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ABSTRACT

Cooperation Among Competitors: The Economics of Credit Card Associations*

The paper analyses two controversial features of the credit card industry. The first is the cooperative determination of the interchange fee by member banks in credit card associations (Visa and MasterCard). The interchange fee is the 'access charge' paid by the merchants' banks, the acquirers, to cardholders' banks, the issuers. The second practice is the prohibition for merchants accepting a card from charging different prices depending on the payment method (the no-discrimination or no-cash-discount rule). We analyse these practices in a framework in which banks and merchants may have market power and consumers and merchants decide rationally on whether to buy or accept a credit card. Under the no-cash-discount rule, an increase in the interchange fee increases the usage of credit cards, as long as the interchange fee does not exceed a threshold level at which merchants no longer accept credit cards. At this threshold level, the net cost for merchants of accepting the card is equal to the average cardholder benefit. The interchange fee selected by the credit card association either is socially optimal or leads to an overprovision of credit card services. Last, if the no-cash-discount rule is lifted, the interchange fee no longer impacts the level of credit card services. The merchant price for cardholders is increased and that for non-cardholders decreased. Credit cards services are reduced by merchant price discrimination regardless of whether the interchange fee is set by the credit card association or by a social planner.

JEL Classification: G21, L31, L42
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NON-TECHNICAL SUMMARY

A key feature of payment systems is the existence of strong network externalities. In particular, in a credit card transaction, the consumer's bank, called the issuer, and the merchant's bank, the acquirer, must cooperate in order to finalize the transaction. Two very successful not-for-profit joint ventures, Visa and MasterCard, have designed a set of rules that govern the 'interconnection' between their members.

(1) *Interchange fee*: The acquirer pays a collectively determined interchange fee (the analogue of an access charge in telecommunications) to the issuer.

(2) *Honour-all-cards rule*: once an issuer is accepted in a credit card system, all affiliated merchants must accept the card.

(3) *No-cash-discount (no-discrimination) rule*: affiliated merchants are not allowed to charge lower prices to customers who pay cash.

Although they have not yet been successfully challenged in court, two features of these interconnection rules have recurrently been viewed with suspicion by competition authorities and by some economists. First, the prohibition of cash discounts is sometimes viewed as an attempt by payment card systems to leverage their market power by forcing more card transactions than is efficient. Second, the collective determination of the interchange fee is regarded by some as a potential instrument of collusion: Aren't the banks able to inflate payments to each other and in fact tax merchants and consumers? Shouldn't the access charge be regulated as in telecommunications? Even if one accepts the existence of an interchange fee, one may still be legitimately concerned that it be set too high. At a general level, agreements among competitors can be anti-competitive and one must investigate whether this is indeed the case in our context. For example, a joint venture among competitors whose primary motive is to raise the price on the final good market by overcharging for a common input and redistributing the proceeds among its members is anti-competitive. Similarly, a high reciprocal access charge negotiated between rival telecommunications networks may in some circumstances be anti-competitive. It is tempting to draw an analogy between such situations and that of a collectively chosen interchange fee. As we will see, one should refrain from making such a quick transposition.

This paper analyses the validity of these two concerns. In order to provide a policy analysis, it develops a normative framework of the determination of an efficient interchange fee and of the impact of the no-cash-discount rule. The strength of our approach relative to the previous literature (in particular Baxter

(1983)) is that we endogenize consumer and merchant behaviour. Baxter focuses on the social net benefits to consumers and merchants brought about by the use of credit cards relative to alternative means of payment. While this focus is adequate for a purely normative analysis, it ignores the fact that consumers and merchants are strategic players. A merchant's total benefit, and thus its decision of whether to accept a card depends not only on this technological benefit (fraud control, theft, speed of transactions, customer information collection), but also on the product of its increase in demand due to system membership and its retail mark-up. Similarly, if merchants offer cash discounts, a consumer's decision to use a card depends not only on the technological benefit (convenience, theft and fraud control), but also on the extra charge for using a credit card.

Under the no-cash-discount rule, an increase in the interchange fee increases the usage of credit cards, as long as the interchange fee does not exceed a threshold level at which merchants no longer accept credit cards. At this threshold level, the net cost for merchants of accepting the card is equal to the average cardholder benefit. The interchange fee selected by the credit card association either is socially optimal or leads to an overprovision of credit card services.

Last, if the no-cash-discount rule is lifted, the interchange fee no longer impacts the level of credit card services. The merchant price for cardholders is increased and that for non-cardholders decreased. Credit card services are reduced by merchant price discrimination regardless of whether the interchange fee is set by the credit card association or by a social planner.

1 Introduction

A key feature of payment systems is the existence of strong network externalities. In particular,[1] in a credit card transaction, the consumer's bank, called the issuer, and the merchant's bank, the acquirer, must cooperate in order to finalize the transaction. Two very successful not-for-profit joint ventures, Visa and MasterCard,[2] have designed a set of rules that govern the "interconnection" between their members.

(1) *Interchange fee*: The acquirer pays a collectively determined interchange fee (the analog of an access charge in telecommunications) to the issuer. The issuer guarantees the payment.[3]

(2) *Honor-all-cards rule*: once an issuer is accepted in a credit card system, all affiliated merchants must accept the card.

(3) *No-cash-discount (no-discrimination) rule*: affiliated merchants are not allowed to charge lower prices to customers who pay cash.

Some of these institutional features have gained wide acceptance. The payment guarantee by the issuer can be motivated by a delegated monitoring story. And to see the benefits of a centrally-determined interchange fee cum the honor-all-cards rule, it suffices to envision the complexity of bilateral bargaining among thousands of banks as well as the cost for issuers (respectively, merchants) of informing consumers about the set of merchants (respectively, banks) with whom an agreement has been reached.[4]

In contrast, although they have not yet been successfully challenged in court,[5] two features of these interconnection rules have recurrently been viewed with suspicion by competition authorities and by some economists.[6] First, the prohibition of cash discounts is sometimes viewed

[1]Similar issues arise for ATM (Automatic Teller Machine) transactions.

[2]Visa and MasterCard are each owned jointly by thousands of banks and handle 75 percent of the total volume of general purpose credit card transactions. There also exist "proprietary systems" such as American Express, for which the issuer and the acquirer are necessarily the same firm. We refer to Evans-Schmalensee (1998) for an excellent overview and analysis of the industry.

[3]The interchange fee depends on the fraud-control devices installed at the merchant's premises.

[4]For more on transaction costs, see Evans-Schmalensee (1995, p886, 887 and 890).

[5]See in particular National Bancard Corp. v. Visa USA, Inc. 596 F. Supp 1231 (SD Florida 1984).

[6]E.g., Frankel (1998) and Carlton-Frankel (1995).

as an attempt by payment card systems to leverage their market power by forcing more card transactions than is efficient. Second, the collective determination of the interchange fee is regarded by some as a potential instrument of collusion: Aren't the banks able to inflate payments to each other and in fine tax merchants and consumers? Shouldn't the access charge be regulated as in telecommunications? [7] Even if one accepts the existence of an interchange fee, one may still be legitimately concerned that it be set too high. At a general level, agreements among competitors can be anticompetitive and one must investigate whether this is indeed the case in our context. For example, a joint venture among competitors whose primary motive is to raise the price on the final good market by overcharging for a common input and redistributing the proceeds among its members is anticompetitive. Similarly, a high reciprocal access charge negotiated between rival telecommunications networks may in some circumstances be anticompetitive.[8] It is tempting to draw an analogy between such situations and that of a collectively-chosen interchange fee. As we will see, one should refrain from making such a quick transposition.

This paper analyzes the validity of these two concerns. In order to provide a policy analysis, it develops a normative framework of the determination of an efficient interchange fee and of the impact of the no-cash-discount rule. The strength of our approach relative to the previous literature (in particular Baxter (1983)) reviewed in section 2 is that we endogenize consumer and merchant behavior. Baxter focuses on the social net benefits to consumers and merchants brought about by the use of credit cards relative to alternative means of payment. While this focus is adequate for a purely normative analysis, it ignores the fact that consumers and

[7]It is sometimes argued that the interchange fee is unnecessary and that its existence is evidence of a collective exercise of market power. In a famous US case, NaBanco whose expertise lied principally in recruiting merchants and which was rewarded for this activity by keeping some or all of the merchant discount revenue, argued that it could not compete effectively with Visa members that issue cards to consumers and service merchants and therefore economize on the interchange fee for some of their merchant transactions. NaBanco's argument that the interchange fee was a per se violation of the Sherman Act was rejected by the court. A careful study explaining the mechanisms of the interchange fee is in order, both to study this argument and to build some intuition about the stumbling blocks that an economic regulation of the interchange fee would probably face. In section 6, we show that issuers do not gain from entering the acquiring business and generating "on us" transactions if the acquiring segment is competitive.

[8]See Laffont-Rey-Tirole (1998 a,b) for a formalization of this argument and a number of qualifications to it.

merchants are strategic players. A merchant's total benefit, and thus its decision of whether to accept a card depends not only on this technological benefit (fraud control, theft, speed of transactions, customer information collection,...), but also on the product of its increase in demand due to system membership and its retail markup. Similarly, if merchants offer cash discounts, a consumer's decision to use a card depends not only on the technological benefit (convenience, theft and fraud control,...), but also on the extra charge for using a credit card.

The paper is organized as follows. Section 2 briefly reviews the literature. Section 3 develops the model under the no-discrimination rule. Section 4 compares the interchange fee selected by the credit card association with the socially optimal one. Section 5 analyses the impact of the no-discrimination rule. Section 6 discusses the robustness of the results and provides further policy analysis. Section 7 summarizes the main insights and discusses some topics for future research.

2 Relationship to the literature

Unfortunately, the formal literature on access pricing in the credit card industry is meager. The standard reference is Baxter (1983)'s analysis of a competitive credit card industry. To recapitulate Baxter's argument, let us introduce some notation (summarized in figure 1). The thrust of Baxter's analysis is that a card payment is a service offered to two parties (the cardholder and the merchant) jointly by two other parties (the issuer and the acquirer). The total cost of this service is the sum of the issuer's cost c_1 and the acquirer's cost c_2. Suppose that at a social optimum the benefit accruing to the cardholder for the marginal use of a credit card (that is, the transaction that could, from a social point of view, equivalently be made through an alternative means of payment) is equal to b_1. Similarly, the benefit to the merchant of this marginal use of a credit card is b_2. The benefits b_i and costs c_i referred to above are *net* benefits and costs. The cardholder and the merchant must compare the utilities they get by using credit cards with those associated with alternative payment methods (cash, checks, ...). At the social optimum, the total benefit, $b_1 + b_2$, is equal to total cost, $c_1 + c_2$.

To implement this social optimum, the cardholder must pay a fee f equal to b_1 and the merchant must pay a discount m equal to b_2. But if the cardholder and the merchant are serviced by two different banks, as is usually the case, there is no reason why both banks should break even on the transaction. [While $b_1 + b_2 = c_1 + c_2$, in general $b_1 \neq c_1$ and $b_2 \neq c_2$]. One bank makes a profit and the other makes a loss equal to the former bank's profit. The winning bank must therefore compensate the losing bank for facilitating the provision of the joint service. Baxter's theory says nothing about the sign of the interchange fee, which can be defined as a (positive or negative) transfer $a = b_2 - c_2 = c_1 - b_1$ from the acquirer to the issuer. That is, the transfer flow from the acquirer to the issuer depends on the magnitude of these costs and benefits.

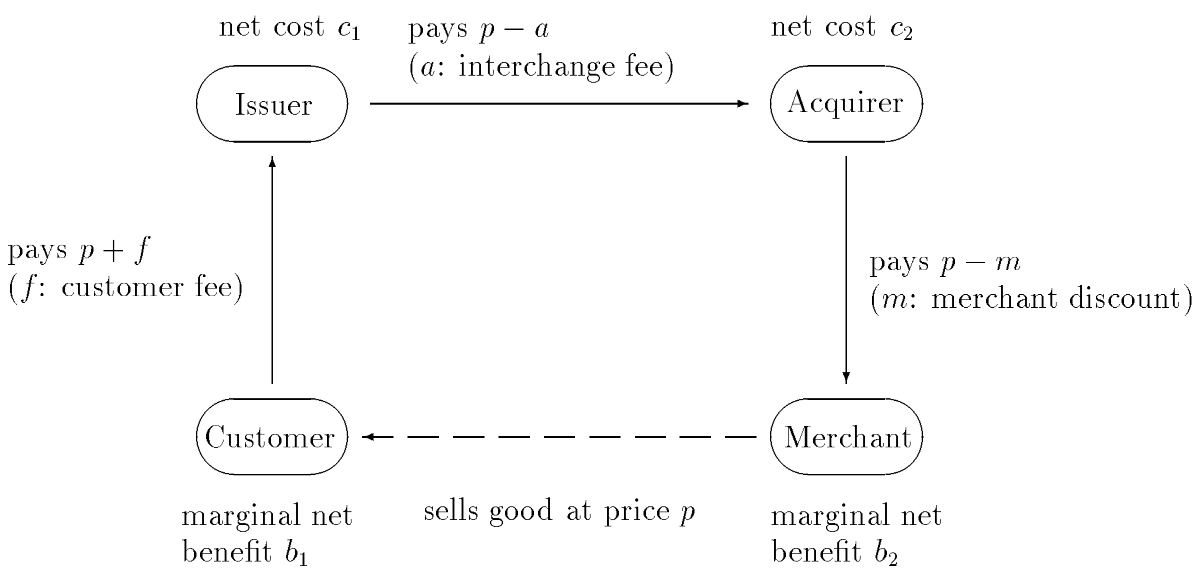

Figure 1

As Schmalensee (1998) notes, Baxter's analysis predicts also nothing concerning the choice of the interchange fee by credit card systems; for, if the perfect competition assumption is to be taken seriously, issuers and acquirers make no profit regardless of the level of the interchange fee. Last, and as we already noted, Baxter's analysis is purely normative and does not investigate whether private incentives coincide with social ones.

Schmalensee (1998), in an analysis complementary to ours, analyzes the provision of credit card services as a moral-hazard-in-teams problem. The number of credit card transactions is a function of the issuers' and the acquirers' efforts, with a complementarity between the two efforts.[9] Each side's effort is bidimensional: marketing effort as well as terms given to the banks' clients (merchant discount for acquirers, customer fee for issuers). The Nash equilibrium of the resulting "second stage" game depends on the interchange fee, which is determined in a first stage through bargaining between issuers and acquirers. Schmalensee solves for the outcome of this two- stage game for an arbitrary allocation of bargaining power (as Schmalensee notes, in the US, banks' voting rights in Visa and MasterCard are more sensitive to issuing volume than to acquiring volume; this suggests that the bargaining power is on the issuing side). Schmalensee argues that there is no support for a public policy of forcing interchange fees to zero.

Our paper, like Schmalensee's, analyzes market power issues. It follows Baxter in its emphasis on the determination of the efficient interchange fee; yet, by departing from Baxter's perfectly competitive paradigm and thus from the banks' indifference as to the level of the interchange fee and by modeling consumer and merchant rational behavior, it allows us to compare the privately optimal interchange fee (the object of Schmalensee's analysis) and the socially optimal one. Furthermore, and because we derive the demand for credit card transactions from individual consumer preferences, we are able to analyze the impact of the no-cash-discount rule, which has not yet been studied in the literature.

3 A model of the credit card industry under the no-discrimination rule

In this section and the next, we assume that the credit card association prohibits merchants from offering discounts to customers paying cash (as Visa and MasterCard currently do). Section 5 looks at the impact of preventing the card association from adopting this policy.

[9]Schmalensee first analyzes the case of a monopoly issuer and a monopoly acquirer. He then generalizes the model to oligopolistic competition on both sides.

Our analysis makes two simplifying assumptions. Although both can easily be relaxed, these two assumptions fit well the credit card industry. First, we assume that acquirers are competitive while issuers have market power. The acquiring side involves little product differentiation as well as low search costs and is widely viewed as highly competitive.[10] In contrast, the issuing side is generally regarded as exhibiting market power. The cause and the extent of market power is highly country-specific. It may be due to innovation[11] or to other factors such as search costs, reputation or the nature of the card. In the model below, we assume that issuers have some market power: The issuing side is not perfectly competitive.

The second simplifying assumption is that customers have a fixed volume of transactions (normalized to one transaction). This implies that there is no difference between a fixed yearly fee and a per transaction customer fee. The analysis of optimal price discrimination and volume discounts offered by issuers is interesting in its own right, but it is somewhat orthogonal to the problem at hand, and we ignore it by assuming a fixed volume of transactions (there is still endogeneity of the volume of *credit card* transactions, though, because consumers may choose not to have a card, or may be unable to use their card if the merchant refuses it).

As in our discussion of Baxter's model, let c_1 and c_2 denote the per transaction cost, incurred by an issuer and an acquirer, respectively. The interchange fee is denoted a and the merchant discount m. The number of transactions per customer is normalized at one; the customer pays a customer fee (yearly or per transaction) equal to f. Last, let b_1 and b_2 denote the customer's and the merchant's (per transaction) benefit from using the card rather than an alternative payment method, say cash.

Consumers: Issuer market power may impact social welfare if issuers cannot perfectly price discriminate. We therefore assume that consumers differ as to their benefit from using a credit card rather than an alternative payment method. For example, some customers have an easy access to cash or a low value of time of going to get cash before shopping while others attach

[10] See, e.g., Evans- Schmalensee (1998, chapter 6).

[11] Attractive frequent user programs, credit facilities, single bill offerings (telephone and credit card for example), corporate card, and so on.

a high value to the convenience afforded by the use of cards. The benefit b_1 is continuously distributed on an interval $[\underline{b}_1, \bar{b}_1]$. The fraction of consumers with benefit less than b_1 is given by the cumulative distribution function $H(b_1)$, with density $h(b_1)$, with a monotone hazard rate ($h/(1-H)$) is increasing) in order to guarantee concavity of the optimization programs. Let

$$E(b_1 \mid b_1 \geq b_1^*) \equiv \frac{\int_{b_1^*}^{\bar{b}_1} b_1 h(b_1) db_1}{1 - H(b_1^*)}$$

denote the expected benefit enjoyed by an average *cardholder* (as opposed to consumers) when consumers with type $b_1 \geq b_1^*$ purchase the card, and those with type $b_1 < b_1^*$ do not.

Issuers: Each issuer has market power over its customers. We further assume in a first step that issuers are not in the acquiring business. In section 6.1 we will observe that due to the competitiveness of the acquiring business, issuers are actually indifferent between entering the acquiring business and staying out at the equilibrium interchange fee (and so they may actually be in the acquiring business after all), and furthermore that they would not benefit from an interchange fee that creates a strict preference for them to enter the acquiring segment..

Assuming that the card is accepted by all merchants (an aspect which we will need to investigate in our equilibrium model), a customer with benefit b_1 and facing customer fee f purchases the card if and only if

$$b_1 \geq f.$$

For expositional simplicity, let us focus on a symmetric oligopolistic equilibrium, in which all issuers in equilibrium charge the same customer fee f. Let $D(f)$ denote the total demand for cards, and $\beta(f)$ the average cardholder benefit. That is

$$D(f) \equiv 1 - H(f),$$

and

$$\beta(f) \equiv E[b_1 \mid b_1 \geq f].$$

The net cost of a transaction for an issuer is equal to the difference between the "technological cost" c_1 and the interchange fee a. Let $f = f^*(a)$ denote the equilibrium customer fee. We make the following very mild assumption:

Assumption A

(i) The oligopolistic equilibrium fee, $f^*(a)$, decreases with the interchange fee. Each member bank's profit increases with the interchange fee.

(ii) The demand for cards, $D(f)$, decreases with the customer fee. The average cardholder benefit, $\beta(f)$, is increasing and bounded.

Let us provide a few examples satisfying Assumption A:

Example 1: Monopoly issuer

A monopolist chooses its fee so as to maximize

$$\Big[f + (a - c_1)\Big]\Big[1 - H(f)\Big]. \tag{1}$$

A simple revealed preference argument shows that this fee is a decreasing function of the interchange fee. That is, a monopoly issuer finds it more costly to restrict the number of credit cards and to exercise its market power if the interchange fee increases.[12] Moreover, from the envelope theorem, the issuer's profit decreases with its net cost, and therefore increases with the interchange fee.

Example 2: Symmetric Cournot oligopoly

Assumption A is satisfied in a symmetric Cournot oligopoly whenever the elasticity of demand exceeds one (Seade 1987).

Example 3: Symmetric differentiated Bertrand oligopoly

With product differentiation, the relevant benefit for the consumer is the intrinsic benefit corrected by the consumer's distance between her brand choice and her ideal specification. Appendix 1 checks Assumption A for the standard Hotelling model of product differentiation.[13]

An analysis focused on the issuing side is incomplete. To understand the impact of the

[12]The reader will here recognize the standard argument that a proportional subsidy to firms with market power reduces the distortion due to excessive margins.

[13]See Vives (1999, exercise VI.10) for an analysis of regularity conditions in a symmetric Bertrand oligopoly with differentiated products and CES demands.

interchange fee, we must perform an equilibrium analysis. For, the interchange fee also impacts the merchant discount, and therefore the merchants' willingness to accept the card. In turn, the customers' willingness to purchase a card depends on the number of merchants accepting it. Last, prices charged by merchants to customers may depend on the interchange fee.

Acquirers: Acquirers face per transaction cost c_2 and are competitive. Thus, for interchange fee a, they offer merchant discount m given by

$$m = a + c_2. \tag{2}$$

Merchants: To study the impact of the interchange fee on final prices and social welfare, we use the standard Hotelling model of the "linear city"[14] (or cities: there may be an arbitrary number of such segments). Consumers are located uniformly along a segment of length equal to 1. Density is unitary along this segment. There are two stores selling the same physical good and located at the two extremes of the segment. Consumers wish to buy one unit and for this transaction must pick a store. They incur transportation cost t per unit of distance. As is usual, this transportation cost is meant to reflect the facts that products or services are differentiated and that different consumers prefer different products. Let d denote each firm's manufacturing/marketing cost (gross of the merchant discount). We normalize d so that it includes transaction costs associated with cash payments. Merchants enjoy benefit b_2 per credit card transaction. We assume that

$$\bar{b}_1 + b_2 > c_1 + c_2. \tag{3}$$

If condition (3) were violated, credit cards would generate no social surplus.

Merchants $i = 1, 2$ set their retail prices (p_1, p_2) noncooperatively as in Hotelling's model. They also decide noncooperatively whether to accept credit cards. We assume that the two decisions are simultaneous. We will observe that sequential decisions (e.g., card acceptance followed by price setting) does not alter the results. Last, for the sake of conciseness, we will

[14] See, eg., Tirole (1988).

focus on "interior solutions". That is, a merchant never corners all consumers of a given type even if he is the only merchant to accept credit cards.[15]

Determination of the interchange fee: We will consider the two cases in which the issuers and a social planner maximizing total surplus choose the interchange fee. Acquirers are indifferent as to the level of this fee.

Timing: The timing is as follows:

Stage 1: The interchange fee is set (either by the issuers or by a central planner).

Stage 2: Issuers set fees for their customers, who elect or not to have a card. The two stores set their retail prices (p_1, p_2) and decide whether to accept credit cards.

Stage 3: Customers observe the retail prices and whether cards are accepted, and pick a store. If the selected store does not accept credit cards or if the consumer does not own a credit card, the consumer must incur his opportunity cost (b_1) of using the alternative payment method; and similarly for the merchant (who has opportunity cost b_2).

4 Socially and privately optimal interchange fees

4.1 Merchant behavior

Let us now analyze the no-discrimination model described in section 3. Let us for the moment take the interchange fee as given. Because $f^*(a)$, the equilibrium customer fee in the oligopolistic issuing market, is a decreasing function of the interchange fee, the average benefit of a *cardholder*, $\beta[f^*(a)]$ is decreasing in a: the higher the interchange fee, the lower the customer fee; and so customers with lower willingness to pay for a card are induced to take a card when the interchange fee increases.

Let

$$m^n(a) \equiv m - b_2 = c_2 + a - b_2$$

denote the net cost (merchant discount minus merchant's benefit) for a merchant of selling to a

[15] This assumption requires that $\bar{b}_1$ not be too large relative to t.

cardholder rather than to a consumer using an alternative payment method. Note that this net cost is a technological cost, and does not embody possible strategic effects of accepting cards in the merchant's competitive environment. And let $\bar{a}$ be uniquely[16] defined by

$$\beta[f^*(\bar{a})] = m^n(\bar{a}). \tag{4}$$

In words, $\bar{a}$ *is the level of the interchange fee at which the net cost to the merchants is equal to the average cardholder benefit* .

Proposition 1 *Under the no-discrimination rule,*

(i) If $a \leq \bar{a}$, all merchants accept the card.

(ii) If $a > \bar{a}$, no merchant accepts the card.

Proof of Proposition 1

(i) Suppose that consumers expect merchants to accept the card. Then issuers charge $f^*(a)$, and the demand for cards is $D(f^*(a))$. Is it indeed optimal for all merchants to accept the card? If this is the case, then a merchant's average cost per customer is $d + D(f^*(a))[c_2 + a - b_2] = d + D(f^*(a))m^n(a)$. As is usual in the Hotelling model, the equilibrium price p^* is the same for both merchants and is equal to the merchants' marginal cost plus the transportation cost:

$$p^* = \Big[d + D(f^*(a))m^n(a)\Big] + t. \tag{5}$$

Each merchant's profit is

$$\pi^* = \frac{t}{2}. \tag{6}$$

Indeed, for given prices (p_i, p^*), merchant i's market share x_i among customers of type b_i is independent of b_i (since a customer pays either cash or with a credit card, independently of the merchant) and is given by

$$p_i + tx_i = p^* + t(1 - x_i),$$

[16]The left-hand side of (4) is decreasing in $\bar{a}$, while the right-hand side is increasing; so there is at most one solution. To prove existence, note that the left-hand side of (4) is bounded, while the right- hand side can take arbitrarily small and arbitrarily large values.

yielding

$$x_i = \frac{1}{2} + \frac{p^* - p_i}{2t}. \tag{7}$$

So, merchant i solves

$$\max_{p_i} \Big\{ [p_i - (d + m^n(a))] x_i \Big\},$$

yielding, at equilibrium, equations (5) and (6).

Suppose now that merchant i deviates from this presumed equilibrium by not taking the card. As we will see, it is then no longer optimal for merchant i to offer the same price p^*, because merchant i offers a lower quality service. Consumers with type $b_1 < f^*(a)$ don't have a card, and are not affected by merchant i's decision. So, merchant i's market share among these customers is still given by (7). In contrast, merchant i's market share is reduced (for a given price) among cardholders. Among cardholders with benefit b_1, this market share is given by

$$p_i + t x_i = p^* + t(1 - x_i) - b_1,$$

or

$$x_i(b_1) = \frac{1}{2} + \frac{p^* - p_i - b_1}{2t} \tag{8}$$

Aggregating over all customers (cardholders and noncardholders), merchant i's market share is

$$x_i = \frac{1}{2} + \frac{p^* - p_i - D\left(f^*(a)\right)\beta\left(f^*(a)\right)}{2t}.$$

On the other hand, merchant i's margin has increased to $(p_i - d)$. So, merchant i solves

$$\max_{p_i} \Big\{ (p_i - d) x_i \Big\},$$

yielding price

$$p_i = \frac{1}{2}\left[p^* + t + d - D\left(f^*(a)\right)\beta\left(f^*(a)\right)\right],$$

and profit

$$\pi_i = \left[1 - \frac{\left[\beta\left(f^*(a)\right) - m^n(a)\right] D\left(f^*(a)\right)}{2t}\right]^2 \frac{t}{2}.$$

Note that $p_i \leq p^*$ as long as $a \leq \bar{a}$. Now, both merchants' accepting the card is an equilibrium if and only if $\pi_i \leq \pi^*$, or

$$m^n(a) \leq \beta\left(f^*(a)\right),$$

i.e.,

$$a \leq \bar{a}.$$

(ii) Let us now show that if $a > \bar{a}$, it is an equilibrium for both merchants to refuse the card even if customers $b_1 \geq f^*(a)$ (foolishly) expect the card to be accepted and buy the card. If both merchants refuse the card, the Hotelling equilibrium price is again marginal cost plus transportation cost:

$$p^{**} = d + t,$$

and the profit is the same as when they both accept the card:

$$\pi^{**} = \pi^* = \frac{t}{2}.$$

Simple computations show that a merchant gains from accepting the card (and raising its retail price) if and only if

$$a \leq \bar{a}.$$

So, for $a > \bar{a}$, it is an equilibrium for both merchants to refuse the card.

(iii) Last, Appendix 2 shows that this equilibrium is unique: There is no mixed equilibrium where only one merchant accepts the card. ■

4.2 Determination of the interchange fee

Suppose first that issuers choose the interchange fee. Because the issuers' profit is increasing in a, and from proposition 1, the optimal interchange fee for the issuers is the highest level that is consistent with the merchants' accepting the card, namely $a = \bar{a}$; corresponding to a customer fee

$$f = f^*(\bar{a}). \tag{9}$$

Suppose that a benevolent and omniscient social planner selects the interchange fee. Ignoring the constraint that the merchants must accept the card, at the (Baxter) socially optimal interchange fee, the total cost and benefit of the marginal transaction are equal, or

$$f = c_1 + c_2 - b_2.$$

We are thus led to consider two cases:

(i) $c_1 + c_2 - b_2 \leq f^*(\bar{a})$.

In this case, the socially optimal provision of credit cards requires a low customer fee, which can be obtained only through an interchange fee that exceeds the level at which merchants accept the card. The socially optimal interchange fee is then equal to $\bar{a}$ and thus coincides with the issuers' preferred interchange fee.

(ii) $c_1 + c_2 - b_2 > f^*(\bar{a})$.

In this case, the socially optimal interchange fee is smaller than the issuers' preferred interchange fee. This means that a credit card association controlled by issuers selects an interchange fee that leads to an *overprovision* of credit card services.

Proposition 2 *Under the no-discrimination rule, the issuer's preferred interchange fee is equal to* $\bar{a}$*.*

(i) If $c_1 + c_2 - b_2 \leq f^*(\bar{a})$*, then the socially optimal interchange fee is equal to the issuers' preferred interchange fee.*

(ii) If $c_1 + c_2 - b_2 > f^*(\bar{a})$*, the interchange fee set by a credit card association controlled by issuers leads to an overprovision of credit card services.*

Example: Let us consider a monopoly issuer and assume that the demand for credit cards is linear: That is, b_1 is uniformly distributed on $[\underline{b}_1, \bar{b}_1]$:

$$1 - H(b_1) = \frac{\bar{b}_1 - b_1}{\bar{b}_1 - \underline{b}_1}.$$

Then

$$f^*(a) = \frac{1}{2}(\bar{b}_1 + c_1 - a),$$

and

$$E[b_1 \mid b_1 \geq f^*(a)] = \frac{1}{2}\left[f^*(a) + \bar{b}_1\right]$$

$$= \frac{1}{4}\left[3\bar{b}_1 + c_1 - a\right].$$

$\bar{a}$ is defined by

$$c_2 + \bar{a} - b_2 = \frac{1}{4}\left[3\bar{b}_1 + c_1 - \bar{a}\right],$$

or

$$\bar{a} = \frac{1}{5}\left[3\bar{b}_1 + c_1 - 4c_2 + 4b_2\right].$$

Therefore,

$$f^*(\bar{a}) = \frac{1}{5}\left[\bar{b}_1 + 2c_1 - 2c_2 - 2b_2\right].$$

The condition for overprovision,

$$f^*(\bar{a}) < c_1 + c_2 - b_2,$$

is thus equivalent to

$$c_1 + c_2 - b_2 > \frac{\bar{b}_1}{3},$$

a condition that is compatible with the condition that credit cards generate social benefits:

$$c_1 + c_2 - b_2 < \bar{b}_1.$$

Thus, for a monopoly facing a linear demand curve, the two cases envisioned in proposition 2 are possible.[17]

5 Cash discounts and the no-discrimination rule

Let us now investigate the implications of lifting the no-discrimination rule. For concreteness, let "cash" be the alternative method of payment. We now show that allowing cash discounts may reduce social welfare. In essence, cash discounts raise the cost of credit cards and may lead to a suboptimal diffusion of that means of payments.

When merchants are allowed to apply cash discounts, their accepting the card is no longer an issue, since they can charge a price for credit card transactions at least equal to the cash price plus their cost of credit card transactions.[18]

With cash discounts, merchants de facto compete on two segmented markets: that of consumers holding no card and that of cardholders. Let p^*_{cash} and p^*_{card} denote the two prices

[17]In the alternative case of a demand with constant elasticity, it turns out that the first case is impossible: There is always overprovision of cards.

[18]In our model, merchants face no fixed cost of accepting credit cards. If they did (and that cost were not subsidized by credit card associations), then they might refuse credit cards for a high enough merchant discount.

quoted by the merchants. These prices follow the Hotelling rule (price equals marginal cost plus the differentiation parameter):

$$
\begin{aligned}
p^*_{\text{cash}} &= d + t \\
p^*_{\text{card}} &= \Big[d + (m - b_2)\Big] + t.
\end{aligned} \tag{10}
$$

Note that[19] $p^*_{\text{card}} > p^* > p^*_{\text{cash}}$, where p^* is the no-discrimination price given by (5). The no-discrimination rule leads, as one would expect, to a redistribution towards cardholders.

For customer fee f, a consumer purchases a card if and only if

$$b_1 \geq f + [p^*_{\text{card}} - p^*_{\text{cash}}] = f + a + c_2 - b_2.$$

The key insight is that *the diffusion of credit cards can no longer be influenced by the interchange fee, since the interchange fee is entirely passed through by merchants to cardholders.* To see this, let

$$\tilde{f} \equiv f + a + c_2 - b_2.$$

Then the issuers' margin $\tilde{f} + b_2 - c_1 - c_2$ and the demand for cards $D(\tilde{f})$ do not depend on a. Thus, at equilibrium, $\tilde{f}$ and market penetration, $D(\tilde{f})$, are independent of the interchange fee.

Last, we compare credit card diffusion and social welfare under the no- discrimination rule and under cash discounts. There are more cardholders under the no-discrimination rule if and only if the net cost of a cardholder for an issuer is smaller under the no discrimination rule:

$$a - c_1 \geq b_2 - c_1 - c_2,$$

or

$$a \geq b_2 - c_2. \tag{11}$$

Condition (11) is satisfied for the privately optimal interchange fee $\bar{a}$, since $\bar{a} + c_2 - b_2 = m^n(\bar{a}) > 0$. It is also satisfied for the socially optimal interchange fee. This is obvious in case (i) of proposition 2 since the privately and socially optimal interchange fees then coincide. In

[19] This is because $m^n(a) = m - b_2 > 0$.

case (ii) of proposition 2, $f = c_1 + c_2 - b_2$, and so the issuers' margin, $f + (a - c_1)$, is equal to $a + c_2 - b_2$. If condition (11) were violated, then the issuers' margin and profit would be negative, which is impossible.

We thus conclude that cash discounts inhibit the diffusion of credit cards. Intuitively, price discrimination reduces the demand for credit cards. Issuers with market power then have an incentive to focus on the high end of the market rather than attract customers who anyway are not willing to pay much given that they will pay a second premium (beyond the annual fee) when they get to the store.

We summarize the analysis of this section in

Proposition 3

(i) For a given interchange fee, allowing cash discounts raises the merchant price for cardholders and lowers it for noncardholders.

(ii) Regardless of whether the interchange fee is set by the credit card association or a social planner: lifting the no-discrimination rule reduces the number of cards issued.

6 Discussion

6.1 Robustness

Let us discuss the robustness of the results to our simplifying assumptions.

Non-Hotelling competition between merchants. The Hotelling assumption (and the absence of cornering by a merchant on some consumer segment) is convenient because it yields linear demands. More general consumer demands for retail goods could be allowed; for example, with nonuniform distributions over the Hotelling interval, in the definition of the threshold level $\bar{a}$, the average cardholder benefit would be replaced by a weighted average cardholder benefit. The expressions would be more complex, but the qualitative results unchanged. The assumption of an inelastic demand for retail goods, which may be reasonable in a first step analysis, implies that a higher interchange fee impacts only the diffusion of credit cards. With a downward sloping demand for retail goods, the merchants discount would also affect the retail price; thus, the optimal interchange fee for the association might lead to an underprovision of the retail good. This however would not affect proposition 2, as the level of credit card services would remain either socially optimal or excessive.

Vertical integration. As we already noted if the acquiring business is competitive, there is no strict incentive for an issuer to integrate with an acquirer. Suppose indeed that an issuer merges with an acquirer (or enters the acquiring business) and sets merchant discount m'. The per cardholder profit of the integrated bank corresponding to its cardholders' transactions is:

$$B = (1-\alpha)(f+a-c_1)[1-H(f)] + \alpha(f+m'-c_1-c_2)[1-H(f)],$$

where α is A's share in the acquiring market. That is, a fraction α of the bank's cardholders' transactions is "on us" transactions. Since the acquiring market is perfectly competitive, α can be positive only if:

$$m' \leq m = a + c_2.$$

Then

$$B \leq (f+a-c_1)[1-H(f)].$$

Furthermore, and because $m' \leq a + c_2$, the bank makes no money or loses money on the transactions of cardholders of other banks who transact with the merchants it has signed up. Thus $(f+a-c_1)[1-H(f)]$ is indeed an upper bound on the integrated issuer's profit. The issuer thus does not gain from operating in the acquiring business.[20]

Acquirer market power. The analysis needs to be modified if there is market power on the

[20]The reader may be concerned that the conclusion follows only in the case in which the issuers are (local) monopolies. In principle, there might be strategic effects that could induce the issuing bank to raise its cost of issuing cards by losing money on the acquiring side in order to soften competition in the issuing market. It can be checked this is not so in the Bertrand and Cournot illustrations given in this paper. In the differentiated Bertrand oligopoly model of Appendix 1, the demand for cards is fixed (as long as the equilibrium merchant discount does not exceed $\bar{a}+c_2$ and so there is a credit card market). Even though the issuer loses money on its acquiring transactions, it cannot reduce this loss by losing customers on the issuing side since customers then go to another issuer and still use a card. So, even though the issuer has a higher cost, its opportunity cost of issuing cards is unaffected and there is no strategic effect. In contrast, there is a strategic effect in the Cournot case; however, this effect goes the wrong way for the integrated issuer. In the Cournot model, the integrated issuer reduces its output if it loses money per transaction on the acquiring side. But this induces other issuers to increase their own output, resulting in a further loss for the integrated issuer. We thus conclude that in either model of strategic competition, vertical integration does not increase profit.

acquiring side as well. First, because acquirers now care about the interchange fee, one needs to consider, as Schmalensee (1998) does, the relative strength of issuers and acquirers within the credit card associations. To some extent, the two groups have conflicting interests with acquirers in favor of a lower interchange fee than the issuers' preferred level. Furthermore, there is now some incentive for vertical integration, so as to partly eliminate the double marginalization in the provision of credit card services. Second, and from a social point of view, the interchange fee must reduce two distorsions: it must be high in order to subsidize issuers and low so as to subsidize acquirers; a single instrument cannot achieve these two conflicting goals. Furthermore, as Schmalensee (1998) emphasizes, providing proper incentives to both sides in this "moral-hazard-in-teams" problem would require outside funding at the margin. The methodology developed in this paper could be used to analyze the welfare consequences of two-sided market power, but we leave this to future research.

Distortions in the provision of alternative payment methods. Our welfare analysis has implicitly assumed that the competing payment methods are efficiently supplied. As is usual, distortions in the provision of the alternative means of payment would lead to a second best situation, in which the interchange fee and the no-discrimination rule should be also assessed in the light of their impact on the alternative means of payment. Of particular interest here are the legal restrictions that exist in some countries on customer charges for checkwriting and the absence of interchange fees for checks,[21] as well as the provision of cash through Automatic Teller Machines (ATMs) which involves a cooperative determination of interchange fees similar to that considered here. Our model can be used as a building block for this broader question, which, again, we leave for future research.

6.2 Further policy implications

Our analysis casts some doubt on three widely held views about the credit card industry: that the cooperative determination of the interchange fee is necessarily welfare-reducing, that it

[21] Mc Andrews (1997) studies the interaction between the interchange fee for cards and the use of checks, which are submitted to a direct presentment regulation. He argues that if this regulation were lifted, banks would probably negotiate the introduction of an interchange fee for checks.

may lead to an underprovision of credit card services, and that the no-discrimination rule is a welfare-reducing anticompetitive practice. We also have provided some insights about the nature of distortions when these exist.

We should add some note of caution concerning the use of regulation in this industry. First, even when the interchange fee is not set optimally by the association, it should be noted that the optimal interchange fee is neither zero as is often suggested, nor marginal cost ($a = c_1$), as is often proposed in other industries.[22] Second, and from a more practical point of view, cost-based regulation in the credit card industry would most likely not be based on a proper measurement cost, for at least four reasons. First, the industry has no regulatory agency with the staff and expertise to collect detailed information for cost measurement. Second, the notion of marginal cost is complex and cannot be directly recovered from a bank's account.[23] Third, and as in other industries, the allocation of joint and common costs is somewhat arbitrary and, relatedly, is likely to be the object of pressure by interest groups. Fourth, the service offered by issuers changes over time, and some costs can be shifted to and from acquirers and merchants (e.g., fraud control). The same impediments would seem to apply to more sophisticated regulations that would try to make use of data on both the issuer and acquirer sides in order to better fit the theoretical recommendations.

[22]See, e.g., Laffont-Tirole (1998) for an overview of theoretical and policy approaches in the telecommunications industry.

[23]A credit card service is a multidimensional object. It involves the transaction function (as for a debit card) as well as a line of credit defined by an interest rate, a grace period, a credit limit and other terms, and finally some rebates and ancillary services (collision damage waivers, frequent flyer miles, telephone calls discounts, insurance against theft, etc.). It is therefore difficult to recover the cost, say of the transaction function and of the payment guarantee function in the overall accounts. This problem arises with a vengeance when the issuer does not operate on a stand-alone basis, but also provides other banking services to the cardholder. For example, personal bankruptcy by the cardholder is a global concept and the cost of monitoring the cardholder's creditworthiness can hardly be split among the various activities (checkwriting, mortgage reimbursement, credit card use, etc.) that may lead to personal bankruptcy.

A second difficulty with the measurement of cost results from the fact that the relevant costs are net costs. For instance, a card holder will pay by check or cash if he does not use his credit card. If for some (regulatory or other) reason, the use by the cardholder of a check or ATM machines is mispriced, the net cost for the cardholder's bank differs from the simple cost of the transaction using the card.

7 Summary and research agenda

The paper has analyzed two controversial features of the credit card industry: the cooperative determination of the interchange fee and the no-discrimination rule. It has developed a framework in which banks and merchants may have market power and consumers and merchants decide rationally on whether to buy or accept a credit card.

Under the no-cash-discount rule, an increase in the interchange fee increases the usage of credit cards, as long as the interchange fee does not exceed a threshold level at which merchants no longer accept credit cards. At this threshold level, the net cost for merchants of accepting the card is equal to the average cardholder benefit. The interchange fee selected by the credit card association either is socially optimal or leads to an overprovision of credit card services.

Last, if the no-cash-discount rule is lifted, the interchange fee no longer impacts the level of credit card services. The merchant price for cardholders is increased and that for noncardholders decreased. Credit card services are reduced by merchant price discrimination regardless of whether the interchange fee is set by the credit card association or by a social planner.

The credit card industry has received scant theoretical attention, and it won't come as a surprise to the reader that more research is warranted. We argued in section 6 that the framework developed here can be used as a building block to analyze more general situations with acquirer market power and distorted competing means of payments. The credit card industry offers many other fascinating topics for theoretical and empirical investigation, such as the impact of duality,[24] the governance of credit card associations, the competition between associations and proprietary systems, and the development of E-commerce. We leave these topics and others for future research.

[24]Duality refers to the fact that banks can (and usually do) belong to both Visa and Mastercard. See Hausman et al (1999) for a start on the analysis of duality.

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Appendix : Modeling the issuing market as a differentiated Bertrand oligopoly

For the reader's convenience, we have not modeled explicitly in the text the imperfect competition between issuers. In this appendix, we give an example of a differentiated oligopoly model of the issuing market where we compute explicitly the demand for cards $D(f)$ and the average cardholder benefit $\beta(f)$.

Let us consider the case of a duopoly where two banks, $i = 1, 2$, issue each a different card. Consumers perceive these cards as differentiated products as in Hotelling's "transportation cost" model. The two banks are located at the two extremes of a line of length one, on which consumers are located uniformly. The "net" benefit b of a cardholder located in y equals the difference between a "gross" benefit $\tilde{b}$ and a "transportation cost" τy (if he goes to bank 1) or $\tau(1-y)$ (if he goes to bank 2). This "transportation cost" is associated to card usage.[25] For example, some consumers have more use than others for American Airlines frequent flyer miles.

For a given statistical distribution of gross benefits in the population, one can compute the (symmetric) equilibrium on the issuing market, the demand for cards and the average (net) benefit of cardholders. For example, if $\tilde{b}$ is uniformly distributed on $[0, 1]$ and f represents the equilibrium customer fee, we easily obtain the (total) demand for cards:

$$D(f) = 2\int_0^{1/2} (1 - f - \tau y)dy = 1 - \frac{\tau}{4} - f,$$

and the average (net) benefit for cardholders

$$\begin{aligned} \beta(f) &= \frac{2}{D(f)} \int_0^{1/2} \int_{f+\tau y}^{1} (\tilde{b} - \tau y) d\tilde{b} dy \\ &= \frac{1}{2D(f)} \left[1 - \frac{\tau}{2} + \frac{\tau^2}{12} - f^2 \right]. \end{aligned}$$

$\beta(f)$ is increasing in f. Note also that the distribution $H(\cdot)$ referred to in the text corresponds to the convoluted distribution, namely the distribution of the *net* benefit.

[25] Our welfare analysis would be modified if the "transportation cost" were associated purely to holding the card. In this case, the welfare analysis would still depend on $\beta(a)$ (which is based on *net* benefits) but the merchants ' decision to accept cards or not would depend on the average *gross* benefit of cardholders.

Appendix 2: There is no mixed equilibrium in the merchants game

Suppose that only merchant 1 accepts the card. Denoting by p_1 and p_2 the two retail prices, merchant 1's market share, x_1, is given by

$$x_1 = \frac{1}{2} + \frac{p_2 - p_1 + \hat{\beta}(a)[1 - H(f^*(a))]}{2t}$$

where $\hat{\beta}(a) = E[b_1 \mid b_1 \geq f^*(a)]$. The two merchants solve, respectively:

$$\pi_1 = \max_{p_1} \{[p_1 - d - m^n(a)(1 - H(f^*(a)))]\, x_1\},$$

and

$$\pi_2 = \max_{p_2} \{(p_2 - d)(1 - x_1)\}.$$

We obtain:

$$p_1 = \frac{1}{2}\left\{d + t + p_2 + [1 - H(f^*(a))](\hat{\beta}(a) + m^n(a))\right\}$$

and

$$p_2 = \frac{1}{2}\left\{d + t + p_1 - [1 - H(f^*(a))]\hat{\beta}(a)\right\}.$$

If there is such an equilibrium, it is characterized by prices and profits given by:

$$\begin{aligned}
p_1^* &= d + t + \frac{1}{3}[1 - H(f^*(a))][2m^n(a) + \hat{\beta}(a)], \\
p_2^* &= d + t + \frac{1}{3}[1 - H(f^*(a))][m^n(a) - \hat{\beta}(a)], \\
\pi_1^* &= \frac{1}{2t}\left\{t + \frac{[1 - H(f^*(a))]}{3}\left[\hat{\beta}(a) - m^n(a)\right]\right\}^2, \\
\pi_2^* &= \frac{1}{2t}\left\{t - \frac{[1 - H(f^*(a))]}{3}\left(\hat{\beta}(a) - m^n(a)\right)\right\}^2.
\end{aligned}$$

Consider the case where $a < \bar{a}$, which means that $m^n(a) < \hat{\beta}(a)$. Then merchant 1 can increase his profit by refusing the card. Indeed, in this case his optimal price is

$$p_1^{**} = \frac{1}{2}\{d + t + p_2^*\} = d + t + \frac{1}{6}[1 - H(f^*(a))][m^n(a) - \hat{\beta}(a)]$$

and his profit becomes

$$\pi_1^{**} = \frac{1}{2t}\left\{t + \frac{[1 - H(f^*(a))]}{6}[m^n(a) - \hat{\beta}(a)]\right\}^2.$$

Since $m^n(a) < \hat{\beta}(a)$, this is smaller than π_1^*: The above situation is not an equilibrium. It is easy to see that when $a > \bar{a}$ (and therefore $m^n(a) > \hat{\beta}(a)$) the second merchant benefits from accepting the card. We thus conclude that there exists no mixed equilibrium.

More generally, it can be shown that, once one solves for equilibrium prices, a merchant accepts the card if and only if $a \leq \bar{a}$, regardless of whether the other merchant accepts the card. This property in particular implies that our results would still hold if the merchants chose sequentially, rather than simultaneously, whether to accept the card.