



Pricing in debit and credit card schemes

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Abstract

This paper presents a model of a debit or credit card payment scheme, providing a simple determination of the socially optimal structure of fees between those charged to cardholders and those charged to merchants.

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1. Introduction

When consumers use debit or credit cards for a purchase, an interchange fee is paid from the merchant's bank (the acquirer) to the consumer's bank (the issuer). The level of this interchange fee determines the relative fees faced by cardholders versus merchants. A higher interchange fee raises the costs of acquirers, who will charge merchants more, and lowers the effective costs of issuers, who will charge cardholders less (or in fact, provide them with rebates).

Frankel (1988), and more recently policymakers such as the European Commission and the Australian Central Bank have argued that card associations (MasterCard and Visa) have set interchange fees too high, the result being that merchants pay too much for accepting credit card transactions, a cost which is ultimately passed on to their customers who pay with cash. Consumers who pay by credit cards, it is argued, are subsidized by taxing cash paying customers.

Several models exist in which these claims can be evaluated. Baxter (1983) provides the seminal analysis of interchange fees in a payment scheme, an analysis that was used to defend the legality of competing banks collectively setting interchange fees in *National Bancard Corp. vs. Visa USA*. His analysis relies on three underlying assumptions: (1) perfect competition between issuers and between

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acquirers, (2) merchants that accept cards do not attract customers from rivals who do not, and (3) all merchants get the same benefits from accepting cards. Assumption (1) implies card schemes are indifferent to the level of interchange fees. Assumption (2) leads to biased welfare conclusions, given that business stealing is not accounted for. Assumption (3) leaves unanswered how interchange fees should be set given heterogeneity across merchants.

Recently, three papers have analyzed interchange fees, addressing these assumptions. Rochet and Tirole (2002) relaxes assumptions (1) and (2), while Schmalensee (2002) relaxes (1) and (3).¹ In Wright (2001), I relax (1)–(3) but without (1) I do not get the strong results obtained here. This paper analyzes socially optimal interchange fees, relaxing instead assumptions (2) and (3). Assumption (1), although not reasonable for a positive analysis of interchange fees, is a useful starting point for a normative analysis.²

2. The model

A transaction that is done using cards costs the issuer c_I and the acquirer c_A . Given perfect competition between issuers and between acquirers, cardholder fees will be $f = c_I - a$ and merchant fees will be $m = c_A + a$, where a is the per-transaction interchange fee paid by acquirers to issuers. When a consumer (buyer) uses a card for a purchase, rather than cash, they are assumed to get a net convenience benefit of b_B , where b_B is continuously distributed over consumers with a positive density $h(b_B)$ over the interval $[\underline{b}_B, \bar{b}_B]$. Consumers have inelastic demand, buying one good from each industry.

We assume each industry is made up of two merchants, which compete according to a Hotelling model of competition. All goods have a cost d and merchants set a single price p .³ Consumers are randomly located in each industry according to the standard ‘linear city’ version of the Hotelling model, and the two merchants are located at the two extremes of the unit interval. Consumers draw an x for each industry from the $U[0, 1]$ distribution, and incur transportation costs of tx if they purchase from firm 1 and $t(1-x)$ if they purchase from firm 2. When a merchant (seller) accepts a card for a purchase, rather than cash, the merchant gets a net convenience benefit of b_S , where b_S is continuously distributed over industries with a positive density $g(b_S)$ over the interval $[\underline{b}_S, \bar{b}_S]$.

Given these assumptions, consumers wish to use cards if and only if $b_B \geq f$. Denote the proportion of consumers who use cards for transactions as D , and the average transactional benefit to these consumers from using cards as β_B . Note that $D = \Pr[b_B \geq f]$ is increasing in a , and $\beta_B = E[b_B | b_B \geq f]$ is decreasing in a . Then it follows from a straightforward modification of the proof of Proposition 1 in Rochet and Tirole,⁴ that merchants will accept cards if and only if:

¹Wright (2003) also relaxes (1) and (2), but in the context of a model of perfect competition between merchants.

²For instance, it is not clear whether policymakers would want to use high interchange fees to subsidize issuing banks, so as to offset the effects of their high markups, even though this may be what is needed to maximize welfare.

³This can be justified by the presence of the no-discrimination rule set by card associations, or by the observation of price coherence—see Frankel (1988).

⁴See Appendix A of Wright (2001) for a proof.

$$b_S \geq b_S^m \equiv m - (\beta_B - f) = c_I + c_A - \beta_B \quad (1)$$

In parallel to the consumer side, the proportion of merchants accepting cards is $S = \Pr[b_S \geq b_S^m]$, and the average transactional benefit to these merchants from accepting cards is $\beta_S = E[b_S | b_S \geq b_S^m]$. Note that b_S^m is increasing in a , S is decreasing in a , and β_S is increasing in a .

3. The welfare maximizing interchange fee

Given the assumption of inelastic consumer demand, total welfare is:

$$W = \int_{f}^{\bar{b}_B} \int_{b_S^m}^{\bar{b}_S} (b_B + b_S - c_I - c_A) g(b_S) h(b_B) db_S db_B \quad (2)$$

Proposition 1. *The welfare maximizing interchange fee equates the merchant fee with the average transactional benefits obtained by merchants that accept cards. It is defined by $a^* = \beta_S - c_A$.*

Proof. The welfare maximizing interchange fee is characterized by:

$$\frac{dW}{da} = (f + \beta_S - c_I - c_A) \frac{dD}{da} S + (b_S^m + \beta_B - c_I - c_A) \frac{dS}{da} D = 0. \quad (3)$$

Substituting (1) into (3), the first order condition simplifies to:

$$\frac{dW}{da} = (\beta_S - c_A - a) h(f) S = 0 \quad (4)$$

which has its solution characterized by:

$$a^* = \beta_S - c_A \quad (5)$$

A sufficient condition for a unique solution to exist is that $d\beta_S/da < 1$. Sufficient conditions to ensure the solution maximizes welfare are $E(b_B) + \bar{b}_S > c_I + c_A$, $\bar{b}_B + E(b_S) > c_I + c_A$, $\underline{b}_B + \bar{b}_S \leq c_I + c_A$, and $\bar{b}_B + \underline{b}_S \leq c_I + c_A$. These rule out the possibility of a boundary solution, whereby welfare could be higher when no merchant accepts cards, when no consumer uses cards, when all consumers use cards, or when all merchants use cards. \square

Welfare is maximized by setting a fee structure so that as many transactions where joint transactional benefits ($b_B + b_S$) exceed joint costs ($c_I + c_A$) take place using cards, and as many transactions where $b_B + b_S < c_I + c_A$ take place using cash. Using a single interchange fee, this objective is best achieved if merchants only accept cards when the sum of their transactional benefit from accepting cards (b_S) and the average transactional benefits of their card paying customers (β_B) exceed joint costs, and if consumers only use cards when the sum of their transactional benefit from using cards (b_B) and the

average transactional benefits from merchants they purchase from which accept cards (β_S) exceed joint costs.⁵

The first condition will be true at any interchange fee in this model, given that merchants, through competition to attract customers, will already internalize the average benefits their card paying customers get from using cards (net of any fees cardholders pay for using cards). This can be seen in (1). At a^* the second condition will also be true. Since consumers face fees of $f = c_1 - a$, absent any interchange fee they will pay issuing costs. At a^* consumers will face the fee $f = c_1 + c_A - \beta_S$, thus they will also face acquiring costs and will internalize the average merchant benefits their card usage generates.

This socially optimal interchange fee has several interesting properties. First, it is straightforward to show that the cardholder and merchant fees implied by this interchange fee also correspond to the fees an unconstrained central planner would choose. At these fees, the card scheme (just) covers its costs, so the fees also correspond to those chosen by a constrained central planner. Second, the socially optimal interchange fee is higher than a naive interpretation of Baxter's optimal interchange fee (a^B) in the face of unobserved merchant heterogeneity. This follows since $a^* = \beta_S - c_A > E(b_S) - c_A = a^B$. Third, given that the merchant fee equals the average transactional benefits that merchants obtain from accepting cards, the average price of goods in the economy will be neither higher nor lower as a result of card acceptance. Cash customers pay more in some industries but less in others. Fourth, if $b_B \sim U[\mu_B - \sigma_B, \mu_B + \sigma_B]$ and $b_S \sim U[\mu_S - \sigma_S, \mu_S + \sigma_S]$, so that consumer and merchant demand is linear in fees, then:

$$a^* = \frac{2(\mu_S + \sigma_S - c_A) - (\mu_B + \sigma_B - c_1)}{3}.$$

Even if costs and benefits of cards are symmetric between the cardholder side and the merchant side of the network, the socially optimal interchange fee will be positive and merchant fees will exceed cardholder fees, reflecting the underlying asymmetry between consumers and merchants. Merchants accept cards, in part, to attract customers from one another. This means that it is efficient, other things equal, to place a greater burden of cost recovery on merchants than on consumers.⁶ Finally, note the socially optimal interchange fee bears little relation to issuing costs.

4. Conclusions

This paper determines the welfare maximizing interchange fee under a different set of assumptions compared to the existing literature. The main finding is that the socially optimal interchange fee

⁵Clearly this implies some inefficient card transactions will take place (where $b_B + b_S < c_1 + c_A$) but it also implies some efficient card transactions will not take place (where $b_B + b_S > c_1 + c_A$). In contrast to the frameworks used by Baxter (1983) and Rochet and Tirole (2002), with a single interchange fee some inefficient transactions are inevitable, reflecting the fact that each different merchant has to make an all-or-nothing acceptance decision.

⁶Intuitively, given symmetry, distortions are minimized when an equal proportion of users on both sides of the network want to make use of the network. This will occur when $b_S^m = f$. Since $b_S^m = m - (\beta_B - f) < m$ this requires that $a > 0$ and $f < m$.

equates the merchant fee with the average transactional benefits obtained by merchants that accept cards, thereby modifying Baxter's original rule. The resulting optimal fee structure between cardholders and merchants tends to favor cardholders, who unlike merchants, will not otherwise internalize the benefits obtained by users on the other side of the card transaction. Despite this, the optimal fee does not distort average retail prices.

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