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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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Card acceptance and surcharging: the role of costs and competition[1]

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Abstract:
The payment cards market is a two-sided market. Cost sensitivity of both consumers and merchants for card services influences total demand. Survey data of Dutch merchants shows that costs, and competition affect acceptance as well as surcharging decisions. Merchants who find payment cards expensive are less likely to accept them and more likely to surcharge their customers for using them. Merchants who face any competition accept debit card payments relatively more often than merchants with monopoly power, and they are less likely to surcharge their customers for debit card usage. Intense competition leads to higher credit card acceptance.

Key words: retail payments, merchants, costs, two-sided markets, competition, pricing, surcharging
JEL code: D23, D40, E41, G20

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1. INTRODUCTION

In several countries, the payment card market has been the subject of antitrust lawsuits (Bradford and Hayashi, 2008). Merchants worldwide complain about the level of merchant service fees levied on card transactions and about the multilateral interchange fees for card payments applied by banks, which exercise upward pressure on merchant service fees.[3] They also criticise the terms imposed by card companies and acquiring banks such as the 'no surcharge' rule or the 'non-discrimination' rule, which forbid merchants to price differentiate between different payment instruments by adding surcharges to card transactions or by offering rebates on alternative payment instruments.

The European Commission is strongly in favour of increasing the price transparency of payment services for consumers and merchants in the European Union (EU). Effective from 1 November 2009, the Payment Services Directive (PSD) harmonises payment legislation across EU Member States. For one thing, merchants in Europe may now price differentiate between customers depending on the payment instrument used. Card companies and card acquirers are no longer allowed to impose the no surcharge/non-discrimination rule.[4] In the US similar legislation is expected to become effective in mid-2011 as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act.

In some countries, such as the Netherlands and the UK, card companies and card acquirers had not been allowed to impose the no surcharge rule on merchants for quite some time. In other countries, such as Australia, Canada, New Zealand and Switzerland, similar legislation was introduced more recently. Usually, the surcharge level depends on the transaction value. This holds especially for credit card payments. In the Netherlands and Canada merchants who surcharge debit card payments apply a fixed value surcharge.[5]

One reason why card payment pricing and price regulation are of interest is their effect on card usage. Several cost studies reveal that for society as a whole, the cost of a debit card payment is often lower than the cost of a cash payment, and that the costs of debit card transactions decrease over time due to economies of scale, whereas the costs of cash payments are fairly stable. Credit card payments turn out to be very costly (see e.g. Brits and Winder, 2005; Bergman, Guibourg and Segendorf, 2007; EIM, 2007; Gresvik and Haare, 2009). In countries such as the Netherlands, where

[3] (Multilateral) interchange fees are interbank fees, usually paid by the merchant's bank to the cardholder's bank. The merchant service fee which is charged by the merchant's bank for each card transaction covers both the cost of the card transaction to the merchant's own bank and the interchange fee it pays to the bank of the cardholder. Higher interchange fees therefore exert an upward pressure on merchant service fees.

[4] However, article 52(3) of the PSD allows individual member states to forbid or limit merchants' right to levy charges, taking into account the need to encourage competition and promote the efficient use of payment instruments. According to an ECB survey among central banks in the EU, 14 countries have employed the option to forbid surcharging, while 12 countries have not.

[5] In the Netherlands this fixed surcharge is only levied if the transaction value is below a certain threshold level which is determined by the merchant. The reason why merchants apply a threshold is that for low-value payments cash is less costly to them than debit card payment. Costs for debit card payments hardly vary with the transaction amount; the merchant service charge for domestic debit card transactions in the Netherlands is fixed and amounts to 4-5 eurocent. Other costs of debit card payments for merchants are also fixed, whereas the cost of cash increases with the transaction amount (Brits and Winder, 2005; EIM, 2007).

consumers mainly use cash and debit cards at points of sale, further substitution of cash by debit card payments may entail considerable economic benefits for society as a whole. Estimates on cash usage in the Netherlands indicate that cash was used about 5 billion times in 2007 (EIM 2007; Jonker and Kosse, 2009), debit cards 1.6 billion times (Currence, 2010) and credit cards 70 million times (DNB, 2008).[6] A significant share of merchants surcharged debit card payments.[7] The substitution of cash by cards would be encouraged if card acceptance increased and if fewer merchants surcharged debit card payments (Bolt, Jonker and Van Renselaar, 2010).

In this study we focus on merchants' card acceptance and card surcharging decisions. New insight into the factors that influence these decisions may provide suggestions for fruitful policy measures that reduce the costs of the retail payment system. Our study also provides useful input for the current interchange fee debate between competition authorities, card companies and banks about the sensitivity of merchants and consumers to the cost of payment card services and, the (optimal) pricing of payment card transactions. We review the theoretical literature on payment pricing, card acceptance and surcharging by merchants and we summarise four main hypotheses:

Hypothesis 1: If accepting card payments increases average unit transaction costs, a merchant will be less inclined to accept card payments;

Hypothesis 2: If accepting card payments increases average unit transaction costs, a card-accepting merchant will be more likely to surcharge card payments;

Hypothesis 3a: A merchant who is a local monopolist will be less likely to accept card payments than a merchant who faces moderate competition;

[6] In the Netherlands consumers at the point-of-sale use mainly cash and debit cards. It is not common to use a credit card, especially for every day purchases. Consumers can buy on credit by using their debit card. When buying on credit, the main difference between the debit card and the credit card concerns the moment the bank starts charging interest. Credit cards offer an interest-free period, whereas debit cards do not. Also, Dutch consumers do not expect merchants to accept credit card payments. As a consequence Dutch merchants hardly run the risk of losing sales by not accepting credit cards, especially if neighbouring merchants do not accept them either. This may be different in credit card countries, such as the U.S. The main reason why the Dutch use debit cards relatively often compared to credit cards is that from the mid 1980s onwards Dutch banks have promoted the use of debit cards for ATM cash withdrawals and for purchases at points-of-sale, as an inexpensive alternative to guaranteed cheques. The cardholder fee used to be zero and everyone with a payment account received a debit card from their bank. At the same time, Dutch consumers were discouraged from taking out credit cards: those who did had to pay a card holder fee and you were not eligible for credit card-holdership unless your monthly income was above a certain non-negligible threshold. As a consequence, Dutch consumers came to consider the credit card as typically suitable for luxury goods and services and they perceived the credit card as the most expensive means of payment of all POS payment instruments (see Jonker, 2007). During the past decade adoption of the credit card has increased. Nowadays about 60% of the Dutch hold a credit card (Jonker and Kosse, 2010). Increased usage of the Internet for online shopping and booking of holidays seems likely to have promoted credit card adoption.

[7] Due to public campaigns stressing potential cost savings from debit card payments for merchants and promoting the charge-free use of the debit card for consumers, the share of small and medium sized merchants who surcharge debit card payments has declined from 24% in 2007 to 8% in 2009 (Currence, 2010). The results found in this paper refer to the autumn of 2007, before these campaigns had started.

Hypothesis 3b: A merchant who faces intense competition will be more likely to accept card payments than a merchant who faces moderate competition;

Hypothesis 4a: A card accepting merchant who is a local monopolist will be more likely to surcharge card payments than a card-accepting merchant who faces moderate competition;

Hypothesis 4b: A card accepting merchant who faces intense competition will be more likely to surcharge card payments than a card-accepting merchant who faces moderate competition.

Regarding the impact of competition on card acceptance and surcharging hypotheses 3 and 4, we follow the economic literature, taking into account that the effect of competition on card acceptance and surcharging may be non-linear.

We evaluate the four hypotheses empirically, using unique survey data collected by DNB among 1,008 Dutch merchants in 2007. Thus we are the first to bridge the existing gap between theory and practice. The research outcomes support the theoretical literature on the functioning of the payment card market. We find empirical evidence for hypotheses 1 and 2. Dutch merchants are sensitive to the cost of card payments. If card acceptance increases the average unit transaction cost compared to cash payments, merchants will be less likely to accept card payments or more likely to surcharge customers for using them (Wright, 2004; McAndrews and Wang, 2008). For the debit cards market, our results also confirm hypotheses 3a and 4a and reject hypotheses 3b and 4b. Local monopolists are less likely to accept debit card payments than merchants who face competition. And if they do, they will surcharge their customers for card usage more often than other merchants. We also find that local monopolists levy far higher surcharge fees than other surcharging merchants who face competition. This implies that monopolists, more than other merchants, employ the possibility to surcharge as a way to extract consumer surplus from card use. These results are in line with theoretical predictions by Rochet and Tirole (2002), Wright (2003) and Hayashi (2006). The effect of competition on credit card acceptance in the Netherlands is slightly different. Here, hypothesis 3a is rejected and 3b is confirmed, which indicates that in an intensely competitive market merchants will be more likely to accept credit card payments than when competition is moderate.

Then we provide an illustration of the potential effects on card acceptance, card surcharging and card usage by consumers that might ensue if the cost of debit card payments for merchants were reduced to that of cash payments, so that merchants would become indifferent between accepting cash or debit card payments. We compare the cost sensitivity for debit card services of merchants with the cost sensitivity of Dutch consumers (Bolt *et al*., 2010). The comparison provides a first insight into the extent to which merchants and consumers differ in cost sensitivity for debit card services.

This paper is structured as follows. Section 2 provides an overview of the literature on payment pricing with a special emphasis on card acceptance decisions. In addition, we present our thoughts about the influence of costs and competition on surcharging by merchants. Subsequently, we formulate the behavioural hypotheses which we evaluate empirically. Section 3 discusses the set-up of the survey and presents some descriptive statistics. Section 4 describes the econometric models which we use to analyse card acceptance, surcharging and cost perception of the merchants regarding card payment costs. In Section 5 we discuss the estimation results. Subsequently, we provide an illustration of the potential effects of merchant cost reduction on card usage and we compare these results with consumer cost sensitivity for payment card services. Finally, Section 6 summarises and concludes.

2 RELATED LITERATURE

2.1 Theoretical literature

During the past decade, theoretical literature on the industrial organisation of payments has resulted in many new insights into the functioning of the payment card market. In this section we focus on the theoretical literature on merchants' card acceptance decisions.

Economic theory (see e.g. Baxter,1983; Rochet and Tirole, 2002; Bolt and Chakravorti 2008a; Chakravorti, 2010 for an overview) provides a rationale for the usage of interchange fees in two-sided markets, of which the card payments market with consumers and merchants as two distinct groups of end users is an example. Banks co-operating in a card network set payment prices for both consumers and merchants to encourage card usage among consumers and card acceptance among merchants. The goal is to maximise the card network's overall profit.[8] The bank of one of the end users, usually the accepting party, may pay a so-called interchange fee to the bank of the other end user for every card payment.[9] Banks use the interchange fee to balance the demand for card services between both sides of the market. The optimal balance depends on banks' costs and on the demand elasticities for payment card services of consumers and merchants. The assumption that merchants are relatively less cost elastic compared to consumers is commonly used as a rationale to justify that acquiring banks pay interchange fees to issuing banks, thus raising merchant service fees for card payments and lowering consumer fees. In early two-sided card market models, consumers and merchants are each assumed to be homogeneous. Depending on the net transactional benefits, being the difference between the transactional benefits of card acceptance to merchants (convenience, safety, security and additional sales) and the merchant service fee, all merchants either do or do not accept payment cards.

[8] In this article the focus is on four-party card networks with banks offering card payment services.
[9] Banks may agree on a common fee, the multilateral interchange fee, or make bilateral agreements.

Another feature of the early models is the focus on variable costs and transaction fees for merchants and consumers. Investment costs or fixed costs are disregarded.

Rochet and Tirole (2002) introduce strategic behaviour by merchants in their theoretical two-sided card market model. They find that merchants who face competition may accept cards even when merchant service fees exceed merchant benefits. They do so in order to attract customers from competitors who do not accept cards (yet) or because they feel obliged to accept cards so as not to lose customers to card-accepting competitors. Wright (2004) builds on Rochet and Tirole (2002), but allows merchants in different sectors to reap different benefits from card acceptance. In his model the trade-off between the benefits and costs of card acceptance may differ by sector. As a result, cards will be accepted in some sectors, whereas in others the benefits do not outweigh the costs. Wright focuses on variable acceptance costs, but excludes fixed costs. McAndrews and Wang (2008) consider both fixed and variable costs. They employ a theoretical two-sided card payment market model in which they analyse the adoption of payment cards among consumers who differ in wealth and merchants that differ in size or average transaction amount. They assume that different payment methods impose different costs on consumer purchases, by assuming relatively high fixed adoption costs and low variable usage costs for card services compared to cash payments for both consumers and merchants. They find that large merchants and merchants selling high-value products will be quicker to adopt the payment card than other merchants as card acceptance reduces their average unit transaction costs compared to acceptance of cash only. As adoption costs fall over time due to economies of scale, other merchants will start accepting cards as well. In equilibrium, large merchants accept both cash and payment cards and charge lower prices than cash only merchants, medium sized firms may accept only cash, or only cards and may charge higher prices than their cash-only competitors. All small merchants accept only cash.

Hayashi (2006) presents a model based on one card network that determines the transaction fees for both merchants and consumers. She assumes that the network sets a merchant fee. Merchants decide whether or not they accept the card and determine the consumer prices for the products they sell. While free to set consumer prices, they may not price discriminate between cash and card payments. Hayashi finds that in such a market only merchants who are (local) monopolists face an inelastic consumer demand curve and may decide not to accept card payments if the merchant service fee exceeds their transactional benefit. However, monopolists may decide to accept cards if it shifts their customers' demand curve upward and brings in additional sales. Wright (2010) generalises this result. He finds that even under a Cournot model of merchant competition and an elastic demand curve, merchants accept payment cards only if it increases their margins. Card acceptance leads to higher industry sales and increases profits without free entry of new merchants. With free entry, industry output and the number of merchants increase as well, but higher profits are competed away by the new entrants.

Other studies relax the assumption that merchants may not price discriminate between cash and card payers. They allow merchants to pass on the card payment fees by surcharging customers for card usage/giving discounts to cash-paying customers or by incorporating the fees in their prices. Gans and King (2003) provide an explanation as to why card companies and banks are not in favour of price discrimination based on the payment instrument used: it neutralises the impact of interchange fees on end user tariffs and it hands merchants a tool with which to influence their customers' payment choice. However, if merchants set the surcharge (discount) below (above) the interchange fee and absorb part of the interchange fee themselves, complete neutralisation does not take place. Rochet and Tirole (2002; 2003) show that if merchants are able to pass their full payment costs on to their customers through differentiating prices by payment instrument, the structure of the payment fees charged by banks to consumers and merchants becomes irrelevant. Bolt and Chakravorti (2008b) examine the possibilities for banks and merchants to influence consumer payment behaviour. They find that card acceptance is negatively related to the level of the merchant service fee and increases with the ability of merchants to pass acceptance costs on to their customers. If merchants are able to pass on their full costs, all merchants will accept the payment card, regardless of the level of the merchant service fee.

2.2 Views on merchants' surcharging decisions

There are hardly any theoretical studies yet on merchants' decisions to set uniform prices or to surcharge by means of payment. The effect of card acceptance on merchants' average unit transaction costs and market power may be important factors. In this section we discuss the possible impact of each on the surcharging decision.

2.2.1 *Average unit transaction costs*

Like the acceptance decision, merchants' surcharging decision may depend on the number of transactions and the average transaction size. If card acceptance increases the average unit transaction costs of payment transactions, merchants who accept the card anyway may pass on the additional costs, for instance by surcharging customers for card usage.

Merchants selling many or high value products are expected to opt for uniform prices and to decide against surcharging on card payments. For them unit transaction costs fall once they accept card payments (Brits & Winder, 2005; EIM, 2007). Merchants who mainly sell medium or low value products or who have few customers, will see average unit transaction costs rise through card acceptance and will have to decide whether to surcharge or not. If they decide not to surcharge, they can only keep profit margins stable if they can incorporate the extra cost of card payments in their prices. If that leads to a decline in demand, accepting card payments will not be profitable for them. Note, however, that card acceptance may also bring in additional sales, because consumers are no

longer limited by the amount of cash in their wallets. Merchants who opt for surcharging can keep both prices and profit margins constant: the surcharge will cover the additional cost of card payments. If, for now, we ignore the impact of competition, merchants do not risk losing demand as consumer prices for cash payments remain unchanged. Surcharging discourages consumers from using payment cards. Only those consumers who value the transactional benefits of a card payment above the surcharge will use the payment card.

Once unit transaction costs fall due to scale economies, more and more merchants will save transaction costs by accepting card payments and may decide to lift the surcharge (EIM, 2007; DNB, 2010). In time, the average transaction cost of card payments will drop below that of cash payments for any transaction size. When this happens, card surcharges no longer contribute to cost effective consumer payment behaviour.[10]

2.2.2 *Competition*

The impact of competition on surcharging decisions seems less clear-cut than the role of costs. On the one hand, competition may lead to surcharging by merchants. On the other, monopoly power may also encourage merchants to start surcharging. Wright (2003) examines price setting of merchants in two extreme markets in terms of competition, as well as welfare implications of surcharging in such different markets, using a theoretical model. In the first market merchants compete according to Bertrand competition[11], whereas in the second market merchants have monopoly power. He concludes that in case of Bertrand competition, there will be both merchants who only accept cash and merchants who accept both cash and cards. Those who accept only cash will charge prices which equal their marginal cost for the items sold. Those who accept both means of payment will differentiate prices according to the payment instrument used. In the case of a cash payment they will charge their customer the same price as their competitors who only accept cash. For card payments, they will levy a surcharge that reflects the difference in net transaction costs between a card and a cash payment, minus the merchants' card over cash convenience value. As the costs of (debit) card payments for merchants decline over time and converge with or drop below the costs of cash payments, the need to surcharge for card payments will decrease as well. Then merchants in the Bertrand setting might even, in theory, apply a payment card discount.

Unlike merchants who operate in a competitive market a (local) monopolist only has to consider the impact of surcharging on the demand of his customers. Wright (2003) shows that when

[10] Note that there may be a difference between cost effective payment behaviour from a merchant's point of view and from a social point of view, i.e. including the costs of all parties in the payment chain. If the transaction costs of debit card payments for society as a whole are lower than the transaction costs for cash payments, whereas the reverse holds for merchants alone, then surcharging card payments may reduce the cost from the merchant's perspective, but not for society as a whole.

[11] Bertrand competition refers to a competitive market in which firms produce homogeneous products, do not cooperate with each other and compete by setting prices simultaneously. Consumers buy from the firm offering the lowest price. In such a market prices converge towards the marginal cost.

merchants with monopoly power are allowed to surcharge, they will do so excessively in order to extract consumer surplus from cardholders. The result will be inefficient card usage as too few consumers will pay with cards. In that case the 'no surcharge' rule may improve social welfare.[12] The level of the surcharge fee in comparison with the marginal costs of an additional debit card payment may indicate whether local monopolists use the surcharge fee to capture consumer surplus.

2.3 Empirical literature

Carbó Valverde *et al.* (2009) are the first to analyse the impact of costs on card acceptance by merchants. They use unique Spanish network-level panel data to analyse the impact of interchange fee regulation by the Spanish government on card acceptance by merchants, card adoption by consumers and card usage. They show that the reduction in interchange fees for debit and credit card payments had a positive impact on card acceptance by merchants, and hence on card usage by consumers. Their study suggests that the regulation of interchange fees has improved social welfare. Arango and Taylor (2009) examine a related issue, i.e. merchant acceptance and the cost of cash, debit and credit cards in Canada as well as merchants' perceptions regarding reliability, risks and costs. According to Canadian merchants cash is the cheapest and most reliable payment instrument to accept at the POS. Credit card payments are rated as the most costly and least reliable. Merchants operating in high transaction value or high transaction volume sectors view card payments as less costly than cash compared to merchants active in sectors where transaction amounts or transaction volumes tend to be low. Loke (2007) focuses on the factors which determine merchants' acceptance of credit cards in Malaysia. Merchants' personal and business characteristics are included both as explanatory variables in the statistical model and as variables that reflect a merchant's perception of credit card usage by his customers and credit card acceptance by his competitors. Loke shows that both perceived customer demand for credit card services and perceived card acceptance by competing merchants positively influence credit card acceptance. Malaysian merchants who are active in businesses characterised by low value transactions cite cost related factors as a barrier for card acceptance.

There are few studies which examine the price sensitivity of consumer demand for payment services. Borzekowski, Kiser and Ahmed (2008) examine the response of cardholders to bank-imposed transaction fees for debit card payments. It turns out that bank-imposed debit card charges cause a 12% reduction in debit card usage. Bolt *et al.* (2010) focus on the impact of debit card transaction surcharges on consumer payment choices, using survey information from both merchants and consumers. They find that surcharging on card payments considerably alters consumers' payment behaviour. If a merchant stops surcharging on debit card payments, the share of card payments on the total number of payments will rise by 8%-points. They also report on consumers' experiences and

[12] Monnet and Roberds (2008) argue that as long as cash is available as a cheaper alternative means of payment for merchants, the 'no surcharge rule' is needed in order to ensure the viability of a card payment system.

views with respect to surcharging. It is noteworthy that consumers turned out to estimate the impact of surcharging on payment choice higher than merchants did. When asked about the impact of surcharging, about 75% of the Dutch answered that they avoided paying a surcharge, by using cash, by going to another shop or by foregoing the purchase. Only 25% stated they would always use their debit card, irrespective of surcharging. On the other hand, when asked explicitly, most merchants thought the payment behaviour of consumers would not change if surcharging stopped. Only 38% thought that without surcharging, consumers would use their debit card more often.

Chakravorti (2010) discusses the impact the lifting of no-surcharge restrictions in 2002 had on the Australian payment cards market. Although most Australian merchants do not employ card surcharges of any type, the number of merchants who do is increasing. At the end of 2007 around 23% of the very large merchants and around 10% of the (very) small merchants imposed card surcharges. The level of the average surcharge amounts to between 1 and 2 per cent of the transaction value, depending on the card payment network. Research by the Reserve Bank of Australia (2008) reveals that consumers react to price signals: they used their cards less where a surcharge applied.

2.4 Confronting theory with practice

In this section we present four hypotheses based on the theoretical literature, which we will test in this paper.

Hypothesis 1: If accepting card payments increases average unit transaction costs, a merchant will be less inclined to accept card payments;

Hypothesis 2: If accepting card payments increases average unit transaction costs, a card-accepting merchant will be more likely to surcharge card payments.

We examine hypotheses 1 and 2 using both subjective information from merchants about the costs associated with debit and credit card payments and exogenous variables from the literature. We use subjective cost information because merchants who do not accept payment cards do not have accurate information about the associated costs and even merchants who accept card payments may not be fully informed about the cost – see Section 5.1.1. However, they may have views about the cost level (costs are low, just right or high) that may influence their acceptance and surcharging decisions. Following Wright (2004) and McAndrews and Wang (2008) we also take the effect of the firm characteristics staff size and sector into account as these factors correlate strongly with both the number and the average value of purchases in a shop and consequently with the effect of card acceptance on average unit transaction costs. As the rejection or non-rejection of hypotheses 1 and 2 depends on the results of three different sets of indicators we cannot simply ‘reject’ or ‘not reject’ a

hypothesis. Instead we use an indicator that ranges from 'full support' or non-rejection of the hypothesis to 'rejection' of an hypothesis. If the estimated effects of cost perception, staff size and sector on card acceptance (surcharging) are significant and have the expected signs, then we interpret these results as providing full support for the relevant hypothesis; if two out of three indicators have the expected sign and are significant, we classify the result as strong support; and if this is the case for one out of three, we interpret this as mild support. In all other cases we reject the hypothesis being tested.

Hypotheses 3a-4b are about the influence of competition on card acceptance and surcharging.

Hypothesis 3a: A merchant who is a local monopolist will be less likely to accept card payments than a merchant who faces moderate competition;

Hypothesis 3b: A merchant who faces intense competition will be more likely to accept card payments than a merchant who faces moderate competition;

Hypothesis 4a: A card accepting merchant who is a local monopolist will be more likely to surcharge card payments than a card-accepting merchant who faces moderate competition;

Hypothesis 4b: A card accepting merchant who faces intense competition will be more likely to surcharge card payments than a card-accepting merchant who faces moderate competition.

Hypothesis 3a follows directly from the theoretical literature: competition incites merchants to accept cards in order to increase sales or to avoid losing customers to card accepting competitors. Hypothesis 3b enables us to test whether the degree of competition affects the acceptance decision. We formulate hypothesis 4 in a non-neutral way as well, because it is not clear yet how competition influences merchants' surcharging decisions. Both a monopolistic market setting (hypothesis 4a) and intense competition (hypothesis 4b) may lead to more surcharging compared to a situation with moderate competition. The main difference concerns the level of the surcharge, which will be relatively low in a competitive market.

We test hypotheses 3a-4b by examining the influence of perceived competition by merchants on the likelihood that a merchant accepts card payments and, if he does, on the likelihood that he surcharges card payments. We distinguish five levels of perceived competition, ranging from 'no competition' (level 1) to 'intense competition' (level 5). In the statistical models we include four dummy variables reflecting perceived competition (levels 1, 2, 4 and 5) and we take 'moderate

competition' (level 3) as our reference category. If the estimated impact of local monopoly versus moderate competition on card acceptance is significantly negative, we do not reject hypothesis 3a. If the estimated impact of local monopoly versus moderate competition on surcharging is significantly positive, we do not reject hypothesis 4a. If the estimated impact of facing intense compared to moderate competition on card acceptance is significantly positive, we do not reject hypothesis 3b. Finally, if the estimated impact of intense versus moderate competition on surcharging is significantly positive, we do not reject hypothesis 4b.

3 SURVEY SET-UP

The merchant survey on POS payments was held in the period between September 16 and October 12, 2007 among 1008 merchants. The sample was drawn from the registers of the Dutch Chamber of Commerce. It was stratified into eleven retail sectors and six firm sizes (measured by numbers of employees) in order to ensure sufficient variation. Table 1 shows the sample stratification.

Interviewing was done by telephone interviewers of private market research company TNS Nipo. The interviewed are mainly shop managers. The questionnaire includes questions on payment instrument acceptance, debit and credit card surcharging and several firm characteristics, as well as questions on the merchant's opinion about the levels of the fixed and variable costs associated with accepting cash, debit card or credit card payments.[13] Merchants have to invest in equipment (both hardware and software) in order to be able to accept payments with different payment instruments. The associated costs are of a fixed nature. Merchants also incur variable costs: costs that vary with the number or the value of the payments made, such as cash handling and transport costs, data communication fees for card transactions, merchant service fees charged by banks on card payments or cash deposits, etc. Merchants who accepted a specific payment instrument were also asked to provide information about the total annual costs (fixed and variable). The merchants could choose among ten cost categories ranging from EUR 250 or less to EUR 4,000 or more. Relative cost measures were constructed by dividing these total costs by annual sales in 2006.[14]

Questions about the fairness of costs associated with the three payment instruments were asked whether or not merchants accepted debit or credit cards or had information on the true costs of card acceptance in their particular case. This enabled us to examine the influence of perceived costs on

[13] In the questionnaire we stated explicitly that fixed costs are costs which do not vary with the number and value of payments while variable costs refer to costs associated with an individual transaction.

[14] This question was intended to get a rough indication of how much money merchants *think* they spend on cash, debit card and credit card payments. It was not intended to get a reliable estimate for the merchants' costs for cash and card payments. It is very hard for most merchants to provide an accurate assessment of their payment cost, as they may easily overlook cost items. Especially labour time cost are often overlooked or underestimated by (small) merchants. However, the perceived cost is likely to correlate positively with realized cost. It also seems likely that if cost influences acceptance and surcharging decisions, merchants may base these decisions on perceived cost rather than on realised cost.

Table 1 Sample merchants by sector and staff size (unweighed data)

Sector	Freq.	%	Staff size (no. of employees)	Freq.	%
Food	101	10	1	228	23
Greenery, florist	105	10	2-4	278	27
Clothing, shoes	100	10	5-9	220	22
Home improvement	100	10	10-19	143	14
Catering, hotels	93	9	20-49	99	10
Department stores, furniture	101	10	>=50	40	4
Media (books, DVDs, Cds)	107	11	Total	1,008	100
Chemists, perfumeries	100	10			
Other retail stores	99	10			
Fuel stations/travel agencies, etc.	41	4			
Other services	61	6			
Total	1,008	100			

merchants' acceptance and surcharging decisions. Merchants rated their opinions on a 10-point scale with 1 indicating very low, 6 indicating reasonable and 10 indicating very high perceived costs.[15] As Cost perception is likely to depend on the actual/expected costs associated with acceptance the reported cost perception may differ systematically between accepting and non-accepting merchants because of information asymmetry in the level of the actual costs. The information asymmetry may give rise to endogeneity problems when employing cost perception as an explanatory variable for card acceptance. In section 4.2 we discuss a Heckman selection model which we use for checking for endogeneity of cost perception and in section 5.2.2. we discuss the estimation results. It turns out that we cannot reject the hypothesis that cost perception can be treated as an exogeneous variable.[16]

The questionnaire also contains a question on market competition. Market power depends on both the elasticity of demand and on the competitiveness of the market. A merchant has market power if he can raise prices above marginal costs without losing (too much) demand (to competitors). There are several ways to measure competition, all having their pros and cons. Using a measure of the mark-up on prices over marginal cost applied by individual merchants would be ideal, but such measures are often hard (Bikker, Shaffer and Spierdijk, 2009) and in our case even impossible to obtain due to the lack of information on the costs and prices of consumer products for merchants. Concentration measures are objective competition measures which were frequently used in earlier studies but turn out to perform poorly in markets with a small number of players where competition may be strong. We therefore apply a more heuristic approach, using merchants' perceived competition as a proxy for their market power. This measure has been used by Hoeberichts and Stokman (2010) in a study on

[15] Note that merchants' perceptions of whether costs associated with card acceptance are 'fair' or 'high' might be biased, since merchants may not be aware of the objective, payment instrument-specific, costs per transaction. They may not know exactly the costs they themselves (would) incur, and they may not have information on the actual costs to other service providers in the payment chain (ACHs, banks, cash-in-transport companies, telcos and terminal suppliers). Although the cost perception may be biased this (biased) perception may still influence merchants' acceptance and surcharging decisions. Therefore, we have decided to include perceived costs in the set of explanatory variables.

[16] Schuh and Stavins (2010) explore the endogeneity of perception variables in a study on consumer payment choice. They conclude that the results of an instrumental variables model on check usage support the results found in a regression model without correction for possible endogeneity of perception factors. They stress the need for more research on finding valid instrumental variables for perception factors.

price setting in the Netherlands. Perceived competition reflects how much market power a merchant thinks he has. Interviewees were asked to rate the seriousness of the competition they faced on a 5-point scale with 1 denoting no competition and 5 denoting intense competition. Almost 50% of the merchants indicated that they met strong to intense competition, 33% experienced moderate competition and the remaining merchants perceived weak (15%) or no (6%) competition. The main advantage of this way of measuring competition is that, ideally, a merchant can provide the researcher with a tailor-made answer about the market power he possesses. A drawback is that the merchant may have a different definition of competition in mind than the researcher. He may only consider the number of competitors in his market and overlook the demand elasticity of his customers. In such a case, we risk overestimating the market power of a merchant.

4. ECONOMETRIC MODELS AND EXPLANATORY VARIABLES

4.1 Card payment acceptance and surcharging

Heckman's probit model with sample selection is a discrete choice model well-suited to analysing the determinants of card acceptance and card surcharging. The surcharging decision is censored in that it will only be observed for merchants who have already decided to accept card payments. Heckman's probit model tackles any self-selection effects in the surcharging decision. The likelihood function is made up of three probabilities, *viz.* 1) the probability that the merchant does not accept the payment card, 2) the probability that the merchant accepts the card but does not surcharge and 3) the probability that the merchant accepts the card and surcharges. The variable ρ measures the correlation between the error term of the card acceptance equation and the error term of the surcharging equation. If ρ does not differ significantly from zero, the acceptance and surcharging decisions can be estimated independently using univariate probit models. The number of merchants accepting credit cards is too low to examine surcharging decisions as well. Instead we focus on acceptance only and estimate a probit model explaining credit card acceptance.

Both the card acceptance equations and the surcharge equation for debit card payments include explanatory dummy variables denoting sector, firm size as measured by the number of employees, urbanisation degree, whether a merchant is independent or part of a chain and the competitiveness of the market the merchant operates in. The logarithm of the average regional income has been included as a proxy for consumer demand for card services. It is a well-established fact that wealth influences card usage (see e.g. Boeschoten, 1992; Jonker, 2007; Klee, 2004).[17, 18] We also only

[17] This variable was obtained from Statistics Netherlands. It measures the logarithm of citizens' average regional income in 2005 by COROP region. There are 40 COROP regions.

include dummies expressing whether a merchant perceives the fixed or variable costs associated with accepting debit (credit) cards as high or not. They are based on merchants' ratings regarding the level of the fixed and variable costs of different payment instruments. Since many merchants do not have an opinion about cost levels, we use the imputation algorithm in the statistical software package Stata to impute the expected value for cost perception when the value is missing. The cost level indicated by the merchants who accepted debit (credit) card payments has been included as an explanatory variable in the surcharging equation as well as a relative cost measure: the cost-sales ratio. Where merchants were not able to provide an estimate for the cost associated with card acceptance we also used an imputed value.[19] We expect merchants with a relatively high cost-sales ratio to be more likely to surcharge for the use of a particular payment instrument than merchants with a relatively low cost-sales ratio. Both the absolute and the relative cost measures have been left out of the acceptance equation, because they are not observed for merchants who do not accept payment cards. In order to ensure identification of the model, province dummies are included in the acceptance equation but not in the surcharging equation. Some of these dummies have a significant impact on acceptance whereas they have little explanatory power in the surcharging equation.[20]

4.2 The impact of costs on cost perception

In order to quantify the relation between true and perceived costs associated with debit card acceptance, we estimate a model explaining whether or not a merchant thinks debit card costs are high. We do this for both perceived fixed cost and perceived variable cost levels. We employ Heckman's probit selection model as a starting point, explaining at once card acceptance and cost perception. This model allows us to test for endogeneity of cost perception due to the partial observation of these costs by merchants who do not accept debit card payments and the full

[18] Next to income information we also included other demand-side variables as proxies for consumer demand. The variables are based on information retrieved from a consumer survey held in 2004, which is described in Jonker (2007). These factors reflect the perceived safety, the ease of use and the costs for consumers associated with debit card payments. The average values of these variables for consumers living in the same province-urbanisation degree combination are linked to merchants who are active there. None of these variables turn out to affect retailers' card acceptance or surcharging decisions in a meaningful and significant way. Therefore, we decided to exclude them from the analysis and to use regional income as a proxy for consumer demand.

[19] In addition to data imputation using the imputation algorithm in Stata, we also used the sample mean as a proxy for a missing value for cost perception or cost, together with a dummy indicating that the value was missing. In the regression we used the cost perception and cost variables as well as the missing value dummies as explanatory variables. Apart from the estimated impact of cost perception on acceptance and surcharging or the estimated impact of cost on surcharging, the main results hardly differed from those we report in this paper. These findings suggest that the estimated parameters are fairly robust. The estimated effect of cost perception on card acceptance and surcharging is stronger than the effects found when using the average value as a proxy in combination with the missing value indicator. The estimated impact of the cost-sales ratio on surcharging became smaller. These results indicate that initially, the estimated effect of cost perception was underestimated whereas the estimated impact of cost was overestimated.

[20] The variables which we employ for identification in the acceptance equation are valid instruments. However, in future research we will include more variables in our survey which we can use as valid instruments when testing for exogeneity of cost perception. That way we will improve the quality of the exogeneity test. In order to check the sensitivity of the estimated parameters we increased the number of explanatory variables in the model step-by step. We also experimented with other variables as omitted variables in the surcharging equation, such as urbanisation degree and the dummy indicating whether the shopkeeper is independent or not. The estimated parameters hardly altered, indicating robustness of the results.

observation of these costs by merchants who accept them. Absolute costs for debit card payments and the costs-sales ratio are used as explanatory variables in the cost perception equation, next to several other merchant characteristics such as staff size, sector, urbanisation degree and competition. In order to ensure identification, province dummies are included in the acceptance equation but not in the cost perception equation. Some of the province dummies also have a significant impact on acceptance whereas they have little explanatory power in the cost perception equation which makes them valid instruments. By deriving the impact of cost on cost perception we will be able in Section 5.3 to make a first attempt to assess the cost sensitivity of merchants for debit card services and the impact of cost changes for merchants on card usage.

5. SURVEY OUTCOMES

5.1 Descriptive statistics

5.1.1 *Acceptance and surcharging debit and credit cards*

Cash is accepted by almost every merchant in the Netherlands, debit cards are accepted by 70% and credit cards by 28% (see Table 2). Sectors in which transaction sizes are relatively large tend to have relatively high card acceptance. This holds especially for the credit card, which has its highest acceptance rates at fuel stations and travel agencies, followed by clothing and shoe shops.

Furthermore, it turns out that the size of the merchant, measured by staff size, correlates positively with both debit and credit card acceptance. Almost all large merchants accept debit cards and the majority accept credit cards, but most small merchants accept debit but not credit card payments. About 20% of the debit card accepting shops surcharge low value debit card transactions. The average threshold used is EUR 10.10. The surcharge is a fixed amount of, on average, 24 eurocent. According to EIM (2007), the average cost of a debit card payment for merchants is 20 eurocent and the average marginal cost is 16 eurocent. These findings suggest that the average surcharge for a debit card payment is higher than the average marginal cost. However, the marginal cost of a debit card payment may be relatively higher for a merchant with a low debit card transaction volume. So the average surcharge may reflect marginal cost. Of the retailers who accept credit cards, 13% apply a surcharge. Surcharging on debit or credit card payments occurs relatively often in sectors where purchases are relatively small, as in food. Surcharging on debit card payments is relatively common in small shops. For credit card payments there is no clear relationship between firm size and surcharging.

When comparing the results of the merchant survey with consumers' experiences and views, we find that the Dutch are satisfied with the debit card acceptance level despite the fact that not all merchants accept the cards (Jonker and Kosse, 2008). 13% of the Dutch are not satisfied with credit

Table 2 Acceptance and surcharging debit and credit cards in 2007

	Acceptance debit card		Surcharging debit card[a]		Acceptance credit card		Surcharging credit card[b]	
Sector	Freq	%[c]	Freq	%	Freq	%	Freq	%
Food	77	76	37	44	14	14	6	40
Greenery, florists	77	73	30	36	23	22	5	15
Clothing, shoes	89	89	9	10	54	54	4	6
Home improvement	80	80	17	19	15	15	2	5
Catering, hotels.	52	56	13	19	24	26	9	21
Department stores, furniture,	74	73	9	11	29	29	4	10
Media (books, DVDs, Cds)	90	84	30	32	35	33	2	4
Chemists, perfumeries	85	85	26	29	25	25	4	17
Other retail stores	74	75	15	19	37	37	1	3
Fuel stations, travel agencies	33	81	12	34	30	72	7	21
Other services	27	44	2	6	10	16	2	10
Staff size (no. of employees)								
1	114	50	29	23	30	13	6	19
2-4	209	75	52	22	81	29	14	15
5-9	196	89	40	19	101	46	7	7
10-19	133	93	12	9	84	59	7	9
20-49	91	92	4	4	53	54	12	24
50 and more	39	97	1	2	30	74	3	10
Competitiveness market								
Intense	135	67	44	26	59	29	12	14
Strong	255	74	45	15	110	32	15	10
Moderate	207	72	36	15	69	24	15	16
Weak	82	69	26	28	39	33	5	11
No	19	44	14	52	7	16	4	30
Total[c]	706	70	167	20	282	28	49	13

[a,b] Percentage of merchants that accept debit card payments (a) or credit card payments (b)
[c] Frequencies of total refer to all merchants in the sample and may not coincide with the sum of the frequencies by sector, staff size or competitiveness market because of missing values for these variables.

card acceptance at points of sale. This finding is in line with the low acceptance rate of the credit card by merchants. The level of debit card surcharges reported by surcharging merchants coincided with the average debit card surcharge levels reported by consumers (Bolt *et al*., 2010).

Regarding competition we find that merchants who do not face any competition are less inclined to accept debit or credit cards than merchants who face weak to intense competition. And those local monopolists who do accept cards are more likely to surcharge on card payments. There are no apparent relationships between acceptance or surcharging decisions and the level of competition faced, if any. There are some indications that local monopolists use surcharging as a means of capturing additional consumer surplus. On average, they charge 38 eurocent for a debit card payment, which is much higher than the average surcharge. In addition, they also apply a relatively high threshold level of EUR 12.42, implying that they also levy the surcharge relatively often.

5.1.2 *Costs and cost perception cash, debit card and credit card*

Merchants' perceptions on the fixed and variable costs associated with different payment instruments appear to be influenced by firm size (Table 3).[21] The results are in line with the results found by Arango and Taylor (2009). The average score for cash lies below 6 indicating low perceived costs by most merchants, whereas the average score for debit card payments lies above 6 indicating high perceived costs. Merchants find the costs of accepting credit card payments very high. This holds for variable costs more than for fixed costs and may be related to the level As economic theory points out, cost perception seems to be related to staff size. Small and medium-sized merchants handling lower numbers of transactions than large shops tend to regard the cost of cash as lower than those of debit card payments, whereas large merchants perceive the cost for cash and debit card payments as about equal. Note that a large share of merchants does not have an opinion about the fairness of costs. Many merchants who do not accept a certain means of payment have no idea about the fairness of the associated costs, but even merchants who do, often did not give a rating.

Merchants stated that on average, they spent about EUR 375 on cash payments, EUR 700 on debit card payments and EUR 1,250 on credit card payments. For each payment instrument, costs increase with staff size, i.e. with payment volume. In fact, once scaled with annual sales, the costs of payments rapidly decline with staff size. Economies of scale reduce average unit transaction costs as fixed costs can be spread over larger payment volumes. In addition, bank and telecom fees decline with increasing payment volumes as merchants with large payment volumes have more bargaining power vis à vis acquiring banks and telcos than merchants with low payment volumes (NMa, 2006). Note that the reported cost figures may not correspond with realised cost, as merchants made quick estimates of their costs during a telephone interview. Many merchants could not answer the cost question: there were 29% non-responses on costs for cash, 38% on card payment and 44% on credit card payment costs. This suggests that other merchants may also have had problems providing

Table 3 Staff size and cost perception, 2007
(reweighed data, 1=very low, 6=sufficient/just right and 10=very high)

Staff size	Fixed costs			Variable costs		
(no. of employees)	cash	debit card	credit card	cash	debit card	credit card
1	5.2	6.2	7.9	4.9	6.1	8.0
2-4	6.1	6.7	7.3	6.2	6.7	7.3
5-9	5.9	6.5	7.2	6.3	6.6	7.6
10-19	6.2	6.6	7.2	6.1	6.6	7.7
20-49	5.5	6.4	6.4	5.6	6.2	7.1
≥50	6.6	6.3	6.7	6.2	6.5	7.6
Total	5.8	6.5	7.4	5.7	6.5	7.5
Don't know (in %)	14	27	67	18	33	68

[21] In order to save space in Table 3 we focus on the relationship between staff size and cost perception. Other interesting relationships could be cost perception and annual sales, average transaction size or number of transactions. Unfortunately, there is no information on the latter two variables in our dataset, and many merchants could not provide us with information about their annual sales.

accurate answers. Especially the cost of cash seems to be underestimated.[22] Given the uncertain reliability of the cost information, we should be cautious when drawing conclusions about the precise effect of payment costs on surcharging. However, the estimation results will provide a rough indication about the influence of costs as it seems likely that reported or perceived costs correlate positively with realised costs. The observed strong positive correlation between firm size, i.e. payment volume, and reported costs confirms this.

5.2 Estimation results card acceptance and surcharging

In this section we present and discuss the estimated effect of the individual explanatory variables on card acceptance and surcharging (for estimation results see Table 4 for debit cards and Table 5 for credit cards).[23] Next, we discuss the results of the hypothesis testing, which are summarised in Table 6. We estimated a Heckman probit model to examine which factors influence merchants' debit card acceptance and surcharging decisions. The estimated value of ρ, which measures the correlation between the error terms of the acceptance and surcharging equation, turns out not to differ significantly from zero. We therefore continued by estimating separate probit models for the acceptance and surcharging decisions. The estimated parameters for explanatory variables in the separate probit models are in line with the estimated parameters in the Heckman probit model, indicating robustness of the estimation results. The number of merchants that surcharge on credit card payments is too low to analyse. Therefore, we only discuss the results for credit card acceptance.

5.2.1 *Testing hypotheses 1 and 2: cost perception, staff size and sector*

Cost perceptions significantly influence merchants' acceptance and surcharging decisions. Merchants who perceive the costs of debit card payments as high are significantly less likely to accept debit cards than merchants who think these costs are low or just right. The estimated marginal effect indicates that a merchant who thinks the fixed costs of debit cards are high is almost 12%-points less likely to accept them than a merchant who thinks these costs are low or just right. The estimated marginal effect of the perception for variable costs is smaller, amounting to 5%-points. For credit cards we see that merchants' perceptions of both fixed and variable costs influence their acceptance decision. Merchants who find fixed costs high are 42%-points less likely to accept credit cards than merchants who find fixed costs low or reasonable, whereas merchants who find variable costs high are 26%-points less likely to accept credit card payments than other merchants. Several reasons may explain the relatively strong effect of cost perception on credit card acceptance compared to debit card

[22] Especially the costs for cash payments appear underestimated, probably because merchants did not include the full labour costs in the estimate. This hard-to-measure cost component determines much of the cost for cash payments, but not for card payments (EIM, 2007).

[23] The estimated effects of province dummies are not listed in Tables 4 and 5 due to space constraints. Some of the provinces differ significantly with respect to the reference province 'Noord Holand' with respect to card acceptance.

acceptance. Despite the cost, merchants may feel compelled to accept debit cards but not credit cards, because debit cards are far more widely used than credit cards. The potential loss of business from non-acceptance is therefore greater for debit than for credit cards. Moreover, if a credit card payment is not accepted for a larger purchase, the customer is unlikely to be able or willing to pay cash instead; however, they may still be able to pay for their purchase by debit card.

Fixed costs also influence the decision to surcharge on debit card payments. Merchants who find fixed costs high are around 9%-points more likely to surcharge than merchants who perceive fixed costs as low or reasonable. The perception for variable costs has no significant influence. This suggests that the merchant service fee, which to some extent determines variable cost, is of limited influence on the surcharging decision. However, the merchant service fee for debit card payments in the Netherlands averages about 4.5 eurocent, which is low compared internationally. Therefore, more research on data from other countries is needed to check whether this finding also holds elsewhere.

An important finding is that the fixed costs associated with debit cards play a much larger role than variable costs in the card acceptance decision and especially in the surcharging decision of Dutch merchants. This result illustrates the importance of the contribution made by McAndrews and Wang (2008) to the modelling of card acceptance decisions. It also implies that when analysing merchants' surcharging decisions in a theoretical framework, both fixed and per transaction costs should be implemented in the model.

Staff size has a positive effect on card acceptance. Firms with fewer than five employees score lower on card acceptance than firms with at least five employees. The effect is about twice as strong for credit cards as for debit cards. With respect to credit card acceptance, medium sized merchants with 5-19 employees have significantly lower acceptance rates than merchants with 20 or more employees. For debit card acceptance there are no differences in acceptance rates between the medium sized and the large to very large merchants. It seems unlikely that the moderate differences in adoption cost explain the heavier influence of staff size on credit card acceptance than on debit card acceptance. Low consumer adoption and usage rates for credit cards compared to debit cards seem more likely to shy small merchants away from accepting credit cards.

Staff size also affects surcharging, in that it reduces the likelihood that merchants who accept debit cards surcharge their customers for using them. Merchants with less than five employees are more likely to surcharge than employees with at least five employees, and merchants with 5-19 employees surcharge more frequently than merchants with at least 50 employees (p-value=0.01). The surcharge rates for merchants with 20-49 employees and the largest merchants are not significantly different (p-value=0.41).

The estimation results considered by business sector (reference group: department stores, furniture) suggest that average transaction size also influences card acceptance and surcharging. Credit cards are accepted by significant numbers of retailers in the fashion sector and by fuel station owners and travel agencies, sectors where transaction sizes tend to be high and which have a

relatively high proportion of foreign customers. Credit cards tend not to be accepted in low transaction size sectors such as specialised food shops and chemists. The relatively high merchant service fees and the low consumer demand for credit card payments make acceptance unattractive for merchants in these sectors. Results for debit cards seem more ambiguous than for credit cards, with both high and low transaction size sectors having relatively high acceptance rates compared to the reference sector, but here the results for surcharging reveal the importance of transaction size. Merchants active in low transaction size sectors, such as specialised food, greenery/florists, chemists and media, surcharge debit cards payments relatively often. Remarkably, surcharging also occurs frequently in the high transaction size 'fuel stations, travel agencies' sector. An explanation may be that fuel station owners face both small and large purchases and may surcharge lower-value debit card payments.

Table 4: Acceptance and surcharging of debit card payments

	Acceptance debit card			Surcharging debit card		
Variable	coef.	stdv.	dF/dx	coef.	stdv.	dF/dx
Ln regional income	3.625**	1.661	0.543	-	-	-
Cost/sales	-	-	-	37.507**	15.071	8.128
Fixed costs high	-0.886**	0.149	-0.121	0.414**	0.140	0.088
Variable cost high	-0.349**	0.140	-0.050	-0.063	0.139	-0.014
Competitiveness market						
Intense competition	-0.042	0.167	-0.006	0.053	0.161	0.012
Strong competition	0.026	0.145	0.004	-0.076	0.141	-0.016
Weak competition	-0.276	0.188	-0.048	0.331**	0.189	0.082
No competition	-0.633**	0.235	-0.137	0.829**	0.316	0.252
Independent store	-0.934**	0.299	-0.086	0.355**	0.174	0.066
Staff size						
5-19 employees	1.186**	0.143	0.150	-0.272**	0.117	-0.057
20-49 employees	1.095**	0.258	0.090	-1.044**	0.279	-0.141
≥ 50 employees	1.435**	0.392	0.087	-1.461**	0.464	-0.143
Sectors						
Food	0.151	0.241	0.021	1.180**	0.270	0.372
Greenery, florists	0.155	0.238	0.021	0.714**	0.258	0.202
Clothing, shoes	0.803**	0.264	0.077	-0.246	0.298	-0.048
Home improvement	0.511**	0.248	0.057	0.245	0.274	0.059
Catering, hotels	-0.408*	0.237	-0.076	0.315	0.311	0.078
Media (books, CDs, DVDs)	0.616**	0.236	0.066	0.854**	0.252	0.250
Chemists, perfumeries	0.655**	0.268	0.068	0.512*	0.264	0.136
Other stores	0.200	0.249	0.027	0.329	0.282	0.082
Fuel station, travel agency etc.	0.266	0.336	0.033	0.837**	0.312	0.254
Other services	-0.810**	0.262	-0.188	-0.267	0.416	-0.050
Urbanisation degree						
City	-0.134	0.192	-0.021	0.092	0.196	0.021
Village	-0.241	0.161	-0.040	0.002	0.167	0.000
countryside	-0.137	0.158	-0.021	0.187	0.149	0.042
Constant	-8.546*	4.942	-	-1.803**	0.328	-
Pseudo R^2			0.29			0.18
Log likelihood			-327.58			-331.77
No. of obs.			1008			837

Robust standard errors; * (**) denotes significance at the 10% (5%) level.

The significant effects of cost perception, staff size and sector on merchants' acceptance of debit and credit card payments support hypotheses 1 and 2 formulated in Section 2.4 in varying degrees. With respect to debit card payments we find strong but not full support for hypothesis 1 (if accepting card payments increases average unit transaction costs, a merchant will be less inclined to accept card payments) and hypothesis 2 (if accepting card payments increases average unit transaction costs a card-accepting merchant will be more likely to surcharge card payments); two out of three indicators have the expected sign and are significant. Regarding credit cards, we find full support for hypothesis 1 as all three indicators have the expected sign and are significant.

Although we do not have hard evidence we think the estimation results in Table 4 show that the possibility to surcharge has contributed to debit card acceptance in the Netherlands. This is supported by merchants' responses to survey questions like "Why do you not accept payment cards?"

Table 5: Credit card acceptance by all and by debit-card accepting merchants

	By all merchants			By debit card accepting merchants		
Variable	coef.	stdv.	dF/dx	coef.	stdv.	dF/dx
Ln regional income	2.030	1.464	0.757	1.492	1.598	0.591
Fixed costs high	-1.084**	0.173	-0.412	-1.134**	0.186	-0.416
Variable cost high	-0.751**	0.212	-0.292	-0.668**	0.224	-0.259
Competitiveness market						
Intense competition	0.240*	0.136	0.091	0.336**	0.147	0.134
Strong competition	0.185	0.119	0.070	0.236*	0.127	0.094
Weak competition	0.022	0.156	0.008	0.066	0.167	0.026
No competition	-0.123	0.221	-0.045	0.067	0.263	0.027
Independent store	-0.359**	0.141	-0.139	-0.300**	0.142	-0.119
Staff size						
< 5 employees	-0.859**	0.147	-0.312	-0.640**	0.158	-0.248
5-19 employees	-0.145	0.144	-0.054	-0.155	0.152	-0.061
Sectors						
Food	-0.979**	0.234	-0.288	-1.125**	0.244	-0.370
Greenery/florist	-0.254	0.209	-0.091	-0.316	0.222	-0.122
Clothing, shoes	0.799**	0.195	0.310	0.684**	0.208	0.265
Home improvement	-0.341*	0.205	-0.120	-0.488**	0.217	-0.184
Catering, hotels	-0.165	0.204	-0.060	0.028	0.227	0.011
Media (books, CDs, DVDs)	-0.091	0.198	-0.034	-0.322	0.208	-0.125
Chemists, perfumeries	-0.651**	0.224	-0.211	-0.827**	0.230	-0.294
Other stores	0.207	0.200	0.079	0.183	0.217	0.073
Fuel station, travel agency etc.	1.037**	0.300	0.394	1.109**	0.377	0.392
Other services	-0.244	0.233	-0.087	-0.197	0.265	-0.077
Urbanisation degree						
City	0.032	0.156	0.012	0.013	0.170	0.005
Village	-0.249*	0.135	-0.090	-0.277*	0.146	-0.108
countryside	-0.395**	0.127	-0.143	-0.461**	0.135	-0.180
Constant	-3.824	4.342	-	-2.186	4.735	-
Pseudo R^2			0.29			0.28
Log likelihood			-476.49			-413.89
No. of obs.			1008			837

Robust standard errors; * (**) denotes significance at the 10% (5%) level.

and "Why do you surcharge your customers for using their debit card?" 53% of the cash-only merchants replied that they accept only cash because investment costs for debit card acceptance are too high, while 39% thought transaction fees were too high.[24] It seems that for the majority of these merchants costs are a barrier. Some merchants overcome this barrier by surcharging. 61% of the merchants who surcharged debit card payments stated they did so to recover the cost of providing this service and 24% replied that they found debit card payments more costly than cash payments. Hence the Dutch results seem to hint that surcharging has fostered debit card acceptance. Future research using information on card acceptance and surcharging in other countries may shed more definite light on the relationship between surcharging and card acceptance.

5.2.2 *Testing hypotheses 3a-4b: competition*

Competition influences both acceptance and surcharging decisions. If merchants operate in a non-competitive market, they are 14%-points less likely to accept debit card payments than merchants who face moderate competition. With respect to surcharging the estimation results reveal that merchants in a non-competitive market who accept debit cards are 25%-points more likely to surcharge debit card payments than merchants in a moderate competitive market. Those facing weak competition are also significantly more likely to surcharge, but the estimated marginal effect is about 1/3 of that for merchants facing no competition at all. The strong impact of being a local monopolist on debit card acceptance and surcharging decisions supports the special position given to monopolists in the theoretical payments literature (see e.g. Rochet and Tirole, 2002; Wright, 2003 or Hayashi, 2006). The results provide full support to hypotheses 3a and 4a.

We also find that merchants who face intense competition do not differ significantly from merchants who face moderate competition with respect to debit card acceptance and surcharging. Therefore we reject hypotheses 3b and 4b for the Dutch debit cards market. Any competition will make a merchant more likely to accept debit card payments and less likely to surcharge. That way he may avoid losing customers to competitors or attract additional custom.

Competition influences credit card acceptance as well. The estimated effect and its significance are more pronounced among debit card accepting merchants than among all merchants in the sample. We discuss the results for debit card accepting merchants. Debit card accepting merchants who face intense or strong competition are more likely (by, respectively, 13%-points and 9%-points) to accept credit cards as well than debit card taking merchants who face moderate competition (reference group). The estimated effects of intense competition and strong competition differ significantly from each other (p-value<0.05). Merchants who are local monopolists seem less likely to accept credit card payments than merchants in the reference group, but the estimated effect is not significant. Therefore, we conclude that hypothesis 3a is not supported by the data.

[24] Other factors also play a role such as the low transaction speed of debit card payments (19%) and the time and effort involved in making debit card acceptance possible (26%).

Unlike in the debit card market, intense competition encourages Dutch merchants to accept credit card payments, whereas a monopolist status allows merchants not to accept debit card payments. Thus the influence of competition on card acceptance depends on the type of payment card. A possible explanation may be the strong consumer demand for debit card payments in the Netherlands compared to demand for credit card payments. It may be an interesting subject for further research to see whether this result holds universally, for instance by examining whether these differences are also present in other countries.

Table 6 Summary test results hypotheses 1-4b by type of payment card

	Debit card payments			Credit card payments		
	Expected sign?	Signifi-cant?	Amount of evidence to support hypothesis	Expected sign?	Signifi -cant?	Amount of evidence to support hypothesis
Hypothesis 1:						
Cost perception	Yes	Yes		Yes	Yes	
Firm size	Yes	Yes		Yes	Yes	
Sector	Mixed	Yes	Strong	Yes	Yes	Full
Hypothesis 2:						
Cost perception	Mixed	Mixed		-	-	
Firm size	Yes	Yes		-	-	
Sector	Yes	Yes	Strong	-	-	-
	Expected sign?	Signifi-cant?	Hypothesis rejected or not rejected?	Expected sign?	Signifi -cant?	Hypothesis rejected or not rejected?
Hypothesis 3a:						
No competition	Yes	Yes	Not rejected	Yes	No	Rejected
Hypothesis 3b:						
Intense competition	Yes	No	Rejected	Yes	Yes	Not rejected
Hypothesis 4a:						
No competition	Yes	Yes	Not rejected	-	-	-
Hypothesis 4b:						
Intense competition	Yes	No	Rejected	-	-	-

5.2.3 *Other results*

In addition to cost perception, competitiveness of the market and firm characteristics, we also find that consumer demand, proxied by the average income level of consumers in a region, furthers debit card acceptance by merchants. The indicator used is a rather crude measure, but the estimated coefficient is significant. Furthermore, we find that urbanisation degree influences the acceptance of credit cards but not of debit cards. A possible explanation may be that urbanisation degree proxies consumer demand from foreign tourists who tend to visit urbanised areas and who may be more used to paying with credit cards than the Dutch. Finally, there is the effect of relative cost on debit card surcharging. Relative cost equals absolute costs involved in accepting debit card payments, scaled by annual sales.

Relative cost influences the surcharging decision. The estimated marginal effect equals 0.08 indicating that if costs rise by 0.1% of sales, the chance a merchant will surcharge increases by 0.8%. The magnitude of the effect is very small if you compare it with the estimated average cost sales ratio of 0.18 (see Table A.1). It suggests that merchants' debit card-related relative cost has rather limited influence on their surcharging decisions.

5.3 The impact of cost on cost perception: debit card payments

We used Heckman's probit model as a starting point for explaining the influence of costs on cost perception. However, the correlation between error terms of the debit card acceptance equation and the debit card cost perception equation turns out not to differ significantly from zero. Therefore, we continued by estimating a univariate probit model to gauge the influence of debit card costs on cost perception using data from debit card accepting merchants only. We distinguished between the perception of variable and of fixed costs (see Table 7). Note that the insignificancy of the correlation term justifies that we treated cost perception as an exogeneous variable in the debit card acceptance equation in the previous section.

The research outcomes reveal that the absolute cost level for debit card payments significantly influences merchants' cost perception, whereas relative costs do not have a significant impact. The magnitude of the effect is fairly small; an increase of EUR 1,000 in total debit card costs would lead to 5%-points more merchants who perceive the fixed costs of debit card payments as high and to 7%-points more merchants dissatisfied with the level of variable costs. Combining these results with the impact of cost perception on card acceptance indicates that card acceptance would increase by 0.25%-points if annual debit card costs would decline by EUR 1,000. This effect is fairly modest given the magnitude of the cost reduction. It implies that the demand for debit card services among Dutch merchants is fairly though not completely inelastic. Card surcharging would decline by 0.8%-points of card accepting merchants if annual debit card costs came down by EUR 1,000.

Apart from costs for debit card payments, an independent position and firm size also significantly influence cost perception. Independent shopkeepers are 21%-points more likely than chain merchants to regard the fixed costs associated with debit card payments as high, whereas the smaller a firm is, the more likely the merchant is to find costs high. The smallest merchants are 20%-points more likely to find variable costs high than merchants with 20 or more employees. These results are in line with those found by Arango and Taylor (2009). They find that firm size measured by the number of payment terminals and the total transaction volume correlate negatively with the perception that debit card payments are costly. They also find a negative effect of the average transaction size. In our model we find some mild evidence for this relationship. The estimated impacts of the sector dummies on cost perception do not significantly different from zero, except for the food sector which is known for its low transaction sizes.

Table 7 Opinion: Debit card costs are high

	Fixed costs			Variable costs		
Variable	coef.	stdv.	dF/dx	coef.	stdv.	dF/dx
Cost/1000	0.133**	0.0474	0.0528	0.176**	0.049	0.069
Cost/sales	19.624	29.354	7.824	18.902	29.800	7.449
Urbanisation degree						
City	-0.418**	0.193	-0.163	-0.144	0.195	-0.056
Town (ref.)	-	-	-	-	-	-
Village	-0.159	0.169	-0.063	0.191	0.170	0.076
Countryside	0.046	0.151	0.018	0.162	0.152	0.064
Competitiveness market						
Perfect competition	-0.143	0.178	-0.057	0.171	0.178	0.068
Strong competition	0.052	0.149	0.021	0.208	0.151	0.082
Moderate competition (ref.)	-	-	-	-	-	-
Weak competition	-0.401	0.206	-0.156	-0.083	0.206	-0.033
No competition	-0.171	0.332	-0.068	-0.195	0.346	-0.075
Independent store	0.561**	0.205	0.214	0.071	0.200	0.028
Staff size						
< 5 employees	0.210	0.213	0.083	0.503**	0.220	0.197
5-19 employees	0.038	0.198	0.015	0.348*	0.206	0.137
≥ 20 employees (ref.)	-	-	-	-	-	-
Sectors						
Department stores, furniture (ref.).	-	-	-	-	-	-
Food	0.267	0.266	0.106	0.476*	0.268	0.188
Greenery/florist	0.101	0.259	0.040	0.072	0.261	0.028
Fashion	0.090	0.266	0.036	0.164	0.267	0.065
Home improvement	0.353	0.258	0.139	0.269	0.259	0.107
Catering, hotels	0.113	0.282	0.045	0.159	0.284	0.063
Media (books, CDs, DVDs)	0.263	0.257	0.104	0.196	0.257	0.078
Chemist, perfumery	0.386	0.261	0.152	0.335	0.263	0.133
Other stores	0.239	0.273	0.095	0.076	0.275	0.030
fuel station, travel agency, etc	-0.246	0.347	-0.097	-0.259	0.343	-0.099
Other services	-0.220	0.305	-0.087	-0.328	0.317	-0.125
Constant	-0.834**	0.350	-	-1.125**	0.355	-
Log likelihood	-321.55			-316.67		
Pseudo R^2	0.05			0.06		
No. obs	490			490		

Robust standard errors; * (**) denotes significance at the 10% (5%) level.

5.4 Scenario analysis: merchant and consumer cost sensitivity for debit card services

To gauge just to what extent reducing the costs of debit card payments for merchants will result in more debit card payments, we examined a scenario which aims to lower the cost level of debit card payments for merchants to that of cash payments. The scenario results are intended merely as a crude indication of the impact of cost reductions for merchants on the total number of debit card payments.

Table 8 Comparing cost sensitivity for debit card services of merchants and consumers, 2006-07

	Nature of cost reduction	Δ costs per transaction	Δ number of debit card transactions	Δ number of debit card payments/ Δ costs per transactions
Merchants	Reduction fixed cost	-1.4 eurocent	+ 6 million	+ 4 million
	Reduction variable cost	-1.4 eurocent	+ 2 million	+1 million
Consumers	Reduction variable cost	- 23 eurocent	+ 67 million	+ 3 million

Lowering costs for debit card payments to the level of cash payments would make the merchant indifferent, from a cost perspective, as to debit card acceptance (Rochet and Tirole, 2010). We distinguish between the impact of lower variable costs and lower fixed costs on card usage, see Table 8. Cost reductions will result in higher card usage as more merchants will decide to accept debit card payments and fewer merchants will let their customers pay for card usage. We assumed that lower costs increase card acceptance indirectly via their impact on cost perception and directly via the impact of the cost-sales ratio on surcharging. We also assumed that the increase in card acceptance results in a similar increase in card usage and, following Bolt *et al.*, (2010) that the change in surcharging leads to 8%-points more card payments in shops where debit card payments will not be surcharged anymore.

Research institute EIM estimated the true costs for Dutch merchants associated with cash and debit card payments in the year 2006 (EIM, 2007). Reducing the total cost of debit card payments to the level of cash payments would, for an average merchant, imply a cost reduction by 1.4 eurocent per debit card payment from 19.3 to 17.9 eurocent. The estimation result on the impact of costs on fixed cost perception presented in Table 7 implies that discontent among merchants about the costs for debit card payments would decline by 2.1 %-points. The impact of such a change on card acceptance and surcharging, is fairly modest. It would raise card acceptance by 0.3 %-points and it would lead to a 0.2 %-points drop in the share of surcharging merchants. This scenario leads to approximately 6 million extra debit card payments, i.e. 4 million extra debit card payments per eurocent cost reduction.[25] If variable costs would be reduced the impact would be even smaller. The share of merchants who thinks that variable debit card costs are high would go up by 2.7 %-points. Such a raise would lead to an increase in card acceptance by 0.1 %-points and consequently to 2 million additional debit card payments or 1 million extra debit card payments per eurocent cost reduction. The share of surcharging merchants would be unaffected as variable cost perception has no significant impact on the surcharging decision.

Bolt *et al.* (2010) examine price sensitivity of consumers by examining the impact of lifting debit card surcharges on consumers' choice of payment instrument. They find that the immediate impact of a eurocent reduction of the average surcharge would result in 3 million extra debit card

payments. Although the results for consumers and merchants cannot be compared directly, they seem to hint that, about 20 years after the introduction of the debit card as a payment instrument, cost sensitivity for debit card services of merchants is, in fact, roughly similar to that of consumers. A eurocent reduction of the surcharge would lead to 3 million extra debit card payments, whereas a similar cost reduction for merchants would lead to about 1 to 4 million extra debit card payments.

6 Concluding remarks

Several social cost studies reveal that very often, debit card payments cost less than cash or credit card payments. Therefore, increasing debit card usage would be beneficial for society as it would save costs. Previous research shows that a higher acceptance rate among merchants will encourage consumers to use their debit card more frequently, as will less debit card surcharging. The aim of this study is to gain insight into the factors influencing merchants' acceptance and surcharging decisions, using survey data collected among 1,008 merchants in the Netherlands in 2007. We derive four hypotheses regarding the influence of transaction costs and competition on card acceptance and surcharging from the economic literature and we test them empirically.

Merchants are sensitive to the cost of accepting card payments, especially fixed costs. Statistical analyses support the results from the theoretical literature that if card acceptance increases average unit transaction costs, merchants will be less likely to accept card payments (hypothesis 1) or become more likely to surcharge their customers for using them (hypothesis 2). We think that the ability to surcharge has fostered card acceptance among Dutch merchants who otherwise would not accept the card. In that sense surcharging may lower the barrier to card acceptance for merchants who think the costs outweigh the benefits. Further empirical research using information from countries where surcharging has recently been permitted may shed more light on this issue.

The estimation results also reveal that costs are not the most important factor explaining merchants' acceptance and surcharging decisions. As economic literature predicted, competition is at least as important. How competition affects card acceptance in the Netherlands depends on the type of card. Facing moderate competition compared to wielding monopoly power encourages merchants to accept debit cards (hypothesis 3a) or accept them without surcharging (hypothesis 4a). In an intensely competitive market Dutch merchants also become more likely to accept credit cards (hypothesis 3b). Merchants who are local monopolists and who accept debit card payments, surcharge their customers significantly more often than merchants who face at least moderate competition. They use surcharging as a way to extract as much consumer surplus as possible from card holders. The levels of the fee and the threshold they use support this conclusion.

The results are not only relevant for the Netherlands but also for other countries. The 'no surcharge' rule which some card companies impose on merchants is under pressure from regulators

and competition authorities. Some of our results suggest that there are strong linkages between the decision to accept card payments and the decision to surcharge customers for using them. It would be worthwhile to examine the relationship between the two decisions more closely in future research as this issue should be carefully assessed as part of any regulatory reform. Lifting the 'no surcharge' rule might encourage specific merchants to start accepting payment cards and might increase card use among consumers. However, surcharging also influences consumers' perception of the cost of card payments and, consequently, their payment behaviour. Surcharging cost-efficient means of payment may deter consumers from paying efficiently. Therefore, card companies and banks should carefully price their payment services and have payment fees reflect true costs. Cost savings in the payment chain should also be passed on to merchants in order to encourage them to accept low cost payment instruments and steer their customers towards cost efficient payment behaviour by surcharging only on costly payment instruments. If merchants surcharge on payment instruments which are cheap from both the social and the merchant's perspective, policy makers and industry associations could join forces and launch public campaigns in order to persuade merchants to lift surcharges by stressing the potential cost savings for merchants. In the Netherlands such an approach turned out be very effective. Another, more far-reaching policy intervention would be to forbid or limit the right to use surcharges by merchants. Such an intervention should only be used if moral suasion fails. A major drawback of such a regulatory intervention is that it limits the bargaining power of merchants vis à vis acquiring banks and card companies. If regulators consider limiting the usage of surcharges legally, they should carefully balance the pros and cons of such a measure and take into account the possible impact on pricing decisions of acquiring banks, merchants' card acceptance decisions and consumer payment behaviour.

7. APPENDIX

Table A.1: Summary statistics of dependent and explanatory variables

Variable	n	average	stdv
Acceptance debit card	1008	0.83	0.38
Surcharging debit card	837	0.19	0.39
Acceptance credit card	1008	0.38	0.48
Surcharging credit card payments	378	0.11	0.32
Ln regional income	1008	2.90	0.06
Cost debit card payments (in EUR)	490	1047.70	1490.72
Cost debit card payments (in EUR) (incl imputations)	837	1106.94	1268.68
Cost debit card payments /sales (*100)	490	0.18	0.22
Cost debit card payments/ sales unknown	1008	0.55	0.50
Cost debit card payments/sales (*100) (incl.imputations)	837	0.18	0.31
Fixed costs debit card payments high	780	0.50	0.50
Fixed costs debit card payments high (incl. imputations)	837	0.55	0.50
Variable costs debit card payments	728	0.48	0.50
No opinion fixed costs debit card payments	1008	0.23	0.42
No opinion variable costs debit card payments	1008	0.28	0.45
Fixed costs credit card payments high	402	0.64	0.48
No opinion fixed costs credit card payments	1008	0.60	0.49
Competitiveness market			
Perfect competition	1008	0.20	0.40
Strong competition	1008	0.34	0.47
Mild competition (ref.)	1008	0.29	0.45
Weak competition	1008	0.12	0.32
No competition	1008	0.04	0.20
Independent store	1008	0.88	0.32
Staff size			
< 5 employees(ref.)	1008	0.50	0.50
5-19 employees	1008	0.36	0.48
20-49 employees	1008	0.10	0.30
≥ 50 employees	1008	0.04	0.20
Sectors			
Food	1008	0.10	0.30
Greenery/florist	1008	0.10	0.31
Fashion	1008	0.10	0.30
Home improvement	1008	0.10	0.30
Catering, hotels	1008	0.09	0.29
Department stores, furniture (ref.)	1008	0.10	0.30
Media (books, CDs, DVDs)	1008	0.11	0.31
Drugstore, perfumery	1008	0.10	0.30
Other stores	1008	0.10	0.30
Fuelling station, travel agency etc.	1008	0.04	0.20
Other services	1008	0.06	0.24
Urbanisation degree			
City	1008	0.16	0.36
Town (ref.)	1008	0.26	0.44
Village	1008	0.22	0.41
Countryside	1008	0.36	0.48

Tabel A.1 continued

Variable	n	average	stdv.
Provinces			
Noord-Holland (ref.)	1008	0.15	0.36
Zuid-Holland	1008	0.16	0.37
Utrecht	1008	0.07	0.26
Flevoland	1008	0.02	0.14
Overijssel	1008	0.06	0.25
Drenthe	1008	0.03	0.16
Gelderland	1008	0.15	0.35
Friesland	1008	0.04	0.20
Groningen	1008	0.05	0.21
Noord-Brabant	1008	0.16	0.37
Zeeland	1008	0.03	0.18
Limburg	1008	0.08	0.27

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