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Optimal Payment Cards Fees

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Abstract

Credit card rebates, which are paid to all credit card users regardless of borrowing, have grown substantially. This paper analyzes this phenomenon by comparing the socially and privately optimal interchange fees in debit and credit cards. Compared to debit cards, credit cards raise efficiency by allowing convenient borrowing, but also tax nonholders in order to finance the rebates paid to credit card users. A welfare enhancing and legally feasible policy is suggested, under which the regressive tax is cancelled while the efficiencies of credit cards are preserved. An outcome of the proposed policy is that credit cards are used for credit purposes only, while debit cards are used as a convenient payment instrument.

1 Introduction

In the past few years, the use of credit and debit cards has been growing rapidly and reached a market size of around 3 trillion dollars a year in the United States. The payment card market is a two sided market, characterized by interchange fees (IFs) which are set by the card association and paid by acquirers to issuers that belong to the same network (figure 1).[1] The collective determination of IFs constitutes a price fixing agreement, and its necessity comes from the (arguable) impracticality of numerous bilateral negotiations between every acquirer and every issuer. Why should one care about an agreement between two banks, i.e. the issuer and the acquirer? While IFs are not of direct interest, the IF constitutes a lower bound for the commission paid by sellers (p_s in figure 1).

Several characteristics of the credit card market are unusual. First, although named 'credit cards', credit cards are used by many for reasons of convenience rather than as a device for obtaining credit easily. Rebates, an interest free period and other benefits received by credit card holders in the United States are high compared to other countries, growing over time, and are not limited to borrowing consumers who generate profits to card issuers. Second, credit card IFs are higher in the United States than those in other countries. Moreover,

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[1] Acquirers (or merchants' banks) transfer payments from all issuers to the seller. Therefore, the seller does not need to contract with every issuer separately: by contracting with one acquirer, the seller is able to accept credit cards of all issuers within the network.

Card Association (e.g. Visa)

1 Sets IF

Issuer

Pays p- IF 3

Acquirer

3
Pays p-p_b

3
Pays p –p_s

Buyer
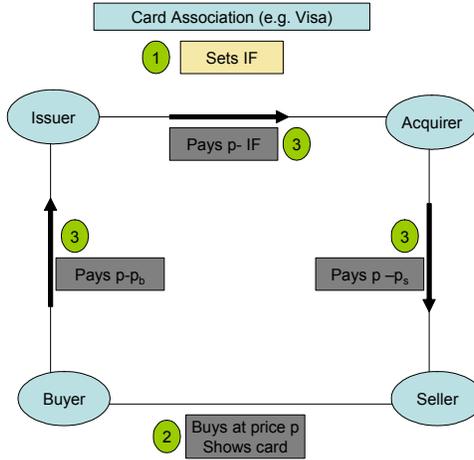
2 Buys at price p
Shows card

Seller

Figure 1: Interchange fees

even though technological advances (which reduce costs) and higher competition between card networks are observed features of the market, IFs keep increasing. Third, IFs and sellers fees of credit cards are substantially higher than those of debit cards.[2] Despite this, and although merchants claim that their fees exceed their transactional benefits of accepting credit cards, most merchants keep accepting credit cards. In particular, very few merchants accept only debit cards and not credit cards.

Theoretically, payments received by credit card holders may be the holders' share of credit cards efficiency gains. Alternatively, issuers may offer high rebates to increase spending and the use of costly loans. These explanations, however, do not seem to account for the high rebates observed. As is argued in section 2, efficiency gains are minor. If loans were in fact a crucial factor, then one would expect rebates to be contingent on borrowing (rather than paid to all cardholders); and, rebates should be awarded whenever the card is used, while in fact they exist only when sellers pay a commission (and therefore cash advances do not entitle cardholders to rebates). In any case, one should wonder whether these bilateral arrangements adversely affect other players in the market.

Intuition. The following example illustrates the mechanism considered in this paper. Suppose that the population is equally divided between left handed and right handed consumers, with inelastic demand. Firm 'Lefty' starts to print

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[2]For example, the IFs for a $100 supermarket transaction as of April 2005 are:

- MasterCard: $0.85 for debit vs. $1.32 for credit, a 55% difference.

- Visa- $0.75 for debit vs. $1.20 for credit, a 60% difference.

For non supermarket (or higher value) transactions, fees and differences are higher.

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blue money notes and distributes them among left handed people in exchange for the regular green notes, promising to pay a 10% rebate to those who pay with blue notes rather than with green notes. Firm Lefty also comes to an agreement with all sellers in the market, according to which it will replace all the blue notes that they accept with green notes, and charge a commission of 10% for this service.

Competitive sellers are willing to pay 10%, blue money's value of consumers, for the right to accept blue notes. *If sellers do not charge users of green and blue money different prices*, then their average marginal costs increase by 5% and so will their prices. Firm Lefty does not earn or lose money, since it sells blue money to the left handed and buys it back from sellers for the same discounted price. All buyers suffer a price increase of 5%, but only the left handed are allowed to use blue money and earn 10% as a rebate. Therefore, the new form of money (blue notes) has no technological advantage over the existing money, and only redistributes wealth.

The analysis in the paper follows this example. Credit and debit cards replace blue and green money, respectively; and only some (in particular, richer) consumers are allowed to use credit cards. The last ingredient of our example, uniform pricing for different payment tools, is widely observed.[3] In some countries, sellers are prohibited by card associations from charging different prices. In other countries (such as several U.S. states) cash discounts are allowed even though surcharges are not, yet cash discounts are rarely seen.[4] Even in countries where any form of price discrimination is allowed, different prices are rarely seen in practice.[5] Eilat (2006) investigates why uniform pricing arises even with cost and demand differences.

Credit cards, then, redistribute wealth regressively. Low income consumers cannot receive credit cards, or have binding limits. Higher income credit card holders enjoy the benefits of using credit cards, financed by a general price increase. Given the fact that credit cards are accepted essentially everywhere, this regressive tax cannot be avoided by non-holders. Given the value of payment card transactions- around 3 trillion dollars a year in the U.S, and constantly growing- issues concerning IFs are significant.

Related Literature and Legal Cases. The unique features of the pay-

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[3]Price differences based on the payment instrument used may be expected in a competitive environment, and make most of the discussion about IFs redundant (Gans and King (2003)). Some suggestions in the literature for the uniform pricing observed: transaction costs (Rochet 2003), confusion of consumers, mental costs of consumers (Hayashi 2004), customer dissatisfaction (Alan Frankel) and consumer resistance (Hayashi, Sullivan and Weiner (2003)), regulatory barriers (Edmund Kitch), bookkeeping costs and loss of goodwill (Evans and Schmalensee (1995)).

[4]In the U.S, a federal law from 1975 has permitted merchants to offer cash discounts. Yet, In 1983, less than 10 percent of retailers in the U.S. offered cash discounts. Most of this activity occurred at gas stations and even this became less common. Evans and Schmalensee (1999) document the decline in cash discounts.

[5]Examples are Australia, Netherlands, Sweden, Israel and the United Kingdom. For example, Sweden and the Netherlands banned no-surcharge rules during the 1990s, but less than 10 percent of retailers report surcharging their customers and there has been little change in the merchant discount (Hunt 2003).

ment card market have attracted the attention of many economists. The fact that the setting of IFs constitutes a price fixing agreement and is therefore subject to a regulatory intervention just adds to the attractiveness of IFs as a research topic. Most studies quoted below have compared payment cards and cash, rather than credit and debit cards.

Australia: A long study that had been started in 2000 by the Reserve Bank of Australia (RBA) concluded that IFs are above cost-based levels and raise costs for consumers paying by cash or check. The RBA presented a plan that significantly reduced IFs. Other countries that have regulated IFs are *Israel, Mexico* and *Spain*.

Europe: In 2000, the European Commission reached a preliminary determination that Visa's IFs violated European competition laws against collective price setting. In 2002, the European Commission announced Visa's agreement to lower its (cross border) IFs and rely on certain cost-based benchmarks for determining its IFs. In 2003, the European Commission announced that it sent a confidential statement of objections to MasterCard citing concerns about the association's IF levels and lack of transparency in pricing.

U.S.A: In the United States, there has not been a regulatory intervention in IFs. In October 1996, Wal-Mart and other retailers sued Visa and MasterCard in a suit later certified as a class action suit of over four million merchants. In 2003, MasterCard and Visa settled the case ahead of trial. The settlement stopped a tying practice which forced credit-card-accepting sellers to accept debit cards as well ('honor all cards rule'), lowered IFs substantially (by around 30%) for a period of time, and resulted in a compensation of 3.4 billion dollars to retailers (the largest compensation in antitrust history).

We will now review theoretical contributions most closely related to this paper.

Rochet and Tirole (2002) were the first to theoretically analyze the behavior of all market participants. They compare cash and payment cards, and study optimal IFs under one price rules using a Hotelling framework. An insight of their model is the importance of competitive considerations (rather than a 'transactional' benefit-cost comparison) in the decision of accepting cards.[6] Rochet and Tirole, as well as Wright, Schmalensee, and others, study the same general framework under varying assumptions (such as the competitiveness of sellers). The main limit of the current literature is the dependence of the results on parameter values which represent the relative efficiency of cash vs. card payments. Since those parameter values are heterogeneous across industries, sellers, and buyers, no robust conclusions may be reached regarding the difference between privately set and socially optimal IFs. To illustrate this point, suppose sellers have a high benefit of accepting cards rather than cash, while consumers slightly prefer cash. In the absence of different prices for cash and cards, an IF

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[6]Similar models in this respect are Chakravorti and To (2003) and Wright (2003b). Many models assume that merchants accept cards if and only if their transactional benefits exceed their fees: Baxter (1983), Schmalensee (2002), Bolt and Tieman (2003), and Wright (2003a, 2004). Other works make the opposite assumption, i.e. that merchants accept cards regardless of fees: Frankel (1998), Gans and King (2002), Katz (2001), and Schwartz and Vincent (2003).

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can be used to indirectly transfer money from sellers to consumers, encouraging consumers to use cards and raising social welfare. Market prices may decrease in this case, since sellers save money by accepting cards. Whether the IF set by the association is different from the socially optimal IF depends on parameter values; and since one cannot point out any persistent gap between socially and privately optimal IFs, IFs should not be regulated (e.g. Schmalensee (2003)).

It seems, therefore, that there is a disagreement between regulators and the economic literature: while many regulators agree that privately set IFs are too high, no theoretical model shows robustly that the regulation of IFs generally raises welfare. Comparing between debit and credit cards has two advantages. First, the debit-credit comparison is absent from the literature, as most works compare between cash and credit cards.[7] Second, many costs and benefits are identical for debit and credit cards, which spares the analysis from dependence on parameter values.

Organization of the paper. The rest of the paper is organized as follows. Section 2 explains the difference between a cash-card comparison and a debit-credit comparison. Section 3 presents a model of debit and credit cards with monopolistic sellers. Section 4 provides an analysis and policy suggestions. Section 5 discusses richer demand formations and considers other models of competition. In particular, it is shown that the results for monopolistic sellers carry over to a competitive Hotelling model, similar in spirit to that used by Rochet and Tirole (2002). A conclusion follows. All proofs are relegated to the appendix.

2   A Debit vs. Credit Comparison

As noted in section 1, the main limitation of a cash-card comparison is the failure to identify the relative cost of the card-acceptance service. Card-accepting sellers pay a fee but may have extra benefits, such as a payment guarantee and savings on cash handling costs. Whether the net cost of accepting cards is positive is an empirical question. Seemingly, the same limitations of the cash-card comparison are relevant in the debit-credit comparison: debit and credit cards present market participants with different costs and benefits. For instance, sellers pay different fees and receive payments from acquirers at a different timing, buyers receive different rebates and benefits, and issuers have different fraud liability policies.

The solution to this problem is a distinction between **costs and benefits**, which follow from the *technology* of cards; and **payments**, which represent all *transfers and risk sharing* agreements between agents and are determined endogenously in the model. In both debit and credit card transactions money

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[7] For example Katz (2001), Rochet (2003) and Chakravorti (2003). Papers that do consider the credit feature of credit cards focus only on these features: Chakravorti and To (2002) focus on merchant benefit from sales to consumers without sufficient funds, while Chakravorti and Emmons (2003) consider the potential subsidization of credit card usage costs from finance charges.

is transferred (using the same technology) from the buyer to the issuer, then to the acquirer, and then to the seller. The only difference between the cards is that in credit cards, there is a delay in transferring funds from buyers to issuers, allowing buyers to borrow money conveniently. Since the borrowing feature is the only exogenous difference between the cards, gains from credit cards are limited to borrowing credit card holders and lending issuers. Otherwise, costs and benefits are the same: these include physical issuing costs, authorization costs, POS equipment costs, fraud risk (which is different than fraud *liability*), the benefit of not having to obtain cash (buyers) or handle cash (sellers), and so on.[8]

Credit cards are therefore just debit cards, bundled with a borrowing feature that benefits lending issuers and borrowing cardholders. Other than those *technological* features, there are other forms of transfers between agents which may differ between credit and debit cards: fraud liability, timing of payments, fees, and rebates; but these are all endogenous payments rather than technological features. This approach is more realistic (since all payments are endogenous), makes the comparison of debit and credit cards more tractable (while usually parameters are assumed to be *exogenous* to simplify the analysis), and may result in more efficient transfers between agents.[9]

A potential objection may be that sellers sell more because of the liquidity of their consumers, making credit cards beneficial for them more than debit cards. This may be true for a specific transaction, but in equilibrium there is no reason to believe that sellers make more sales because of the opportunity of borrowers to obtain credit easily. Total spending of consumers depends on their wealth, and consumers are not wealthier because of credit cards (on the contrary!).[10] In equilibrium in which all sellers accept credit cards, no seller has a relative advantage, and extra liquidity accommodates the business stealing effect rather

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[8] An example for POS costs is keypads. Although card associations only encourage the use of keypads in on-line debit transactions, there is no *technological* reason why this should be the case. Therefore, such practice is viewed as a difference in the commission paid in debit vs. credit, rather than a technological difference between the cards.

[9] In the payment card market, there are many examples of inefficiency: signature debit cards are used although their risk is high relative to the convenience of not using a pin number, costly interest free period is provided automatically to all consumers, etc.

[10] Consumers may be better off because they smooth consumption, but sellers are indifferent between selling small quantities to many consumption smoothing consumers or large amounts to few non-smoothing consumers. The Federal Reserve Board's Congressionally commissioned study failed to find "any strong, consistent relationship exists between credit cards and incremental sales among retailers as a group".
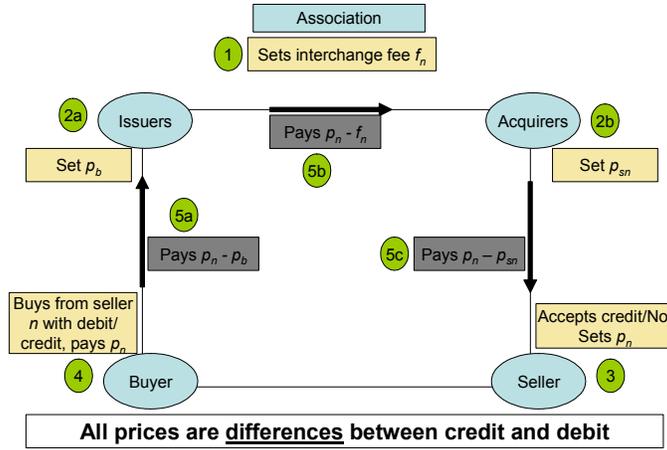
Figure 2: Timing and prices of a credit (rather than a debit) transaction

than a real benefit to sellers.[11]

3   A Monopolistic Model of Payment Cards

3.1   The Model

Since our goal is to compare between credit and debit cards, the starting point is an economy in which all sellers accept debit cards and prices of debit cards are set. The introduction of credit cards is then analyzed. All payments in the model are *differences* between credit and debit (rather than levels).

   Buyers: The number of buyers is normalized to 1. There are three types of buyers, all of whom possess debit cards and have the same linear demand for good x_n. D_{x_n}:

- A fraction a_n are not issued credit cards by issuers ('*nonholders*').[12]

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[11] If one is still unconvinced and believes that more transactions do take place thanks to credit cards, then sellers who are willing to pay for their consumers' liquidity can do so *directly*. Technically, this is very simple using debit cards: fees can be transferred over several months from the buyer to the seller. This might be less efficient then lending money using credit cards (otherwise there would be no need for credit cards), but it solves an important moral hazard problem: credit cards are a good device for loans from *issuers* to buyers, but are a bad device for loans from *sellers* to buyers. If sellers are willing to pay for the credit of their buyers, then this should be reflected in their direct relationship with customers who need credit rather than through a loop of payments which involves other buyers. Recall that merchants (or acquirers) are not consulted on the credit worthiness of consumers being provided with credit cards.

[12] Since credit cards are costless (given the prevalence of no fee cards and a strong fraud protection), only the supply side prevents buyers from having cards (Zinman 2004). The

- A fraction a_b hold credit cards and have a net benefit of $B_{bl} > 0$ from borrowing ('*borrowers*'). This net benefit includes the benefit of borrowing conveniently, net of the high interest rates charged by issuers. Borrowers, therefore, always borrow money when using their credit cards.[13]

- A fraction a_c hold credit cards and have a net benefit of $B_{bl} \leq 0$ from borrowing money at high interest rates ('*convenience users*'). These buyers do not borrow money when using credit cards.[14]

Credit card holders (from now: cardholders) receive from issuers a per-transaction-fee of p_b for using their credit rather than debit card (figure 2).[15] This price includes rewards, rebates, an interest-free-period, extra fraud protection and (average) penalties for late payments or annual fees.

Sellers: There are N monopolistic sellers, each selling a good x_n. Sellers incur a marginal cost c_{xn} for each good sold. Sellers accept debit cards and can accept or reject credit cards, but are not allowed to charge different prices based on the payment tool used.

A seller n who does not accept credit cards faces a downward sloping linear demand curve $(a_b + a_c + a_n)D_{x_n}$. Sellers may decide to accept credit cards, thereby increasing their costs and some of their customers' willingness to pay. As discussed in section 2, the cost difference of accepting credit vs. debit can be summarized by the difference in the payment paid to acquirers. Specifically, sellers pay acquirers an extra fee of p_{sn} per credit transaction. p_{sn}, the difference between the credit and debit fee, includes all transfers between sellers and acquirers (commission, payment timing, risk sharing) and may be positive, negative, or zero.[16]

Issuers: Issuers are identical and imperfectly competitive, and issue debit

fraction of credit card holders, $1-a_n$, can also be interpreted as follows: consumers are given credit cards and have different credit limits, where the distribution of credit limits has the support $[0, \bar{M})$ with a mass of consumers having a credit limit of 0. Under this interpretation, $(1-a_n)$ represents the fraction of **transactions** (rather than consumers) that can be carried out using credit cards.

In reality, some credit card holders use debit cards. This can be either because they are over their credit limit, or because they already revolve balances and pay high interest rates (so in both case they cannot be convenience users). Others (around 20% of those who own credit but use debit) use debit cards because of some mental costs (e.g. a commitment device against overspending- Ausubel (1991)). These debit users do not effectively own credit cards (at least for some of their purchases) and in this model they are thought of as nonholders.

[13] B_{bl} is exogenous in this model, since we do not focus on the level of interest rates (determined exclusively within the issuers-cardholders relationship).

[14] According to the SCF (2001), 40 percent of cardholding families do not borrow on credit cards. Convenience use grew rapidly between 1992 and 2001 particularly when compared with the amount borrowed (Johnson (2004)).

[15] In reality, the payment for using a debit card is usually 0 (less than 15% of debit card holders pay positive fees), so p_b stands for the positive payment received by credit cards users.

[16] Wright (2001) models a continuum of industries, across which merchants differ in their benefits. This can be accommodated in this model: sellers may have different benefits from card payments, as long as 'exogenous' benefits do not vary across cards. This assumption seems natural- for instance, the benefit of not handling cash is the same (for a specific seller) for debit and credit card transactions.

and credit cards.[17] For every transaction carried out by credit rather than debit, sellers pay cardholders p_b and receive from acquirers f_n. Additionally, issuers make a net profit of B_{il} per transaction made by a borrowing consumer. This profit reflects the high interest rates charged, net of loan related costs such as defaulting or determining credit limits. Imperfect competition of issuers is reflected in a profit function of g(revenues-costs), where $0 < g(\lambda) < \lambda$ for $\lambda > 0$, and $g'(\lambda) > 0$.[18]

Acquirers: Acquirers are identical and perfectly competitive, and have the same costs for debit and credit transactions. Acquirers pay issuers f_n and receive from sellers p_{sn} for a transaction made with credit instead of debit.

Card association: There is one debit and credit card association that sets f_n. Its objective is to maximize the profits of its members (i.e. issuers and acquirers) and (if indifferent) to maximize the use of credit cards by cardholders. Competition between associations is informally discussed in section 4.1.

Timing: As mentioned, our starting point is a market in which debit cards are owned by all buyers and accepted by all sellers. Debit prices (i.e. the debit interchange fee, sellers' and buyers' fees) have been set. Timing is as follows:

1. Card association sets an IF for credit cards (which determines f_n).

2. Acquirers set sellers' credit price (which determines p_{sn}), and issuers set buyers' credit price (and therefore p_b).

3. Sellers decide whether to accept credit cards and set prices. Buyers buy using credit or debit cards.

3.2 Sellers and Buyers

We first solve the last stage of the game, i.e. the behavior of sellers and buyers after f_n, p_b, and p_s have been set. The subscript n is suppressed from now on, but all seller-related parameters are seller-specific.

Proposition 1 *Define a_u as the number of credit card users and Ψ as their average benefit from credit cards: $\Psi = p_b + \dfrac{a_b}{a_u} B_{bl}$. Seller n accepts credit cards if and only if $p_{sn} \leq \Psi$.*

Proof. All proofs are in the appendix. ∎

Proposition 1 has a simple intuition: since sellers cannot charge separately for credit cards, they accept credit if the cost is low enough. Specifically, a seller accepts credit if and only if the cost is lower than the average benefit of credit

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[17]The prevalent assumption in the literature (which is not crucial for the results) is that issuers are imperfectly competitive and acquirers are perfectly competitive (e.g. Wright (2001), Rochet and Tirole (2002) and Schmalensee (2002)). Evans & Schmalensee (1999) explain why this is the case in the U.S: in the issuing side, there is a relative importance of features such as consumer loyalty, issuers' reputation, product differentiation and search costs.

[18]Fees do not vary much by acquirer or issuer. Many other papers (e.g. Hayashi (2004)) assume that issuers are a monopoly or that the association sets both interchange fees and prices for cardholders and sellers. Those assumptions are equivalent to the ones in this paper.
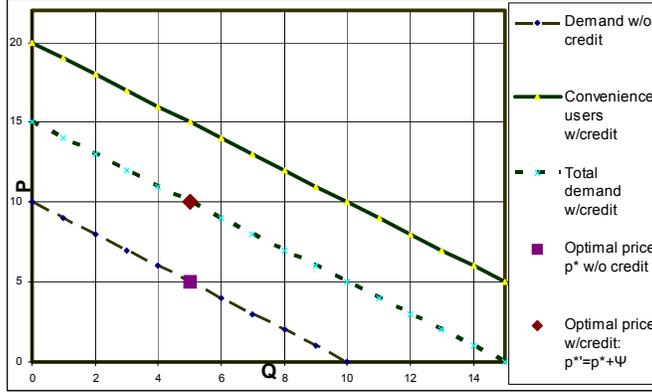
Figure 3: A graphical example

users.[19] Credit users are all cardholders when $p_b \geq 0$ ($a_u = a_b + a_c$), and only borrowers when $-B_{bl} \leq p_b < 0$ ($a_u = a_b$).

Figure 3 provides a graphical intuition. Suppose that there are two groups of the same size, convenient users and nonholders, with $p_b = 10$ and $c_x = 0$. If $p_s = \Psi = 10$, then the seller can accept credit cards and increase her price by her average extra cost, 5. Her total quantity and markup are unchanged, and the seller is just indifferent between accepting and not accepting credit cards. An increase [decrease] in p_s makes the seller worse [better] off when she accepts credit cards, making the cost threshold under which the seller accepts credit exactly Ψ.

3.3 Acquirers, Issuers and the Card Association

Proposition 2   *1. Given f, acquirers set $p_s = f$.*

2. Define $\Pi_{\max} = g(a_b(B_{bl} + B_{il}))$ as the maximum profit issuers can obtain. Given f, issuers set p_b as follows:

If f is	*then issuers set*	*and profit is*
$f < -(B_{bl} + B_{il})$	*no credit cards*	$\Pi = 0 < \Pi_{\max}$
$-(B_{bl} + B_{il}) \leq f < 0$	$p_b = -B_{bl} < 0$	$0 \leq \Pi < \Pi_{\max}$
$0 \leq f < \dfrac{a_b}{a_b + a_c} B_{bl}$	$p_b = f - B_{bl} < 0$	$\Pi = \Pi_{\max}$
$\dfrac{a_b}{a_b + a_c} B_{bl} \leq f < B_{bl}$	*See below*	$\Pi = \Pi_{\max}$
$B_{bl} \leq f$	$p_b = f - \dfrac{a_b}{a_b + a_c} B_{bl} > 0$	$\Pi = \Pi_{\max}$

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[19]This result is similar to those obtained by Rochet and Tirole (2002) and Wright (2003b).

- When $\dfrac{a_b}{a_b + a_c} B_{bl} \leq f < B_{bl}$, *issuers have a choice: either they set* $p_b = f - B_{bl} < 0$ *and attract only borrowers, or they set* $p_b = f - \dfrac{a_b}{a_b + a_c} B_{bl} > 0$ *and attract all credit card holders. In both cases, profits are* $\Pi_{\max}$.

3. *The association sets* f *such that* $f \geq B_{bl}$.[20]

3.4 Summary of Market Outcome

Combining our results from propositions 1 and 2, market outcome is as follows:

1. The association sets f such that $f \geq B_{bl}$.

2. Issuers pay **all** credit card users a price of $p_b = f - \dfrac{a_b}{a_b + a_c} B_{bl} > 0$ and make positive profits based on B_{il} and B_{bl}, the 'real' benefits generated by credit cards. Acquirers charge sellers a price of $p_s = f$.

3. Sellers accept credit cards and increase their prices by $(a_c + a_b)f$ compared to a market without credit cards. Nonholders suffer from the price increase and lower their purchased quantity. All credit card holders use credit cards, and borrowers borrow. Convenience users receive a rebate of $p_b = f - \dfrac{a_b}{a_b + a_c} B_{bl} > 0$, which can be higher or lower than the price increase. Borrowers receive the same rebate and have an additional utility of B_{bl}, which is higher than the price increase.

4 Analysis and Policy Implications

4.1 Discussion

The existence of credit cards has a positive effect on borrowers, a negative effect on nonholders, and an ambiguous effect on convenience users: convenience users use credit cards since other cardholders do so, but might be better off if credit cards did not exist.[21] Even in a setting where buyers capture some of the credit cards efficiencies, nonholders always have a negative utility from their existence.[22]

f monotonically increases redistribution by raising [lowering] the utility of cardholders [nonholders]. Since the exact magnitude of f is undetermined by the model, we review some factors that affect f:

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[20] This result is similar to Rochet and Tirole (2002): in their model, privately optimal IFs are also set at the maximum compatible with sellers accepting cards.

[21] The regressive taxing problem has been presented by several authors, including Carlton and Frankel (1995).

[22] Recall that non credit card holders do not receive any direct benefit from credit cards, and therefore their utility change depends on market prices only.

- **Competition between card associations**. Buyers decide which credit card to use for their purchases. Therefore, sellers must accept the cards of *all* associations, and competition between associations concentrates on buyers.[23] A higher f set by an association helps issuers to compete against issuers of other associations by offering higher rebates to buyers. Therefore, competition between card associations is expected to push f (and p_b) up. Indeed, cards with high rebates and high sellers fees tend to succeed. Competition between card associations may be socially harmful, as opposed to desired competition at the issuing and acquiring levels.[24]

- **Relative market power** of the association in credit vs. debit cards. When the relative market power in credit cards is high (as is the case with Visa and MasterCard), the association has a higher incentive to encourage the use of credit, and does so by increasing f and p_b.

- **A regulatory intervention and other legal suits**. Legal intervention (or the threat of such intervention) is likely to push f down. In many countries, regulators lowered IFs. Class action suits have also been initiated in several countries, claiming that card associations set IFs at high levels, taking advantage of their market power.

The existence of loans is not crucial for the results: loans add realism and provide issuers an incentive to issue, but other incentives (such as the association's reputation) would yield a similar market structure.

4.2 Predictions

The model's predictions seem to be consistent with reality:

1. *All credit card holders (including convenience users) receive a positive rebate for using credit cards.*[25]

2. *The IF for credit cards is higher than the IF for debit cards.*

3. *Debit-accepting sellers also accept credit cards.*

4. *Positive correlation between cardholders' payments, sellers' commissions, and credit IFs.*[26]

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[23] This is particularly true if buyers do not hold credit cards of several associations, and therefore insist on using the (only) card they have. Indeed, it has been reported (The 2004 Preferred Card Study conducted by Edger, Dunn & Company) that consumers are beginning to hold fewer cards, given the universal acceptance of credit and debit cards by merchants. According to Rysman (2004) most card users use cards from only one network, and keep cards from other networks to ensure low switching costs.

[24] Studies that analyze explicitly competition among card networks include Guthrie and Wright (2003) and Rochet and Tirole (2003). According to Rochet and Tirole (2002) and in line with my analysis, competition between networks need not result in lower IF.

[25] Recall that p_b is the difference between credit and debit cards prices (rather than the levels), but the observed market price of debit cards is usually 0.

[26] See Weiner and Wright (2005) for empirical facts.

5. *Positive correlation between network competition and interchange fees.*

6. *Reductions in costs need not result in lower IFs.*

7. *Fees are proportional to transaction values*: f and p_b depend on B_{bl}, which in turn depends on the transaction value.[27]

4.3 Alternative Regimes and Policy Implications

Suppose that f, the difference in IFs between debit and credit, is regulated rather than privately set by the card association. Recall that the setting of IFs constitutes a price fixing agreement, and as such is subject to antitrust scrutiny. The previous analysis, and in particular the observation that f magnifies redistribution, suggests three possibly attractive regimes.

Regime 1: Regulator Sets $f = \dfrac{a_b}{a_b + a_c} B_{bl}$. A possible objective function of the regulator is $min_f (regressive\ tax)\ s.t.\ participation\ is\ unchanged$. This calls for $f = \dfrac{a_b}{a_b + a_c} B_{bl}$, the lowest f which allows all cardholders to use credit cards. Under this regime, $p_b = f - \dfrac{a_b}{a_b + a_c} B_{bl} = 0$, and credit cards increase the price by $a_b B_{bl}$ (throughout this section, recall proposition 2). Compared to no intervention, nonholders are strictly better off while cardholders are worse off. Credit and debit cards are equivalent for convenience users ($p_b = 0$), so convenience users lose as much as nonholders do. When $a_b B_{bl}$ is low, so is the cross subsidy between buyers (which was not the case before, since B_{bl} was only a lower bound for the level of redistribution). Other market participants are unaffected.

Regime 2: Regulator Sets $f = 0$. Suppose that the objective function of the regulator is $min_f (regressive\ tax)\ s.t.\ issuers'\ profits\ are\ unchanged$. The regulator sets $f = 0$, while issuers set $p_b = f - B_{bl} = -B_{bl} < 0$. Only borrowers use credit cards. The status of sellers, acquirers and issuers is again unchanged. Under this regime, there is no price increase and therefore no regressive tax. p_b is determined by the bilateral relationships between issuers and borrowers and is not financed by IFs.

Regime 3: Regulator Sets $-(B_{bl} + B_{il}) \le f < 0$. Now suppose that our brave regulator cares only about consumers (and in particular poor ones), and sets $-(B_{bl} + B_{il}) \le f < 0$. This means that the credit card fee is lower than the debit card fee. Clearly, issuers do not want convenience users to use their cards, as they produce costs (negative IFs) and no revenues. Issuers charge $p_b = -B_{bl}$, and make profits of $g(a_b (f + B_{bl} + B_{il})) \ge 0$. Under this regime, all consumers enjoy credit cards through a reduction in market prices. Issuers' profits are lower, while acquirers and sellers are unaffected.

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[27]Fees observed in the market usually have a very low fixed part and a more significant part which depends on the transaction amount. This has been a source of debate between card networks and regulators, as regulators have claimed that many costs (e.g. processing and issuing) are fixed and so should the commission be.

Policy Suggestions. Credit cards create an efficiency gain based on borrowers' willingness to pay, but also redistribute wealth. The first two regimes do not change the payoffs of any *group* of agents. On the other hand, they minimize and eliminate the redistribution effect, respectively. Therefore, they create a social welfare (which is not a Pareto) improvement by canceling the tax levied on non-holders.

The suggested regime, $f = 0$, does not necessarily imply zero rebates to credit card holders: issuers might keep paying cardholders to use credit cards, hoping to create revenues based on borrowing. As opposed to the current regime, this conduct only involves issuers and cardholders, without imposing externalities on other market participants.

Since this paper does not discuss the optimal IF of debit cards, one might ask whether adopting the $f = 0$ regime would raise the IF for debit cards rather than lower the IF for credit cards. This is not likely to happen: debit card issuers are less concentrated than the (increasingly) concentrated credit card issuers, and the market share of Visa and MasterCard is relatively low in debit cards.[28] This makes debit prices relatively fixed. Following the Wal-mart case, sellers can credibly threaten not to accept the associations' debit cards.

The use of credit cards by borrowers only may also solve the 'temptation' problem, where buyers use credit cards excessively and end up paying high interest rates. Under the suggested regime, using credit cards is costly and therefore only buyers who *plan to borrow* use credit rather than debit cards.

Closed systems. The framework in this paper is focused on open card networks (such as Visa and MC). Note, however, that closed card networks (such as American Express) cause the same market distortion as open networks. Intervention in closed systems is legally more complicated, since there are no IFs to be regulated. This difference is legal rather than economic.[29]

5 Extensions and Other Models of Competition

5.1 Convex and Heterogeneous Demand Functions

Consider the model introduced in section 3, with strictly convex demand functions.Proposition 1 is still valid, except that the cost threshold under which a seller accepts credit cards becomes $\hat{p}_s > \Psi$. To see this, suppose that the seller raises the price (sub-optimally) by her cost of accepting cards, $(a_c + a_b)p_s$. Markup is unchanged, and convexity implies that quantity is higher, since

$$\sum_{k=b,c,n} a_k D_x(p^* + \Psi, seller\ accepts) \geq \sum_{k=b,c,n} a_k D_x(p^*, seller\ does\ not\ accept).$$

Profit is therefore also higher. Since profit (when accepting credit) is monotonic

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[28] The market share of the top ten credit cards issuers was 85.7 in 2003, as opposed to a market share of around 35 percent of the top ten debit card issuers.

[29] Visa and MasterCard often argue that regulating their IFs discriminates against open systems, which are better for consumers (since they facilitate competition at the issuers' and acquirers' level). While this argument makes sense, its consequence should be the regulation of *all* card associations rather than no intervention at all.
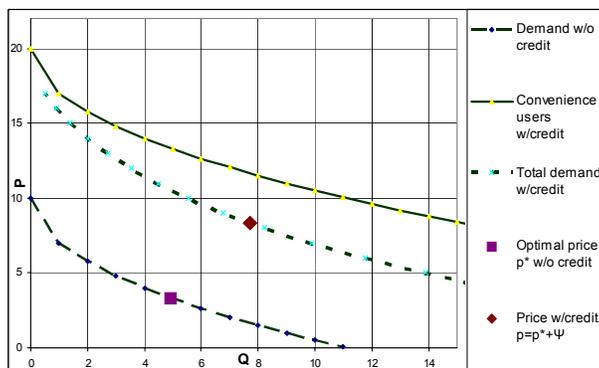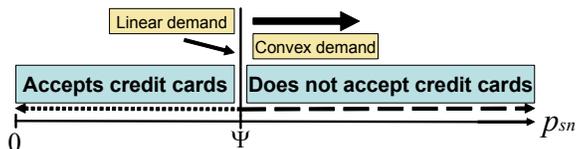
Figure 4: Convex demand

Figure 5: Credit card acceptance as a function of cost

in p_s, the seller accepts cards if and only if $p_{sn} \leq \hat{p}_s$, where $\hat{p}_s > \Psi$. Figures 4 and 5 present this idea graphically.

Similarly, when different types of consumers have different elasticities of demand for the product, the condition that compares p_{sn} and Ψ is 'in favor' of the more elastic types: for example, if cardholders are more elastic, then the result is qualitatively similar to the convex demand case.[30]

5.2   A Hotelling Model of Payment Cards

Market outcome is equivalent in a Hotelling model of competition, where strategic effects are taken into consideration. Consider the same model as in section 3, with the following adjustments to sellers and buyers:

Sellers: There are two identical sellers, located at the endpoints of a straight line of size 1 and selling a homogeneous product x. We assume that if there are multiple equilibria in which either both sellers accept or both sellers reject

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[30]The idea is similar to Ramsey pricing, where less elastic types pay more; here, inelastic types have less influence on the provision of credit cards. An implication that IFs are positively correlated with demand elasticity of credit card holders, and negatively correlated with demand elasticity of non-holders. Whether this is indeed the case in reality is an empirical question.

credit cards, then the outcome is that both accept cards.[31]

Buyers: All buyers buy exactly one unit from one of the sellers, where the value of consumer h from buying the good with a debit card is v_{xh}. Consumers incur a cost of td_h [or $[t(1 - d_h)]$ when buying from seller 1 [seller 2].[32]

More specifically U_{hn}, the utility of buyer h from buying from seller n at price p_n ($n \in \{1, 2\}$) using a card is

$$
\begin{aligned}
U_{h1} &= v_{xh} - td_h - p_1 + \lambda_c p_b + \lambda_b (p_b + B_{bl}) \\
U_{h2} &= v_{xh} - t(1 - d_h) - p_2 + \lambda_c p_b + \lambda_b (p_b + B_{bl})
\end{aligned}
$$

where λ_c [λ_b] is equal 1 if the buyer is a convenience user [borrower] **and** seller n accepts credit cards **and** the buyer chooses to use a credit card.

Proposition 3 *The behavior of all market participants (and therefore market outcome) is identical to that of the monopolistic model.*

Intuition. Suppose that $f = \Psi$ and that seller 2 accepts credit cards. If seller 1 accepts credit as well, then sellers are symmetric and each has half the market; optimal prices (as is usual in linear Hotelling models) are the average cost plus a constant markup t. When seller 1 does not accept credit, she loses a fraction of credit card consumers which is proportional to the benefit of using credit cards, $a_u \Psi$. On the other hand, the seller captures a higher market share because she offers a lower price; more specifically, her quantity gain is proportional to the difference in prices, which (in the Hotelling model) is equal to the difference in costs. But the difference in costs is exactly the interchange fee times the number of users, which is equal to $a_u \Psi$ as well (recall subsection 3.4). Therefore, when $f = \Psi$ (and given that the other seller accepts credit), seller 1 is indifferent between accepting and not accepting credit, since her markup and quantity are the same in both cases. When f is higher [lower], the seller strictly prefers to reject [accept] credit cards. This intuition is made more precise in the appendix.

This Hotelling model is, therefore, equivalent (in terms of sellers' acceptance decisions) to the monopoly model used in section 3, with demand $p = 2t + c_x$ $- 2tq$. In the monopoly model, as opposed to the fixed-transaction-volume Hotelling model, differences in prices are reflected in lower [higher] quantities consumed by nonholders [borrowers].

5.3   Other Models of Competition

Recall that in the payment cards setting, the price of two different products (a good+debit and a good+credit) must be the same. Monopoly and Hotelling

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[31] The card association may ensure this outcome by initially setting a low IF, then increasing it to the maximum level which allows a 'both accept' equilibrium.

[32] Rochet and Tirole (2002) assume that consumers differ in the benefit to them of paying with a card rather than cash. As in the sellers' case, the model is capable of accommodating heterogeneity in buyers' benefits, as long as for each buyer convenience benefits are the same for debit and credit.

models accommodate equilibria in which the same seller makes positive sales to consumers of both products, because sellers have 'enough' market power to charge the average price of two products without losing 'too many' consumers of the cheaper product. In contrast, in many other models of competition (e.g. perfect competition and Bertrand) such equilibria generally do not exist. The reason is that a seller who charges a higher price (even marginally) loses a discrete quantity of consumers of the cheaper product. In our example, if seller n accepts credit cards and charges p_n, then seller l can reject credit cards, charge $p_l = p_n - \epsilon$, and attract all consumers who do not use credit cards. Seller n, in turn, makes positive sales to credit card users *only*. The market outcome is such that some sellers make sales to credit users only, while others sell to non-credit users only; such models are analyzed by Wright (2003a) and Chakravorti and Emmons (2003a). In Cournot models, price is uniform across sellers *by definition*. To define price as a function of credit and debit sales, one must assume that credit and debit are one 'homegeneous' good which has a uniform price, thereby assuming away the possibility that different sellers make different acceptance decisions. Wright (2002) tackles this by assuming that consumers values of using cards are only realized *at the store*. Therefore, buyers are ex-ante identical and do not choose sellers based on their card acceptance decisions. The result is that all sellers make the same acceptance decision, based on the same criterion as in section 3: the cost vs. the expected benefit.

6 Conclusion

Credit cards have two major effects: they create efficiency by enabling convenient loans, and tax nonholders in order to finance wealthier cardholders. This regressive tax creates a market outcome in which convenience users use credit cards just to get paid, thereby raising sellers' costs and market prices. Alternative legally feasible and welfare improving regimes are considered. In particular, it is suggested to equate debit and credit cards' interchange fees. Under the suggested regime, the efficiency gains of credit cards are realized and the payoffs of all groups of agents are identical. The only difference is that the proposed regime cancels the tax currently levied on consumers who do not hold credit cards. The result of this regime is that credit cards are used for borrowing only, while debit cards are used for convenience.

In general, it is important to distinguish between technological characteristics, which determine efficiency, and payments and risk sharing, which only affect the distribution of wealth in (and outside!) the system. Interchange fees are designed to balance the two sides of markets, but should not be used to resolve issues which only involve one side. While the level of IFs in two sided markets remains an important question, using *differences* may help design optimal IFs.[33]

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[33]Pin and signature debit cards are another example of inefficiency. Associations promote signature (offline) debit cards by offering rebates to consumers and charging sellers high prices for their acceptance, although signature debit cards are more susceptible to fraud and are

7 Appendix

7.1 Proof of Proposition 1

Define $\Delta\pi_n \equiv \pi_{n,no\ credit} - \pi_{n,credit} = \sum_{k=b,c,n} a_k D_{xn}(p_n^*)(p_n^* - c_{xn}) - \sum_{k=b,c,n} a_k D_{xnk,credit}(p_n^{*'})(p_n^{*'} -$

$c_{xn} - (a_c + a_b)p_{sn})$; note that $D_{xnk,credit}$ is different among types according to their benefit from credit cards, and that $(p_{n,no\ credit}^*, p_{n,credit}^{*'}) = (c_{xn} +$

$$\frac{\sum_{k=b,c,n} a_k D_{nk}}{\sum_{k=b,c,n} a_k \frac{\partial D_{nk}}{\partial p_n}\Big|_{p_n^*}}, c_{xn} + (a_c + a_b)p_{sn} + \frac{\sum_{k=b,c,n} a_k' D_{nxk,service}}{\sum_{k=b,c,n} a_k' \frac{\partial D_{nk}}{\partial p_n}\Big|_{p_n^{*'}}}). \text{ When } p_{sn} = \Psi,$$

linearity implies that $p_{n,credit}^{*'} = p_{n,no\ credit}^* + (a_c + a_b)p_{sn}$ (both the numerator and the denominator are equal with and without credit cards); since markup and quantity are the same, so is the profit and the seller is indifferent between accepting and rejecting credit cards. Since $\Delta\pi_n$ is increasing in p_{sn}, the seller accepts [rejects] credit cards whenever $p_{sn} < \Psi$ $[p_{sn} > \Psi]$.

7.2 Proof of Proposition 2

Define $a_H = (a_c + a_b)$ and $a_{BH} = \dfrac{a_b}{a_b + a_c}$ as the fraction of credit card holders and the fraction of borrowers within holders, respectively.

1. Perfectly competitive acquirers recover costs by setting $p_s = f$.

2. Symmetric issuers earn f and lose p_b per credit card transaction; in addition, they earn B_{il} for every borrower. Issuers can choose whether to encourage all cardholders or only borrowers to use credit cards, which results in different sets of constraints.

   Case I: Attracting all cardholders
   The issuers' problem is:
   $max_{p_b} g(a_H(f - p_b) + a_b B_{il})$ s.t.
   (1) $f \le p_b + a_{BH}B_{bl}$ (sellers accept credit cards)
   (2) $p_b \ge 0$ (all cardholders use credit cards)
   Clearly, profits decrease with p_b, so either (1) or (2) are binding. Issuers set p_b as low as possible, as long as it is larger than both $f - a_{BH}B_{bl}$ and 0; therefore, $p_b = \max(f - ma_{BH}B_{bl}, 0)$. Nonnegative profits imply that issuers exit the market when $f < a_{BH}B_{il}$. Profits of issuers are, therefore: $profit(issuer) =$

$$g(a_H(f - p_b) + a_b B_{il}) = \begin{cases} g(a_b(B_{bl} + B_{il})) & \text{if } a_{BH}B_{bl} \le f \\ g(a_H f + a_b B_{il}) & \text{if } -a_{BH}B_{il} \le f < a_{BH}B_{bl} \\ 0 & \text{if } f < -a_{BH}B_{il} \end{cases}$$

   Case II: Attracting only borrowers
   The issuers' problem is $max_{p_b} g(a_b(f - p_b + B_{il}))$ s.t.
   (1) $f \le p_b + B_{bl}$ (sellers accept credit cards)

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therefore less efficient then pin (online) debit cards.

(2) $-B_{bl} \leq p_b$ (borrowers use credit cards)

Profits decrease with p_b, so either (1) or (2) are binding. Issuers exit the market when $f < -(B_{il} + B_{il})$. Note that for $f \geq B_{bl}$, issuers set $p_b \geq 0$ and we are back in case I. Profits of issuers are, therefore: $profit(issuer) = $

$$g(a_b(f - p_b + B_{il})) = \begin{cases} g(a_b(B_{bl} + B_{il})) & \text{if } 0 \leq f \\ g(a_b(f + B_{bl} + B_{il})) & \text{if } -(B_{il} + B_{il}) < f < 0 \\ 0 & \text{if } f < -(B_{il} + B_{il}) \end{cases}$$

Part 2 of proposition 2 summarizes these two cases by choosing the optimal p_b for each possible f.

3. Given part (2), maximization of issuers' profits requires that $f \geq 0$. The number of credit card users is maximized by setting $f \geq B_{bl}$.

7.3 Proof of Proposition 3

Suppose that $a_u = a_b + a_c$, and therefore $f = p_b + \dfrac{a_b}{a_b + a_c} B_{bl}$. We look at seller 1 (given that seller 2 accepts credit and her optimal price):

If seller 1 does not accept credit, then $s_1 = \frac{1}{2t}(t + p_2 - p_1 - a_H p_b - a_b B_{bl}) = \frac{1}{2t}(2t + c_x - p_1)$, or $p_1 = 2t + c_x - 2ts_1$.

If seller 1 accepts credit, then $s_1 = \frac{1}{2t}(t + p_2 - p_1) = \frac{1}{2t}(2t + c_x + a_H p_b + a_b B_{bl} - p_1)$, or $p_1 = 2t + c_x - 2ts_1 + a_H p_b + a_b B_{bl}$.

Therefore, when seller 1 accepts credit, her demand curve goes up by $a_H p_b + a_b B_{bl}$. Her cost is raised by $a_u f$, which is exactly the same. If a seller is a monopolist and has an initial demand curve of $p_1 = 2t + c_x - 2ts_1$, then her problem is identical to the Hotelling problem. This does not depend on a_c, a_c, a_b.[34]

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[34] One should note that when seller 2 *does not* accept credit cards, then the condition is different and seller 1 rejects credit cards for every $f \geq \tilde{f}$, where $0 < \tilde{f} < p_b + a_{BH} B_{bl}$. The reason is that in the range $\tilde{f} \leq f \leq p_b + a_{BH} B_{bl}$, both 'both accept' and 'both reject' equilibria exist. Our assumption that the 'both accept' equilibrium prevails ensures that the sellers' problem is the same as in the monopoly case. However, as opposed to the monopoly case, accepting cards when $f \leq p_b + a_{BH} B_{bl}$ is *not* a weakly dominant strategy (since it depends on the acceptance decision of the other seller).

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