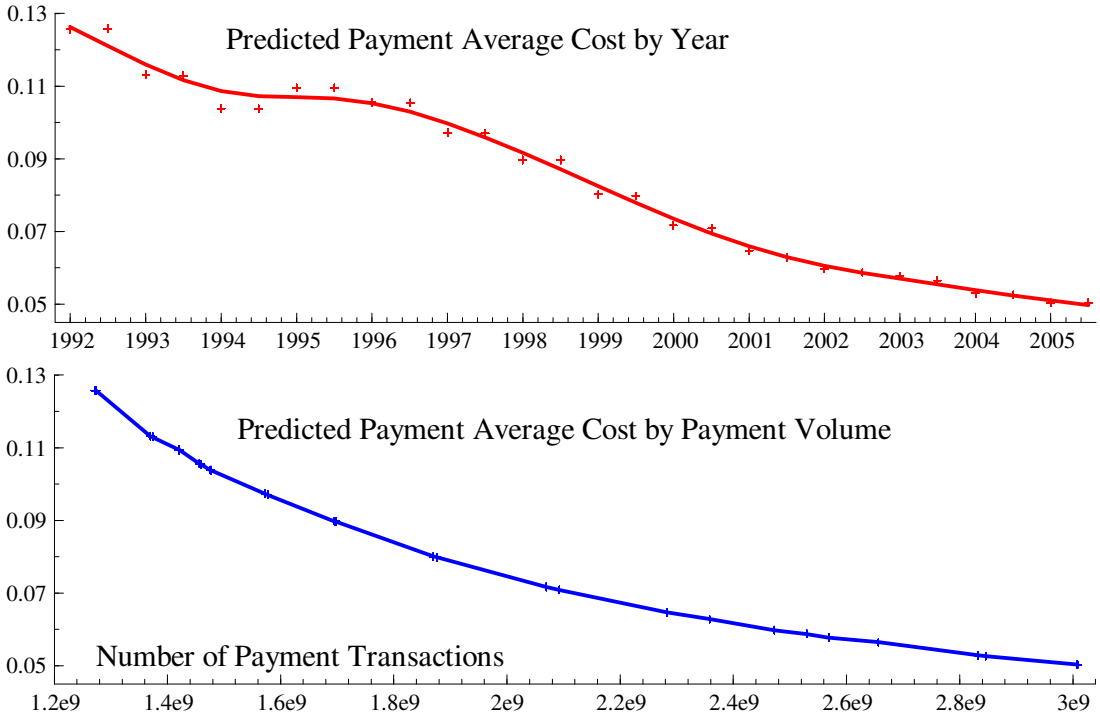
[15] If some of the decline in the operating cost/asset ratio is due to banks substituting purchased funds (which generate interest costs) for produced deposits or servicing off-balance sheet mutual funds (which generate operating expenses), then we should see a reduction in the ratio of produced deposits (demand, savings, and time deposits) plus mutual funds to assets over 1992-2005. As this ratio rises only slightly from 78.0% in 1992, to 79.5% in 2000, and to 79.8% in 2005, the reduction in the operating cost/asset ratio is attributed to cost effects, not to changes in liability composition.

[16] Multi-output cost functions like (1) that have interaction terms overstate the level of predicted average cost for subsets of outputs such as payments. This is because predicted values are obtained by evaluating the estimated cost function holding other variables constant at their means. This led Baumol, Panzer, and Willig

operating costs fall by 4.5% when payment volume rises by 10%. Put differently, over the entire 14 year period payment operating cost only rose by (10% - 4.5%) = 5.5% for each 10% rise in payment volume, suggesting an overall payment scale economy (SCE) value of .55. Letting AC = average operating cost and Q = payment volume, the average cost scale economy derived from the lower half of Figure 9 is (percent change in AC)/(percent change Q) = ∂lnAC/∂lnQ = - .45. Since ln AC = ln (TC/Q), where TC = total operating cost, the standard expression for scale economies is SCE = ∂lnTC/∂lnQ = 1.0 + ∂lnAC/∂lnQ = 1.0 - .45 = .55. Here total costs rise by 5.5% when volume increases by 10% while average costs fall by 4.5%.

Figure 9

Predicted Payment Average Cost in Euros by Year and by Payment Volume
(evaluated holding numbers of ATMs, branch offices,
and input prices constant at their mean values)



(1982) to suggest a measure of average incremental cost in place of average cost. However, we have detailed unit cost data (presented above) plus information from other industry sources that allows us to

Scale economies typically vary as volume expands and this is the case here since the slope of the predicted payment average cost curve in the bottom half of Figure 2 is not constant. Re-estimating the model over three shorter time periods yields the payment scale economy values shown in Table 1. The usual expectation is that scale economies are largest when volume is relatively small (consistent with a scale elasticity value of .18 over 1992-1996) but weakens as volume expands and there is a proportionally smaller increase in fixed cost to spread over a much higher volume (consistent with the higher scale elasticities over 1996-2000 and 2000-2005 in Table 6).

Weighting the three scale economy values shown in Table 6 by the percent change in volume for each period gives a scale economy value of .33. Due to non-linearities in the data, different scale effects can be estimated over different time periods. For example, estimating our model over 1992-2000 yields a scale economy of .36 while estimation over 2001-2005 gives .28. This strongly suggests that payment scale economies in Spain are within the range of .30 to the mid .30s, rather than markedly higher or lower. Some confirming information exists in a cross-country study of payment scale effects in Europe which yielded a scale economy of .30 for Spain (Bolt and Humphrey, 2007). This is not very different from debit card scale economies of .39 for the Netherlands and Belgium obtained using a cost accounting approach rather than statistical information.[17]

Not all payment costs are falling. Indeed, the reduction in unit payment expense seen in Figure 2 is composed of rising check average costs and falling giro and card average costs over time. These changes are seen in Figure 3 where the level of predicted unit costs for check, giro, and card transactions have been re-scaled or "normalized" at their mean value to reflect internal industry estimates of the level of average cost for each of these payment instruments.[18] As a result, both the levels and the changes shown in Figure 10 are likely good approximations to underlying (but

---

approximate average cost at a point in time. This allows us to re-scale the predicted costs and obtain more accurate estimates of the level of average costs from which to compute percent changes and scale effects.

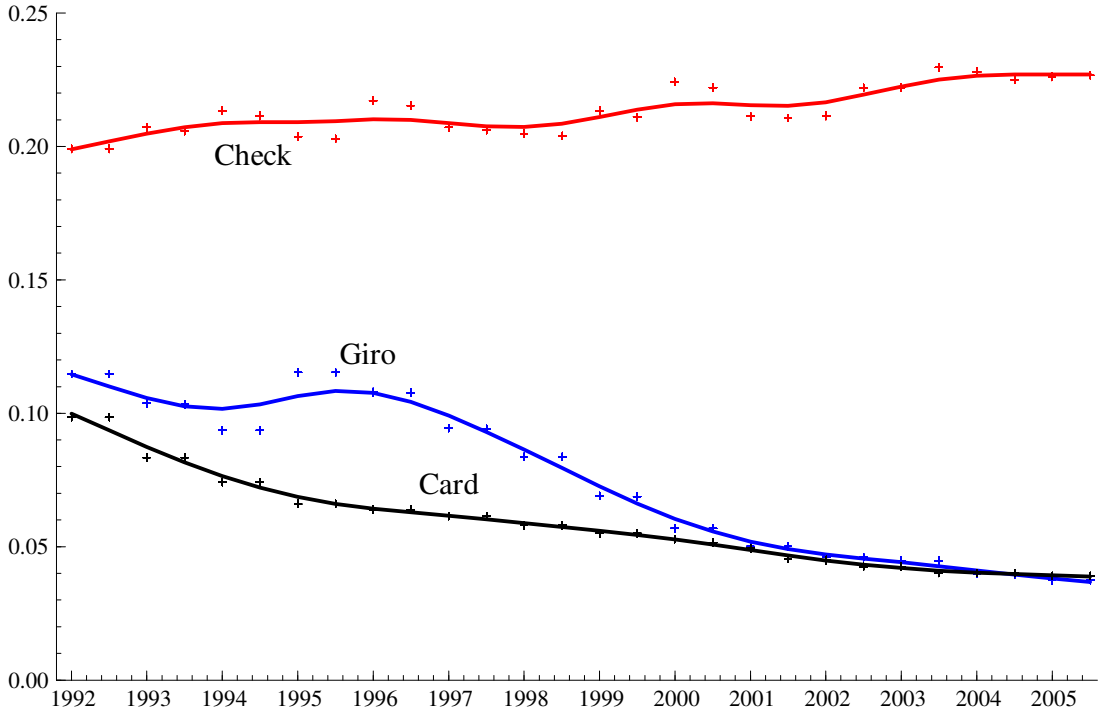
[17] These results are based on a manipulation of data reported in Brits and Winder (2005) for Norway and Quaden (2005) for Belgium (manipulated in Bolt and Humphrey, 2007).

[18] The mean value of the predicted average cost for each payment instrument derived from our cost function is overstated since it includes the mean value of the variables held constant in evaluating the estimated function to obtain the predicted time-series of operating cost for each payment instrument. According to industry sources and information presented in Section 4 above, a point estimate of the average cost of a check is € 0.213, € 0.0775 for a giro transaction, and € 0.060 for a card payment. The average cost data series derived from the cost function is re-scaled by multiplying each element in the series by the ratio of its corresponding point estimate to the mean value of the series. This effectively eliminates the overstatement and yields the separate average cost curves shown in Figure 3 as well as the curves in Figure 2.

unavailable) time-series cost accounting values for these instruments.

Figure 10

Approximate Card, Giro, and Check Average Cost in Euros by Year



Over 1992-2005, giro and card payments expanded by 174% and 169%, respectively, while checks fell by 18%. As a result, the share of checks in all non-cash payment transactions fell from .19 in 1992 to only .07 in 2005. Giro transactions accounted for a .58 share in 2005 while cards were .36. Scale economies in the processing of electronic giro and debit card payments help explain the reduction in the average per transaction payment expenses in Figure 9 while the scale benefit works in reverse (to offset some of this benefit) as the number of checks processed falls.

5.4 SEPA and Lower Payment Costs.

The promotion of a Single Euro Payments Area (SEPA) with cross-border inter-operability for electronic payments will, depending on realized cost efficiencies, make card transactions increasingly attractive to replace cash and checks for intra-European as well as national payments. Currently most payments in Europe are domestic with little

cross-border activity. Cross-border payments at present are "piggy-backed" onto existing operations within each country. While this addresses the SEPA goal of making cross-border payments as easy as domestic transactions, it is unlikely to result in any significant cost reduction. Cross-border transaction volume is currently low and these transactions require extra telecommunications expense so even if processing scale economies are large (as we show above) unit costs would not fall by much and could even rise since there would only be "normal" growth in each country's transaction volume at existing processing centers.

Lower cross-border as well as domestic unit payment costs, however, would be achievable by consolidating processing operations across borders. The scale economies estimated here suggest that the long-run reduction in unit payment costs would be substantial if various nations' electronic payment transaction volumes were consolidated. Such a development is currently underway in the Netherlands which is in the process of consolidating its payment operations with that of a German processor, substantially raising transaction volume. As the cost of electronic payments is reduced further, more retail outlets would be encouraged to install EFTPOS terminals and use of cash would fall. While this has implications for government seigniorage revenue and tax avoidance behavior, it would reduce the bank cost of supplying cash at branch offices and through ATMs.

6. Summary and Conclusions.

This study provides detailed estimates of the costs and benefits (income) realized by the bank, merchant, central bank, and consumer participants in the Spanish payment system. While cash and check use are included in this analysis, the focus is on the two-sided credit and debit card market for Spain. The estimated costs and benefits presented here are based upon expert opinions and judgment as well as internal cost accounting analyses and were made available to us by industry sources. The analysis makes clear the benefits of electronic payments for Spain and parallels similar exercises for the U.S. and Australia.

The main results are that banks, on balance, incur net losses (costs - income) in providing credit card, debit card, and cash payment services but experience a net gain in providing checks. Bank cash services have the smallest net loss per transaction (at €-0.063) but this is more than doubled for credit and debit cards. Looking at card issuing banks separately from merchant acquiring banks, it appears that only the issuing side of

this two-sided card market is profitable. There do not seem to be net benefits for banks on the acquiring side.

As accepting payments is a cost of doing business for Merchants, it is not surprising that accepting any of the four payment instruments is not profitable by themselves. Considering only cost, cash is the least expensive instrument for merchants to accept but, when estimated income is factored in, the smallest net loss occurs for debit and credit cards (at €-0.150 per transaction), which is about half the net loss associated with cash. Checks incur a net loss for merchants almost seven times higher.

While the net effect of government and the central bank on payment cost and income is close to zero, the net effect for consumers is significant. Consumers incur a net cost in using any of the four instruments but this net expense is lowest for debit cards (€-0.355 per transaction), followed by credit cards (€-0.480), checks (€-1.002), and finally cash (€-1.112). On balance, at the bank, merchant, or consumer level payments are a net cost although these net costs are less for cards than for cash or checks.[19]

Since debit cards are generally the cheapest payment instrument of the four covered here, payment costs for the Spanish economy would be reduced if debit cards continue to replace more expensive cash and checks in transactions. Another way to reduce payment costs relies on payment scale economies. These were shown to be large for Spain in that a 100% rise in payment transaction volume may only result in a 33% increase in operating cost (so the scale economy is 33%/100% = .33). If the average operating cost of processing 2 million debit card transactions per day is €0.06 and a consolidation of currently national card processing operations across borders expanded processed volume by 100%, average processing cost could fall to €0.04, a one-third reduction.[20] Such an development would be consistent with the effort to create a more efficient Single Euro Payments Area (SEPA).

[19] The social cost of different payment instruments can be approximated by summing the separate cost plus income figures for banks, merchants, the central bank, and consumers presented in the tables. Although some costs will be double counted, as when the bank cost to produce payment services for merchants is added to merchant costs of accepting payments, merchant payments to banks corrects for what otherwise would be a double counting of costs.

[20] From [(€0.06 x 2 million) x 1.33] /[2 million + 2 million] = €0.04.

Bibliography

Baumol, W., J. Panzer, and R. Willig (1982). *Contestable Markets and the Theory of Industrial Structure.* Harcourt Brace Jovanovich, San Diego.

Baxter, W. F. (1983). "Bank Interchange of Transactional Paper: Legal and Economic Perspectives", *Journal of Law and Economics*, 26: 541-588.

Bolt, W., and D. Humphrey (2007). "Payment Network Scale Economies, SEPA, and Cash Replacement", Working Paper, Dutch National Bank, Amsterdam.

Box, G., and D. Cox (1964). "An Analysis of Transformations", *Journal of the Royal Statistical Society*, Series B, 26: 211-246.

Brits, H., and C. Winder (2005). *Payments Are No Free Lunch*, De Nederlandsche Bank, Occasional Studies, Vol. 3/Nr. 2.

Chang, H., Evans, D. and D. Garcia Swartz (2005). "The Effect of Regulatory Intervention in Two-Sided Markets: An Assessment of Interchange-Fee Capping in Australia", *Review of Network Economics*, 4: 328-358.

Carbó, S., D. Humphrey, and R. López (2006). "Electronic Payments and ATMs: Changing Technology and Cost Efficiency in Banking", in Balling, M., F. Lierman, and A. Mullineaux (eds.), *Competition and Profitability in European Financial Services. Strategic, Systemic and Policy Issues*, Routledge, Abingdon (UK): 96-113. UK.

Chakravorti, S. and T. To (2000). "Towards a Theory of Merchant Credit Card Acceptance", mimeo, Federal Reserve Bank of Chicago.

Gans, J. and King, S.P. (2003). "The Neutrality of Interchange Fees in Payment Systems", *Review of Network Economics*, 2: 125-145.

Government Accountability Office (2006), “Credit Cards: Increased Complexity in Rates and Fees Heightens Need for More Effective Disclosures to Consumers”, Report to the Ranking Minority Member, Permanent Subcommittee on Investigations, Committee on Homeland Security and Governmental Affairs, U.S. Senate, GAO-06-929, September.

Gresvik, O. and G. Øwre (2002). "Banks’ Costs and Income in the Payment System in 2001", *Norges Bank Economic Bulletin*, 73: 125-33.

Guerin-Calvert, M. and J. A. Ordover (2005). "Merchant Benefits and Public Policy towards Interchange: An Economic Assessment", presented at the New York Fed Conference on ‘Antitrust Activity in Card-Based Payment Systems: Causes and Consequences’.

Humphrey, D, Willesson, M., Lidblom, T. and G. Bergendahl (2006a). "What does it Cost to Make a Payment?", *Review of Network Economics*, 2:159-174

Humphrey, D., M. Willesson, G. Bergendahl, and T. Lindblom (2006b). "Benefits from a Changing Payment Technology in European Banking", *Journal of Banking and Finance*,

30: 1631-1652.

Pulley, L., and Y. Braunstein (1992). "A Composite Cost Function for Multiproduct Firms with an Application to Economies of Scope in Banking", *Review of Economics and Statistics*, 74: 221-230.

Pulley, L., and D. Humphrey (1993). "The Role of Fixed Costs and Cost Complementarities in Determining Scope Economies and the Cost of Narrow Banking Proposals", *Journal of Business*, 66: 437-462.

Quaden, G. (2005). *Costs, Advantages and Drawbacks of the Various Means of Payment*, National Bank of Belgium, English summary, December: 41-7.

Reserve Bank of Australia and Australian Competition and Consumer Commission (2000). *Debit and Credit Card Schemes in Australia: A Study of Interchange Fees and Access*, October.

Rochet, J.C. and J. Tirole (2002). "Cooperation Among Competitors: Some Economics of Payment Card Associations", *RAND Journal of Economics*, 33: 1-22.

Rochet, J.C. and J. Tirole (2006). "Tying in Two-Sided Markets and the Honor All Cards Rule", IDEI Working Paper, n. 440

Robinson, P. and D. Flatraaker (1995). "Costs in the Payment System", *Norges Bank Economic Bulletin*, 66: 207-16.

Schmalensee, R., (2002). "Payment Systems and Interchange Fees", *Journal of Industrial Economics*, 50: 103-122.

Simes, R., A. Lancy, and I. Harper (2006). "Costs and Benefits of Alternative Payments Instruments in Australia", Working Paper, Melbourne Business School, Australia, April.

Small, J. and J. Wright (2001). "The Bilateral Negotiation of Interchange Fees in Payment Schemes" mimeo, NECG and University of Auckland.

Swartz, D., R. Hahn, and A. Layne-Farrar (2006). "The Move toward a Cashless Society: A Closer Look at Payment Instrument Economics", *Review of Network Economics*, 5: 175-98.

Weiner, S.T. and J. Wright (2004), “Interchange Fees in Various Countries: Developments and Determinants”, *Review of Network Economics*, 4, 290-323

Wright, J. (2005). "Why do firms accept credit cards?", mimeo, University of Auckland.

Appendix A: Generating cost/income data for Spain. Some methodological issues.

This study relies on data from a broad range of industry sources along with the informed views of payment market participants. Currently, there is no publicly or systematically collected payment cost information available for Spain. The study follows earlier methodologies yielding payment cost estimations for the U.S. outlined in Humphrey and Berger (1990) and especially in Swartz, Hahn, and Layne-Farrar (2004).

The main estimates of payment costs rely on the Delphi forecasting technique. Here a panel of experts, including bankers, payment network managers, and bank accounting managers, were interviewed over two rounds. These industry experts were asked to provide their informed views based on their internal (mainly confidential) information and their own views regarding different cost and income items for each payment instrument. In the first round, the experts were provided with information from previous studies of payment unit costs in other European countries and the U.S. This information was used to “cross-check” the cost estimates generated for Spain. Fortunately, the production function for the same payment instruments in different countries is quite similar and unit cost would vary primarily due to the scale of processing operations and the overall level of payment instrument use. In a second round, the experts were provided with an anonymous summary of all experts’ forecasts and their reasons for them. After these two rounds, the experts' informed views regarding payment costs tended to converge so the process was stopped and our final data were derived by averaging the resulting experts' final values. The methodology applied set out clearly the various stages in the payment instrument production process and income framework.

The goal of the project was to obtain the likely unit average cost per payment instrument at their different stages of production in order to estimate the cost of using cards (debit and credit cards separately) relative to other payment instruments (cash and checks) in Spain. The approach of giving payment participants illustrative payment data based on analyses of payment systems of other countries is a good one as this information assists Spanish experts in focusing on how the cost of payments in Spain differ (or not) from costs in other countries. Our four sets of expert payment participants consisted of consumers, merchants, commercial bankers and, when applicable, the central bank. A distinctive methodological issue of this study is that it considers all the different players in the industry as well as all sources of both costs and income.

Considering the four parties involved, there are certain specific assumptions that should be highlighted. These are:

(1) Merchants: the “time to make a payment” is the number of seconds multiplied by the “value of time” (unit labor cost). Float cost is an average daily expense based on the value of money and the time involved to effectively deposit funds received (1 day for cards, 2 for cash, 4 for checks). The cost of “fraud” is virtually zero for cards since all merchants are directly and fully covered by the bank and this “guarantee of payments” is not directly charged for. Infrastructure and other costs were obtained from internal accounting data of the different payment providers. Estimation of fraud costs for checks and cash represent the informed views of the experts participating in the analysis.

(2) Issuing banks: the cost of ATM cash withdrawals was obtained from internal data on on-us withdrawals (as they represent around 86% of total withdrawals) and adjusted using the estimated value of the other types of withdrawals (i.e., international customer withdrawals and withdrawals by customers of other Spanish banks within Spain). Fees charged for ATM withdrawals were obtained from internal data sources.

(3) Cardholders: While most costs were directly observable, revenues from reward and fidelity programs correspond to the costs of the card issuer.

(4) Government and central bank: these costs correspond to informed industry expert views as well as academics and the central bank.

Appendix B: Parameter Estimates for the Composite Cost Function.

The number of observations is 2,282 over 1992-2005 while the log likelihood of equation (2) is 2417.97. Standard errors are computed from a heteroscedastic-consistent matrix (Robust-White) and the Durbin-Watson is 1.95 (indicating no autocorrelation problem). The cost function is concave as the matrix of second derivatives of the cost function is negative semidefinite.

Likelihood ratio tests of setting the 15 parameters associated with check, giro, and card payment transactions or the 11 parameters associated with ATM and branch variables equal to zero were -2ln = 5840 and 272, respectively, indicating that these restrictions would significantly reduce the explanatory power of the model. The three payment transaction variables are not publicly available by bank in any country and only varied over time but their parameters were jointly significant at the .01 level. The ATM and branch variables varied by bank and over time and were also significant at the .01 level.

Parameter	Estimate	t-statistic
ϕ	.209	14.54
α_0	.331E+08	2.43
α_1	-2.52	-2.27
α_2	.521E-02	1.48
α_3	-.028	-2.93
α_4	-.225E+05	-1.77
α_5	.456E+05	3.52
α_{11}	.945E-09	2.11
α_{22}	.176E-11	.62
α_{33}	.134E-10	1.34
α_{44}	-3.45	-2.48
α_{55}	5.20	3.03
α_{12}	-.372E-10	-1.33
α_{13}	.223E-09	2.85
α_{14}	.164E-03	1.60
α_{15}	-.166E-03	-1.72
α_{23}	-.878E-11	-.84
α_{24}	.337E-06	.05
α_{25}	-.642E-05	-.86
α_{34}	.291E-04	1.91
α_{35}	-.302E-04	-1.96
α_{45}	3.22	1.09
β_1	.065	3.33
β_{11}	.047	27.62

FUNDACIÓN DE LAS CAJAS DE AHORROS

DOCUMENTOS DE TRABAJO

Últimos números publicados

159/2000 Participación privada en la construcción y explotación de carreteras de peaje
Ginés de Rus, Manuel Romero y Lourdes Trujillo

160/2000 Errores y posibles soluciones en la aplicación del *Value at Risk*
Mariano González Sánchez

161/2000 Tax neutrality on saving assets. The spahish case before and after the tax reform
Cristina Ruza y de Paz-Curbera

162/2000 Private rates of return to human capital in Spain: new evidence
F. Barceinas, J. Oliver-Alonso, J.L. Raymond y J.L. Roig-Sabaté

163/2000 El control interno del riesgo. Una propuesta de sistema de límites
riesgo neutral
Mariano González Sánchez

164/2001 La evolución de las políticas de gasto de las Administraciones Públicas en los años 90
Alfonso Utrilla de la Hoz y Carmen Pérez Esparrells

165/2001 Bank cost efficiency and output specification
Emili Tortosa-Ausina

166/2001 Recent trends in Spanish income distribution: A robust picture of falling income inequality
Josep Oliver-Alonso, Xavier Ramos y José Luis Raymond-Bara

167/2001 Efectos redistributivos y sobre el bienestar social del tratamiento de las cargas familiares en el nuevo IRPF
Nuria Badenes Plá, Julio López Laborda, Jorge Onrubia Fernández

168/2001 The Effects of Bank Debt on Financial Structure of Small and Medium Firms in some European Countries
Mónica Melle-Hernández

169/2001 La política de cohesión de la UE ampliada: la perspectiva de España
Ismael Sanz Labrador

170/2002 Riesgo de liquidez de Mercado
Mariano González Sánchez

171/2002 Los costes de administración para el afiliado en los sistemas de pensiones basados en cuentas de capitalización individual: medida y comparación internacional.
José Enrique Devesa Carpio, Rosa Rodríguez Barrera, Carlos Vidal Meliá

172/2002 La encuesta continua de presupuestos familiares (1985-1996): descripción, representatividad y propuestas de metodología para la explotación de la información de los ingresos y el gasto.
Llorenc Pou, Joaquín Alegre

173/2002 Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de credito.
Rosa Puertas, María Bonilla, Ignacio Olmeda

174/2002 Mercado único, comercio intra-industrial y costes de ajuste en las manufacturas españolas.
José Vicente Blanes Cristóbal

175/2003 La Administración tributaria en España. Un análisis de la gestión a través de los ingresos y de los gastos.
Juan de Dios Jiménez Aguilera, Pedro Enrique Barrilao González

176/2003 The Falling Share of Cash Payments in Spain.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey
Publicado en "Moneda y Crédito" nº 217, pags. 167-189.

177/2003 Effects of ATMs and Electronic Payments on Banking Costs: The Spanish Case.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

178/2003 Factors explaining the interest margin in the banking sectors of the European Union.
Joaquín Maudos y Juan Fernández Guevara

179/2003 Los planes de stock options para directivos y consejeros y su valoración por el mercado de valores en España.
Mónica Melle Hernández

180/2003 Ownership and Performance in Europe and US Banking – A comparison of Commercial, Co-operative & Savings Banks.
Yener Altunbas, Santiago Carbó y Phil Molyneux

181/2003 The Euro effect on the integration of the European stock markets.
Mónica Melle Hernández

182/2004 In search of complementarity in the innovation strategy: international R&D and external knowledge acquisition.
Bruno Cassiman, Reinhilde Veugelers

183/2004 Fijación de precios en el sector público: una aplicación para el servicio municipal de suministro de agua.
Mª Ángeles García Valiñas

184/2004 Estimación de la economía sumergida es España: un modelo estructural de variables latentes.
Ángel Alañón Pardo, Miguel Gómez de Antonio

185/2004 Causas políticas y consecuencias sociales de la corrupción.
Joan Oriol Prats Cabrera

186/2004 Loan bankers' decisions and sensitivity to the audit report using the belief revision model.
Andrés Guiral Contreras and José A. Gonzalo Angulo

187/2004 El modelo de Black, Derman y Toy en la práctica. Aplicación al mercado español.
Marta Tolentino García-Abadillo y Antonio Díaz Pérez

188/2004 Does market competition make banks perform well?.
Mónica Melle

189/2004 Efficiency differences among banks: external, technical, internal, and managerial
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

190/2004 Una aproximación al análisis de los costes de la esquizofrenia en españa: los modelos jerárquicos bayesianos
F. J. Vázquez-Polo, M. A. Negrín, J. M. Cavasés, E. Sánchez y grupo RIRAG

191/2004 Environmental proactivity and business performance: an empirical analysis
Javier González-Benito y Óscar González-Benito

192/2004 Economic risk to beneficiaries in notional defined contribution accounts (NDCs)
Carlos Vidal-Meliá, Inmaculada Domínguez-Fabian y José Enrique Devesa-Carpio

193/2004 Sources of efficiency gains in port reform: non parametric malmquist decomposition tfp index for Mexico
Antonio Estache, Beatriz Tovar de la Fé y Lourdes Trujillo

194/2004 Persistencia de resultados en los fondos de inversión españoles
Alfredo Ciriaco Fernández y Rafael Santamaría Aquilué

195/2005 El modelo de revisión de creencias como aproximación psicológica a la formación del juicio del auditor sobre la gestión continuada
Andrés Guiral Contreras y Francisco Esteso Sánchez

196/2005 La nueva financiación sanitaria en España: descentralización y prospectiva
David Cantarero Prieto

197/2005 A cointegration analysis of the Long-Run supply response of Spanish agriculture to the common agricultural policy
José A. Mendez, Ricardo Mora y Carlos San Juan

198/2005 ¿Refleja la estructura temporal de los tipos de interés del mercado español preferencia por la liquidez?
Magdalena Massot Perelló y Juan M. Nave

199/2005 Análisis de impacto de los Fondos Estructurales Europeos recibidos por una economía regional: Un enfoque a través de Matrices de Contabilidad Social
M. Carmen Lima y M. Alejandro Cardenete

200/2005 Does the development of non-cash payments affect monetary policy transmission?
Santiago Carbó Valverde y Rafael López del Paso

201/2005 Firm and time varying technical and allocative efficiency: an application for port cargo handling firms
Ana Rodríguez-Álvarez, Beatriz Tovar de la Fe y Lourdes Trujillo

202/2005 Contractual complexity in strategic alliances
Jeffrey J. Reuer y Africa Ariño

203/2005 Factores determinantes de la evolución del empleo en las empresas adquiridas por opa
Nuria Alcalde Fradejas y Inés Pérez-Soba Aguilar

204/2005 Nonlinear Forecasting in Economics: a comparison between Comprehension Approach versus Learning Approach. An Application to Spanish Time Series
Elena Olmedo, Juan M. Valderas, Ricardo Gimeno and Lorenzo Escot

205/2005 Precio de la tierra con presión urbana: un modelo para España
Esther Decimavilla, Carlos San Juan y Stefan Sperlich

206/2005 Interregional migration in Spain: a semiparametric analysis
Adolfo Maza y José Villaverde

207/2005 Productivity growth in European banking
Carmen Murillo-Melchor, José Manuel Pastor y Emili Tortosa-Ausina

208/2005 Explaining Bank Cost Efficiency in Europe: Environmental and Productivity Influences.
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

209/2005 La elasticidad de sustitución intertemporal con preferencias no separables intratemporalmente: los casos de Alemania, España y Francia.
Elena Márquez de la Cruz, Ana R. Martínez Cañete y Inés Pérez-Soba Aguilar

210/2005 Contribución de los efectos tamaño, book-to-market y momentum a la valoración de activos: el caso español.
Begoña Font-Belaire y Alfredo Juan Grau-Grau

211/2005 Permanent income, convergence and inequality among countries
José M. Pastor and Lorenzo Serrano

212/2005 The Latin Model of Welfare: Do 'Insertion Contracts' Reduce Long-Term Dependence?
Luis Ayala and Magdalena Rodríguez

213/2005 The effect of geographic expansion on the productivity of Spanish savings banks
Manuel Illueca, José M. Pastor and Emili Tortosa-Ausina

214/2005 Dynamic network interconnection under consumer switching costs
Ángel Luis López Rodríguez

215/2005 La influencia del entorno socioeconómico en la realización de estudios universitarios: una aproximación al caso español en la década de los noventa
Marta Rahona López

216/2005 The valuation of spanish ipos: efficiency analysis
Susana Álvarez Otero

217/2005 On the generation of a regular multi-input multi-output technology using parametric output distance functions
Sergio Perelman and Daniel Santin

218/2005 La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los diputados en España
Gonzalo Caballero Miguez

219/2005 Determinants of bank market structure: Efficiency and political economy variables
Francisco González

220/2005 Agresividad de las órdenes introducidas en el mercado español: estrategias, determinantes y medidas de performance
David Abad Díaz

221/2005 Tendencia post-anuncio de resultados contables: evidencia para el mercado español
Carlos Forner Rodríguez, Joaquín Marhuenda Fructuoso y Sonia Sanabria García

222/2005 Human capital accumulation and geography: empirical evidence in the European Union
Jesús López-Rodríguez, J. Andrés Faíña y Jose Lopez Rodríguez

223/2005 Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Processing
Waymond Rodgers and Andrés Guiral

224/2005 The effect of Structural Fund spending on the Galician region: an assessment of the 1994-1999 and 2000-2006 Galician CSFs
José Ramón Cancelo de la Torre, J. Andrés Faíña and Jesús López-Rodríguez

225/2005 The effects of ownership structure and board composition on the audit committee activity: Spanish evidence
Carlos Fernández Méndez and Rubén Arrondo García

226/2005 Cross-country determinants of bank income smoothing by managing loan loss provisions
Ana Rosa Fonseca and Francisco González

227/2005 Incumplimiento fiscal en el irpf (1993-2000): un análisis de sus factores determinantes
Alejandro Estellér Moré

228/2005 Region versus Industry effects: volatility transmission
Pilar Soriano Felipe and Francisco J. Climent Diranzo

229/2005 Concurrent Engineering: The Moderating Effect Of Uncertainty On New Product Development Success
Daniel Vázquez-Bustelo and Sandra Valle

230/2005 On zero lower bound traps: a framework for the analysis of monetary policy in the 'age' of central banks
Alfonso Palacio-Vera

231/2005 Reconciling Sustainability and Discounting in Cost Benefit Analysis: a methodological proposal
M. Carmen Almansa Sáez and Javier Calatrava Requena

232/2005 Can The Excess Of Liquidity Affect The Effectiveness Of The European Monetary Policy?
Santiago Carbó Valverde and Rafael López del Paso

233/2005 Inheritance Taxes In The Eu Fiscal Systems: The Present Situation And Future Perspectives.
Miguel Angel Barberán Lahuerta

234/2006 Bank Ownership And Informativeness Of Earnings.
Víctor M. González

235/2006 Developing A Predictive Method: A Comparative Study Of The Partial Least Squares Vs Maximum Likelihood Techniques.
Waymond Rodgers, Paul Pavlou and Andres Guiral.

236/2006 Using Compromise Programming for Macroeconomic Policy Making in a General Equilibrium Framework: Theory and Application to the Spanish Economy.
Francisco J. André, M. Alejandro Cardenete y Carlos Romero.

237/2006 Bank Market Power And Sme Financing Constraints.
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández y Gregory F. Udell.

238/2006 Trade Effects Of Monetary Agreements: Evidence For Oecd Countries.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano.

239/2006 The Quality Of Institutions: A Genetic Programming Approach.
Marcos Álvarez-Díaz y Gonzalo Caballero Miguez.

240/2006 La interacción entre el éxito competitivo y las condiciones del mercado doméstico como determinantes de la decisión de exportación en las Pymes.
Francisco García Pérez.

241/2006 Una estimación de la depreciación del capital humano por sectores, por ocupación y en el tiempo.
Inés P. Murillo.

242/2006 Consumption And Leisure Externalities, Economic Growth And Equilibrium Efficiency.
Manuel A. Gómez.

243/2006 Measuring efficiency in education: an analysis of different approaches for incorporating non-discretionary inputs.
Jose Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro y Javier Salinas-Jiménez

244/2006 Did The European Exchange-Rate Mechanism Contribute To The Integration Of Peripheral Countries?.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

245/2006 Intergenerational Health Mobility: An Empirical Approach Based On The Echp.
Marta Pascual and David Cantarero

246/2006 Measurement and analysis of the Spanish Stock Exchange using the Lyapunov exponent with digital technology.
Salvador Rojí Ferrari and Ana Gonzalez Marcos

247/2006 Testing For Structural Breaks In Variance Withadditive Outliers And Measurement Errors.
Paulo M.M. Rodrigues and Antonio Rubia

248/2006 The Cost Of Market Power In Banking: Social Welfare Loss Vs. Cost Inefficiency.
Joaquín Maudos and Juan Fernández de Guevara

249/2006 Elasticidades de largo plazo de la demanda de vivienda: evidencia para España (1885-2000).
Desiderio Romero Jordán, José Félix Sanz Sanz y César Pérez López

250/2006 Regional Income Disparities in Europe: What role for location?.
Jesús López-Rodríguez and J. Andrés Faíña

251/2006 Funciones abreviadas de bienestar social: Una forma sencilla de simultanear la medición de la eficiencia y la equidad de las políticas de gasto público.
Nuria Badenes Plá y Daniel Santín González

252/2006 "The momentum effect in the Spanish stock market: Omitted risk factors or investor behaviour?".
Luis Muga and Rafael Santamaría

253/2006 Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita.
Jordi Perdiguero García

254/2006 Desigualdad regional en España: renta permanente versus renta corriente.
José M.Pastor, Empar Pons y Lorenzo Serrano

255/2006 Environmental implications of organic food preferences: an application of the impure public goods model.
Ana Maria Aldanondo-Ochoa y Carmen Almansa-Sáez

256/2006 Family tax credits versus family allowances when labour supply matters: Evidence for Spain.
José Felix Sanz-Sanz, Desiderio Romero-Jordán y Santiago Álvarez-García

257/2006 La internacionalización de la empresa manufacturera española: efectos del capital humano genérico y específico.
José López Rodríguez

258/2006 Evaluación de las migraciones interregionales en España, 1996-2004.
María Martínez Torres

259/2006 Efficiency and market power in Spanish banking.
Rolf Färe, Shawna Grosskopf y Emili Tortosa-Ausina.

260/2006 Asimetrías en volatilidad, beta y contagios entre las empresas grandes y pequeñas cotizadas en la bolsa española.
Helena Chuliá y Hipòlit Torró.

261/2006 Birth Replacement Ratios: New Measures of Period Population Replacement.
José Antonio Ortega.

262/2006 Accidentes de tráfico, víctimas mortales y consumo de alcohol.
José Mª Arranz y Ana I. Gil.

263/2006 Análisis de la Presencia de la Mujer en los Consejos de Administración de las Mil Mayores Empresas Españolas.
Ruth Mateos de Cabo, Lorenzo Escot Mangas y Ricardo Gimeno Nogués.

264/2006 Crisis y Reforma del Pacto de Estabilidad y Crecimiento. Las Limitaciones de la Política Económica en Europa.
Ignacio Álvarez Peralta.

265/2006 Have Child Tax Allowances Affected Family Size? A Microdata Study For Spain (1996-2000).
Jaime Vallés-Giménez y Anabel Zárate-Marco.

266/2006 Health Human Capital And The Shift From Foraging To Farming.
Paolo Rungo.

267/2006 Financiación Autonómica y Política de la Competencia: El Mercado de Gasolina en Canarias.
Juan Luis Jiménez y Jordi Perdiguero.

268/2006 El cumplimiento del Protocolo de Kyoto para los hogares españoles: el papel de la imposición sobre la energía.
Desiderio Romero-Jordán y José Félix Sanz-Sanz.

269/2006 Banking competition, financial dependence and economic growth
Joaquín Maudos y Juan Fernández de Guevara

270/2006 Efficiency, subsidies and environmental adaptation of animal farming under CAP
Werner Kleinhanß, Carmen Murillo, Carlos San Juan y Stefan Sperlich

271/2006 Interest Groups, Incentives to Cooperation and Decision-Making Process in the European Union
A. Garcia-Lorenzo y Jesús López-Rodríguez

272/2006 Riesgo asimétrico y estrategias de momentum en el mercado de valores español
Luis Muga y Rafael Santamaría

273/2006 Valoración de capital-riesgo en proyectos de base tecnológica e innovadora a través de la teoría de opciones reales
Gracia Rubio Martín

274/2006 Capital stock and unemployment: searching for the missing link
Ana Rosa Martínez-Cañete, Elena Márquez de la Cruz, Alfonso Palacio-Vera and Inés Pérez-Soba Aguilar

275/2006 Study of the influence of the voters' political culture on vote decision through the simulation of a political competition problem in Spain
Sagrario Lantarón, Isabel Lillo, Mª Dolores López and Javier Rodrigo

276/2006 Investment and growth in Europe during the Golden Age
Antonio Cubel and Mª Teresa Sanchis

277/2006 Efectos de vincular la pensión pública a la inversión en cantidad y calidad de hijos en un modelo de equilibrio general
Robert Meneu Gaya

278/2006 El consumo y la valoración de activos
Elena Márquez y Belén Nieto

279/2006 Economic growth and currency crisis: A real exchange rate entropic approach
David Matesanz Gómez y Guillermo J. Ortega

280/2006 Three measures of returns to education: An illustration for the case of Spain
María Arrazola y José de Hevia

281/2006 Composition of Firms versus Composition of Jobs
Antoni Cunyat

282/2006 La vocación internacional de un holding tranviario belga: la Compagnie Mutuelle de Tram-ways, 1895-1918
Alberte Martínez López

283/2006 Una visión panorámica de las entidades de crédito en España en la última década.
Constantino García Ramos

284/2006 Foreign Capital and Business Strategies: a comparative analysis of urban transport in Madrid and Barcelona, 1871-1925
Alberte Martínez López

285/2006 Los intereses belgas en la red ferroviaria catalana, 1890-1936
Alberte Martínez López

286/2006 The Governance of Quality: The Case of the Agrifood Brand Names
Marta Fernández Barcala, Manuel González-Díaz y Emmanuel Raynaud

287/2006 Modelling the role of health status in the transition out of malthusian equilibrium
Paolo Rungo, Luis Currais and Berta Rivera

288/2006 Industrial Effects of Climate Change Policies through the EU Emissions Trading Scheme
Xavier Labandeira and Miguel Rodríguez

289/2006 Globalisation and the Composition of Government Spending: An analysis for OECD countries
Norman Gemmell, Richard Kneller and Ismael Sanz

290/2006 La producción de energía eléctrica en España: Análisis económico de la actividad tras la liberalización del Sector Eléctrico
Fernando Hernández Martínez

291/2006 Further considerations on the link between adjustment costs and the productivity of R&D investment: evidence for Spain
Desiderio Romero-Jordán, José Félix Sanz-Sanz and Inmaculada Álvarez-Ayuso

292/2006 Una teoría sobre la contribución de la función de compras al rendimiento empresarial
Javier González Benito

293/2006 Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model
Daniel Vázquez-Bustelo, Lucía Avella and Esteban Fernández

294/2006 Testing the parametric vs the semiparametric generalized mixed effects models
María José Lombardía and Stefan Sperlich

295/2006 Nonlinear dynamics in energy futures
Mariano Matilla-García

296/2006 Estimating Spatial Models By Generalized Maximum Entropy Or How To Get Rid Of W
Esteban Fernández Vázquez, Matías Mayor Fernández and Jorge Rodriguez-Valez

297/2006 Optimización fiscal en las transmisiones lucrativas: análisis metodológico
Félix Domínguez Barrero

298/2006 La situación actual de la banca online en España
Francisco José Climent Diranzo y Alexandre Momparler Pechuán

299/2006 Estrategia competitiva y rendimiento del negocio: el papel mediador de la estrategia y las capacidades productivas
Javier González Benito y Isabel Suárez González

300/2006 A Parametric Model to Estimate Risk in a Fixed Income Portfolio
Pilar Abad and Sonia Benito

301/2007 Análisis Empírico de las Preferencias Sociales Respecto del Gasto en Obra Social de las Cajas de Ahorros
Alejandro Esteller-Moré, Jonathan Jorba Jiménez y Albert Solé-Ollé

302/2007 Assessing the enlargement and deepening of regional trading blocs: The European Union case
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

303/2007 ¿Es la Franquicia un Medio de Financiación?: Evidencia para el Caso Español
Vanesa Solís Rodríguez y Manuel González Díaz

304/2007 On the Finite-Sample Biases in Nonparametric Testing for Variance Constancy
Paulo M.M. Rodrigues and Antonio Rubia

305/2007 Spain is Different: Relative Wages 1989-98
José Antonio Carrasco Gallego

306/2007 Poverty reduction and SAM multipliers: An evaluation of public policies in a regional framework
Francisco Javier De Miguel-Vélez y Jesús Pérez-Mayo

307/2007 La Eficiencia en la Gestión del Riesgo de Crédito en las Cajas de Ahorro
Marcelino Martínez Cabrera

308/2007 Optimal environmental policy in transport: unintended effects on consumers' generalized price
M. Pilar Socorro and Ofelia Betancor

309/2007 Agricultural Productivity in the European Regions: Trends and Explanatory Factors
Roberto Ezcurra, Belen Iráizoz, Pedro Pascual and Manuel Rapún

310/2007 Long-run Regional Population Divergence and Modern Economic Growth in Europe: a Case Study of Spain
María Isabel Ayuda, Fernando Collantes and Vicente Pinilla

311/2007 Financial Information effects on the measurement of Commercial Banks' Efficiency
Borja Amor, María T. Tascón and José L. Fanjul

312/2007 Neutralidad e incentivos de las inversiones financieras en el nuevo IRPF
Félix Domínguez Barrero

313/2007 The Effects of Corporate Social Responsibility Perceptions on The Valuation of Common Stock
Waymond Rodgers , Helen Choy and Andres Guiral-Contreras

314/2007 Country Creditor Rights, Information Sharing and Commercial Banks' Profitability Persistence across the world
Borja Amor, María T. Tascón and José L. Fanjul

315/2007 ¿Es Relevante el Déficit Corriente en una Unión Monetaria? El Caso Español
Javier Blanco González y Ignacio del Rosal Fernández

316/2007 The Impact of Credit Rating Announcements on Spanish Corporate Fixed Income Performance: Returns, Yields and Liquidity
Pilar Abad, Antonio Díaz and M. Dolores Robles

317/2007 Indicadores de Lealtad al Establecimiento y Formato Comercial Basados en la Distribución del Presupuesto
Cesar Augusto Bustos Reyes y Óscar González Benito

318/2007 Migrants and Market Potential in Spain over The XXth Century: A Test Of The New Economic Geography
Daniel A. Tirado, Jordi Pons, Elisenda Paluzie and Javier Silvestre

319/2007 El Impacto del Coste de Oportunidad de la Actividad Emprendedora en la Intención de los Ciudadanos Europeos de Crear Empresas
Luis Miguel Zapico Aldeano

320/2007 Los belgas y los ferrocarriles de vía estrecha en España, 1887-1936
Alberte Martínez López

321/2007 Competición política bipartidista. Estudio geométrico del equilibrio en un caso ponderado
Isabel Lillo, Mª Dolores López y Javier Rodrigo

322/2007 Human resource management and environment management systems: an empirical study
Mª Concepción López Fernández, Ana Mª Serrano Bedia and Gema García Piqueres

323/2007 Wood and industrialization. evidence and hypotheses from the case of Spain, 1860-1935.
Iñaki Iriarte-Goñi and María Isabel Ayuda Bosque

324/2007 New evidence on long-run monetary neutrality.
J. Cunado, L.A. Gil-Alana and F. Perez de Gracia

325/2007 Monetary policy and structural changes in the volatility of us interest rates.
Juncal Cuñado, Javier Gomez Biscarri and Fernando Perez de Gracia

326/2007 The productivity effects of intrafirm diffusion.
Lucio Fuentelsaz, Jaime Gómez and Sergio Palomas

327/2007 Unemployment duration, layoffs and competing risks.
J.M. Arranz, C. García-Serrano and L. Toharia

328/2007 El grado de cobertura del gasto público en España respecto a la UE-15
Nuria Rueda, Begoña Barruso, Carmen Calderón y Mª del Mar Herrador

329/2007 The Impact of Direct Subsidies in Spain before and after the CAP'92 Reform
Carmen Murillo, Carlos San Juan and Stefan Sperlich

330/2007 Determinants of post-privatisation performance of Spanish divested firms
Laura Cabeza García and Silvia Gómez Ansón

331/2007 ¿Por qué deciden diversificar las empresas españolas? Razones oportunistas versus razones económicas
Almudena Martínez Campillo

332/2007 Dynamical Hierarchical Tree in Currency Markets
Juan Gabriel Brida, David Matesanz Gómez and Wiston Adrián Risso

333/2007 Los determinantes sociodemográficos del gasto sanitario. Análisis con microdatos individuales
Ana María Angulo, Ramón Barberán, Pilar Egea y Jesús Mur

334/2007 Why do companies go private? The Spanish case
Inés Pérez-Soba Aguilar

335/2007 The use of gis to study transport for disabled people
Verónica Cañal Fernández

336/2007 The long run consequences of M&A: An empirical application
Cristina Bernad, Lucio Fuentelsaz and Jaime Gómez

337/2007 Las clasificaciones de materias en economía: principios para el desarrollo de una nueva clasificación
Valentín Edo Hernández

338/2007 Reforming Taxes and Improving Health: A Revenue-Neutral Tax Reform to Eliminate Medical and Pharmaceutical VAT
Santiago Álvarez-García, Carlos Pestana Barros y Juan Prieto-Rodriguez

339/2007 Impacts of an iron and steel plant on residential property values
Celia Bilbao-Terol

340/2007 Firm size and capital structure: Evidence using dynamic panel data
Víctor M. González and Francisco González

341/2007 ¿Cómo organizar una cadena hotelera? La elección de la forma de gobierno
Marta Fernández Barcala y Manuel González Díaz

342/2007 Análisis de los efectos de la decisión de diversificar: un contraste del marco teórico "Agencia-Stewardship"
Almudena Martínez Campillo y Roberto Fernández Gago

343/2007 Selecting portfolios given multiple eurostoxx-based uncertainty scenarios: a stochastic goal programming approach from fuzzy betas
Enrique Ballestero, Blanca Pérez-Gladish, Mar Arenas-Parra and Amelia Bilbao-Terol

344/2007 "El bienestar de los inmigrantes y los factores implicados en la decisión de emigrar"
Anastasia Hernández Alemán y Carmelo J. León

345/2007 Governance Decisions in the R&D Process: An Integrative Framework Based on TCT and Knowledge View of The Firm.
Andrea Martínez-Noya and Esteban García-Canal

346/2007 Diferencias salariales entre empresas públicas y privadas. El caso español
Begoña Cueto y Nuria Sánchez- Sánchez

347/2007 Effects of Fiscal Treatments of Second Home Ownership on Renting Supply
Celia Bilbao Terol and Juan Prieto Rodríguez

348/2007 Auditors' ethical dilemmas in the going concern evaluation
Andres Guiral, Waymond Rodgers, Emiliano Ruiz and Jose A. Gonzalo

349/2007 Convergencia en capital humano en España. Un análisis regional para el periodo 1970-2004
Susana Morales Sequera y Carmen Pérez Esparrells

350/2007 Socially responsible investment: mutual funds portfolio selection using fuzzy multiobjective programming
Blanca Mª Pérez-Gladish, Mar Arenas-Parra , Amelia Bilbao-Terol and Mª Victoria Rodríguez-Uría

351/2007 Persistencia del resultado contable y sus componentes: implicaciones de la medida de ajustes por devengo
Raúl Iñiguez Sánchez y Francisco Poveda Fuentes

352/2007 Wage Inequality and Globalisation: What can we Learn from the Past? A General Equilibrium Approach
Concha Betrán, Javier Ferri and Maria A. Pons

353/2007 Eficacia de los incentivos fiscales a la inversión en I+D en España en los años noventa
Desiderio Romero Jordán y José Félix Sanz Sanz

354/2007 Convergencia regional en renta y bienestar en España
Robert Meneu Gaya

355/2007 Tributación ambiental: Estado de la Cuestión y Experiencia en España
Ana Carrera Poncela

356/2007 Salient features of dependence in daily us stock market indices
Luis A. Gil-Alana, Juncal Cuñado and Fernando Pérez de Gracia

357/2007 La educación superior: ¿un gasto o una inversión rentable para el sector público?
Inés P. Murillo y Francisco Pedraja

358/2007 Effects of a reduction of working hours on a model with job creation and job destruction
Emilio Domínguez, Miren Ullibarri y Idoya Zabaleta

359/2007 Stock split size, signaling and earnings management: Evidence from the Spanish market
José Yagüe, J. Carlos Gómez-Sala and Francisco Poveda-Fuentes

360/2007 Modelización de las expectativas y estrategias de inversión en mercados de derivados
Begoña Font-Belaire

361/2008 Trade in capital goods during the golden age, 1953-1973
Mª Teresa Sanchis and Antonio Cubel

362/2008 El capital económico por riesgo operacional: una aplicación del modelo de distribución de pérdidas
Enrique José Jiménez Rodríguez y José Manuel Feria Domínguez

363/2008 The drivers of effectiveness in competition policy
Joan-Ramon Borrell and Juan-Luis Jiménez

364/2008 Corporate governance structure and board of directors remuneration policies: evidence from Spain
Carlos Fernández Méndez, Rubén Arrondo García and Enrique Fernández Rodríguez

365/2008 Beyond the disciplinary role of governance: how boards and donors add value to Spanish foundations
Pablo De Andrés Alonso, Valentín Azofra Palenzuela y M. Elena Romero Merino

366/2008 Complejidad y perfeccionamiento contractual para la contención del oportunismo en los acuerdos de franquicia
Vanesa Solís Rodríguez y Manuel González Díaz

367/2008 Inestabilidad y convergencia entre las regiones europeas
Jesús Mur, Fernando López y Ana Angulo

368/2008 Análisis espacial del cierre de explotaciones agrarias
Ana Aldanondo Ochoa, Carmen Almansa Sáez y Valero Casanovas Oliva

369/2008 Cross-Country Efficiency Comparison between Italian and Spanish Public Universities in the period 2000-2005
Tommaso Agasisti and Carmen Pérez Esparrells

370/2008 El desarrollo de la sociedad de la información en España: un análisis por comunidades autónomas
María Concepción García Jiménez y José Luis Gómez Barroso

371/2008 El medioambiente y los objetivos de fabricación: un análisis de los modelos estratégicos para su consecución
Lucía Avella Camarero, Esteban Fernández Sánchez y Daniel Vázquez-Bustelo

372/2008 Influence of bank concentration and institutions on capital structure: New international evidence
Víctor M. González and Francisco González

373/2008 Generalización del concepto de equilibrio en juegos de competición política
Mª Dolores López González y Javier Rodrigo Hitos

374/2008 Smooth Transition from Fixed Effects to Mixed Effects Models in Multi-level regression Models
María José Lombardía and Stefan Sperlich

375/2008 A Revenue-Neutral Tax Reform to Increase Demand for Public Transport Services
Carlos Pestana Barros and Juan Prieto-Rodriguez

376/2008 Measurement of intra-distribution dynamics: An application of different approaches to the European regions
Adolfo Maza, María Hierro and José Villaverde

377/2008 Migración interna de extranjeros y ¿nueva fase en la convergencia?
María Hierro y Adolfo Maza

378/2008 Efectos de la Reforma del Sector Eléctrico: Modelización Teórica y Experiencia Internacional
Ciro Eduardo Bazán Navarro

379/2008 A Non-Parametric Independence Test Using Permutation Entropy
Mariano Matilla-García and Manuel Ruiz Marín

380/2008 Testing for the General Fractional Unit Root Hypothesis in the Time Domain
Uwe Hassler, Paulo M.M. Rodrigues and Antonio Rubia

381/2008 Multivariate gram-charlier densities
Esther B. Del Brio, Trino-Manuel Ñíguez and Javier Perote

382/2008 Analyzing Semiparametrically the Trends in the Gender Pay Gap - The Example of Spain
Ignacio Moral-Arce, Stefan Sperlich, Ana I. Fernández-Saínz and Maria J. Roca

383/2008 A Cost-Benefit Analysis of a Two-Sided Card Market
Santiago Carbó Valverde, David B. Humphrey, José Manuel Liñares Zegarra and Francisco Rodriguez Fernandez