

Theory of Credit Card Networks: A Survey of the Literature

SUJIT CHAKRAVORTI *

Federal Reserve Bank of Chicago

Abstract

Credit cards provide benefits to consumers and merchants not provided by other payment instruments as evidenced by their explosive growth in the number and value of transactions over the last 20 years. Recently, credit card networks have come under scrutiny from regulators and antitrust authorities around the world. The costs and benefits of credit cards to network participants are discussed. Focusing on interrelated bilateral transactions, several theoretical models have been constructed to study the implications of several business practices of credit card networks. The results and implications of these economic models along with future research topics are discussed.

1 Introduction

Credit cards are the second most popular non-cash instrument in the United States and growing in popularity around the world.¹ While initially introduced as primarily a credit instrument, today it has become an extremely popular payment instrument.² Some financial observers doubted the viability of credit cards in their initial years and many issuers exited the business only to return later. However, today, most observers agree that credit cards offer unique benefits to consumers and merchants and profit opportunities to banks.

The success of the two largest credit card networks – MasterCard and Visa – is critically dependent on the membership of thousands of financial institutions that jointly establish rules, standards, and interchange fees.³ Interchange fees are payments made

* Mailing address: Federal Reserve Bank of Chicago, 230 S. LaSalle Street, Chicago, IL 60604, USA. E-mail: sujit.chakravorti@chi.frb.org. I thank Michele Bullock, Jean-Charles Rochet, Joshua Gans, Stephen King, Marius Schwartz, Dan Vincent, Julian Wright and seminar participants at the Payment Cards Center at the Federal Reserve Bank of Philadelphia for their comments. Carrie Jankowski provided excellent research assistance. The views expressed are mine and should not be attributed to the Federal Reserve Bank of Chicago or the Federal Reserve System. All remaining errors are my own.

¹ This article will focus on general-purpose charge and credit cards issued by third parties. Charge card end-of-cycle balances must be paid in full on the due date whereas credit cards allow consumers to make partial payments.

² For a discussion of the evolution of charge and credit cards and their benefits to consumers and merchants, see Baxter (1983), Chakravorti (2000), Evans and Schmalensee (1993) and (1999), Mandel (1990), and Nocera (1994).

³ While these card networks account for the bulk of credit card transactions, there are also proprietary networks. In proprietary credit card networks, such as American Express (in the United States) and Discover, the same entity interacts with cardholders and merchants.

between the merchant's financial institution, known as the acquirer, and the consumer's financial institution, known as the issuer. Regulators, especially antitrust authorities around the world have kept a watchful eye on the credit card industry.⁴ Recently, authorities in Australia, the European Union, the United Kingdom, and the United States have questioned some business practices of MasterCard and Visa.⁵ These business practices include no-surcharge and non-discrimination rules, the level and collective determination of interchange fees, honor-all-card provisions, and the competitive nature of credit card service providers.

Recently, several theoretical models have been constructed to study the effects of various regulatory policies. The results of the models are dependent on the underlying assumptions. The results are critically affected by the elasticity of consumer demand for goods and payment services, and the degree of competition in the markets for goods and card services. Given competitive markets for goods, one-price policies do not affect overall welfare. Welfare effects of one-price policies are ambiguous when merchants have some level of market power.

If competitive merchants are allowed to set prices based on the costs and benefits of the underlying payment instrument used, the level of the interchange fee would have no effect on welfare. Under such conditions, regulation of the interchange fee is not warranted. Alternatively, when merchants have sufficient market power, the socially optimal interchange fee may not be different than issuers and acquirers' profit maximizing interchange fee.

Unfortunately, no one model is able to capture all the essential elements of each interrelated bilateral relationship, but the theoretical models do offer some guidance to policymakers. Some issues, such as network competition in the provision of credit card services and competition from other payment instruments, still remain understudied.

This article is organized as follows. First, this article discusses the costs and benefits of using credit cards for consumers and merchants along with the profit opportunities for issuers and acquirers and the role of credit card networks. Then, the economic models that study the interrelated bilateral relationships underlying credit card transactions are reviewed in the context of recent public policy concerns. The article concludes with suggestions for future research.

2 The participants

Participants in credit card networks are primarily comprised of consumers, issuers, merchants, acquirers, and network operators. These participants are involved in a series of interrelated bilateral transactions. In this section, we will explore the costs and benefits of each participant in the credit card network.

⁴The United States has a long history of antitrust challenges. See Evans and Schmalensee (1999) for a history of U.S. antitrust cases and Chakravorti and Shah (2003) for a discussion of two recent antitrust challenges against MasterCard and Visa.

⁵ See Cruickshank (2000), Office of Fair Trading (2003), United States v. Visa (2001), Reserve Bank of Australia (2002), and European Commission (2002).

2.1 Consumers

Credit cards provide consumers a secure, reliable and convenient means of payment. Consumers often receive incentives to use their credit cards such as dispute resolution services, frequent-use awards, and interest-free short-term loans if no balances are carried between billing periods. Credit cards also provide various security features and limit consumer liability in the event of fraudulent use.

Chakravorti (1997) concluded that based on underlying incentives versus other payment instruments, consumers should always use their credit cards to make payment and payoff their balances in full by the due date.⁶ However, some consumers are reluctant to make most of their purchases with credit cards because they fear that they may not be able to make full payment when their credit card bills are due. Furthermore, there are certain purchases that cannot be made with credit cards although this set continues to decrease.

Unlike other payment instruments, credit cards allow consumers access to long-term credit, mostly uncollateralized, at the point of sale.⁷ Consumers that use this option are known as revolvers. Those cardholders who do not avail the credit feature are commonly referred to as convenience users. Industry estimates of U.S. convenience users range from 30 percent to 40 percent of all cardholders. Some observers have suggested that the financing of credit card debt also supports the payment infrastructure and subsidizes convenience use (Chakravorti and Emmons, 2003).

Little data exists on the allocation of costs to convenience users and revolvers. Analyzing a Federal Reserve survey of issuer fees to consumers, Chakravorti and Shah (2003) report that more than half of the issuers do not impose annual fees.⁸ Furthermore, consumers seldom face per-transaction fees. Therefore, convenience users probably pay less than the marginal cost to use credit cards.⁹ In Australia, Katz (2001) reports that while issuers face positive marginal costs per transaction, consumers generally do not pay transaction fees when making credit card purchases and often receive rebates or loyalty points.¹⁰ However, issuers may offer convenience users payment services below their marginal cost because such a pricing strategy improves the risk of their credit portfolios, increases market share, or increases revenue from those convenience users that may choose to borrow in the future.

⁶ I did not consider the costs and benefits of credit card borrowing but instead focused on the payment aspect.

⁷ For empirical studies of consumer decisions to use the long-term credit component, see Ausubel (1991), Brito and Hartley (1995), and Stavins (1996). In the United States, consumers may also be able to access credit lines by using checks.

⁸ However, Rochet and Tirole (2002) report that most issuers in Europe impose annual fees.

⁹ One issuer temporarily dropped convenience users suggesting they may not be profitable. Beneficial National Bank dropped 12,000 cardholders that paid their balances in full each month but later reinstated them with a \$30 annual fee if they did not have \$30 in finance charges that year (USBanker, 1997).

¹⁰ Katz (2001, p.48) states: "Credit and charge card users generally pay transactions fees that are below marginal cost. Indeed, a striking feature of the Australian credit card industry is that many cardholders face negative prices for using their credit cards. These negative prices are the result of rebates and rewards programs." In the same paragraph, he also states: "Even cardholders who are not members of loyalty programs generally pay below-cost transactions fees: The typical transaction fee levied on consumer charges is zero, although the associations and their members have stated that their marginal costs are positive."

2.2 Merchants

Credit cards also offer several benefits to merchants. Merchants are usually paid in good funds within 48 hours of submitting the transaction to their acquirers. In an U.S. survey, 83 percent of merchants said that their sales increased and 58 percent said that their profits increased by accepting credit cards (Ernst and Young, 1996). Credit cards allow merchants to sell to illiquid consumers or to those paying with future income.¹¹ Some observers have noted that credit card acceptance can be used strategically by merchants to steal customers from other merchants. Katz (2001) notes that while individual merchants may benefit, merchants, as a group, may not experience greater sales.

Clearly, these benefits do not come without costs. Merchants pay their financial institutions a percentage of the sales price for credit card purchases known as a merchant discount fee. Generally, in the United States, this fee ranges from one percent to three percent of the total transaction amount. Merchants have successfully negotiated lower merchant discount fees since the introduction of credit cards when the merchant discount rate was six percent.

Data from Australia and the United States indicate that credit cards cost merchants more to accept. In Australia, credit card transactions cost twice as much as checks and over six times as much as cash and debit cards (Australian Retailers Association, 2001). In the United States, credit cards cost twice as much as cash, checks and online debit cards (Food Marketing Institute, 2000). However, the unique benefits provided by credit cards to merchants may outweigh their costs.

2.3 Issuers

Credit card issuers earn revenue from consumers and acquirers. As mentioned above, consumers may pay annual fees, finance charges if they revolve, and other fees, such as cash-advance and over-the-limit fees. Issuers compete for cardholders on various dimensions such as various fees, frequent usage awards, finance charges, and other characteristics.

Acquirers pay interchange fees to issuers to compensate them for costs of attracting and maintaining a cardholder base. These fees are set at the network level. In the United States, these fees vary depending on the types of merchants and other characteristics of the transaction, such as whether the merchant views the physical card or processes it electronically. In Australia, interchange fees are the same for all classes of merchants but differ depending on whether the payments were processed electronically with card and cardholder present or not.

While the main cost to U.S. issuers is associated with the cost of funds and customer defaults comprising of around 50 percent of total costs, around 22 percent of their costs are associated with the operation and marketing of their credit card programs (Budde, 2001). However, over 70 percent of their revenue is from interest income from revolvers and only

¹¹ Merchants can also extend credit directly to consumers. While such extension of credit is common, general-purpose credit card volumes dwarf volumes of merchant-issued credit cards. When general-purpose credit cards were introduced, small merchants found the cost of accepting general-purpose credit cards lower than the cost of extending credit and collecting that debt. On the other hand, many large department stores were initially reluctant to accept general-purpose cards because they feared their own card programs would be adversely affected. Even today, store credit cards generate significant revenues and have the added benefit of increasing repeat business.

a little over 13 percent is from merchant discounts. Annual fee income comprises only 2 percent of total revenue.

2.4 Acquirers

Acquirers earn revenue from merchants by bilaterally setting merchant discount rates and pay interchange fees to issuers. In the United States, some larger merchants are charged merchant discounts close to the interchange fee suggesting that certain market segments may be competitive. Alternatively, merchants could have significant bargaining power individually or as a group to negotiate lower rates. However, there are significant differences between merchant discount fees and interchange fees in other countries.

2.5 Networks

Credit card networks can be classified as two types – proprietary and open networks. Proprietary networks, such as American Express (in the United States) and Discover, operate as issuer, acquirer, and network operator. Open networks are comprised of member banks that can be issuers, acquirers or both. The network sets the interchange fees, which are paid by acquirers to issuers. For the most part, Visa operates as a non-profit organization and until recently MasterCard had a similar structure. The main purpose of these organizations is to meet the needs of their members by providing a set of rules, underlying infrastructure, and some level of research and development to improve their networks. Some of these rules govern the setting of interchange fees, no-surcharge rules, and the acceptance of branded products.

3 Policy issues and the related models

Many regulators are concerned about the effects of certain policies set by payment networks on consumers and merchants. Some economists argue that policymakers should use economic efficiency as the basis for setting policies governing payment systems. Other economists have argued that the least expensive payment instrument should be encouraged. However, incentives in today's marketplace may encourage the use of more expensive payment instruments.¹²

Recently, economists have started to study the effects of some common practices of credit card networks on consumers, merchants, issuers and acquirers. Models that study the interrelated bilateral relationships to date have been theoretical and have highlighted credit card services as a two-sided and a network good. A good is defined as a network good if the increase in the number of users of a good benefits other users.¹³ In credit card markets, the network good is two-sided: a consumer's benefit from card usage is related to the number of merchants that accept them and a merchant's benefit from card acceptance is

¹² An interesting puzzle is the high number of per capita check transactions in the United States. Many observers have argued that checks are more expensive to process than electronic substitutes. However, underlying incentives to each participant have resulted in the continued reliance on checks (Chakravorti and McHugh, 2002).

¹³ For a discussion of network goods and their effects, see Economides (1996), Farrell and Saloner (1986), Katz and Shapiro (1985), McAndrews (1997), and Osterberg and Thomson (1998).

related to the number of cardholders.¹⁴ In this section, I will outline policy concerns of various regulatory and legal authorities around the world and summarize the findings of the recently developed economic models.

3.1 Restrictions on merchant pricing

A policy concern in various jurisdictions is the ability of merchants to impose surcharges for credit card purchases or offer discounts for purchases made with other payment instruments.¹⁵ In the United States, merchants are not prevented from offering cash discounts. While there is no federal statute banning surcharges in the United States, some states ban them. Furthermore, the card networks prevent merchants from imposing surcharges.

One-price policies are defined as policies set by law, card networks, or acquirers that require consumers to pay the same price regardless of the type of payment instrument used.¹⁶ Katz (2001) suggests two potential effects of one-price policies. First, one-price policies may distort the nature of competition and limit the retail price as a mechanism to provide incentives to use certain payment instruments. Second, one-price rules prevent the neutrality of interchange fees. These fees are neutral if the consumption of consumers, profits of merchants and the ability of banks to be compensated for their costs are not affected by the level of the fee.

Most merchants do not set multiple prices based on the cost associated with accepting the payment instrument in jurisdictions where they are allowed to do so. In the 1980s, many U.S. gas stations posted a credit card price and a lower cash price but this practice is not common today (Barron, Staten, and Umbeck, 1992). Australia, the Netherlands, Sweden, and the United Kingdom prohibit credit card networks from imposing NSRs for credit card transactions.¹⁷ A study on surcharging practices in the Netherlands found that only 10 percent of merchants surcharge (Vis and Toth, 2000). The study states that 72 percent of merchants interviewed were not aware that they could impose surcharges. The study also found that of the firms that did not surcharge, 60 percent stated that they did not surcharge because acceptance of credit cards was a service provided as part of the shopping experience and charging for it was viewed as being “unfriendly.” A similar study in Sweden found that only 5 percent of merchants impose surcharges (IMA Market Development AB, 2000).¹⁸ Based on the results of these two studies, the European

¹⁴ Note that in mature markets, the two-sidedness of the good may be independent of the network effect. For example, underlying incentives may prevent usage of a payment product even if consumers have access to it and merchants accept it.

¹⁵ For a discussion of U.S. legislative history of credit card surcharges, see Board of Governors of the Federal Reserve System (1983), Kitch (1990), and Lobell and Gelb (1981).

¹⁶ NSRs are less restrictive than one-price policies. One-price policies imply the price is constant regardless of the payment instrument used. An NSR does not allow merchants to impose surcharges but allows discounts for non-card purchases or discount card purchases vis-à-vis non-card purchases.

¹⁷ Although not common, there are examples of where merchants offer discounts for credit card purchases. In Germany, a department store, immediately following the launch of the Euro, discounted credit card purchases twenty percent over cash purchases because of the added cost of handling cash at that time (Benoit, 2002). In the United States, an online merchant imposed a \$3 fee to process check payments while imposing no such fee for credit card payments. In New Zealand, direct marketers, who sell products through TV infomercials, often provide discounts or special deals for those paying by credit card.

¹⁸ However, acquirers are allowed to impose no-surcharge rules. Visa (2001, p. 36) states: “Swedish law permits acquiring banks to enter into contracts with their merchants under which the merchant is prevented

Commission decided not to further investigate Visa's one-price policies (European Commission, 2001).

Rochet and Tirole (2002) study the effects of one-price policies. Their model assumes issuers have market power, a perfectly competitive acquiring market, and merchants compete in a Hotelling framework.¹⁹ Consumers purchase one unit of a good and are heterogeneous in terms of net benefits received from using the payment card. Their model predicts that for a given interchange fee, allowing merchants to set different prices raises prices for cardholders and reduces the price for users of less-expensive payment instruments. Removing one-price restrictions, when issuers are imperfectly competitive would reduce welfare, if the sum of the issuer and acquirer's costs minus merchant benefits is less than the cardholder's fee. Basically, in a world where merchants set different prices, consumers would reduce their demand for payment cards because of markups at the point of sale for card purchases resulting in issuers focusing on the high-end consumers. Given a sufficiently high cardholder fee, there is already an underprovision of cards and further downward pressure from one-price policies would only decrease welfare. On the other hand, removing the one-price restriction may reduce or increase welfare if the sum of the issuer and acquirer's costs minus the merchant's benefits is greater than the customer's fee subject to the interchange fee where merchants are indifferent between accepting and declining card purchases. If there is an overprovision of cards as is the case when the cardholder fee is sufficiently low, depending on the degree of downward pressure caused by the existence of multiple prices, welfare may improve or worsen.

Wright (2003a) constructs a model to study one-price policies. He considers both fixed fees and per-transaction fees that may be negative. He assumes consumers have inelastic demand for goods and acquirers are perfectly competitive. For monopolist merchants, Wright finds that one-price policies improve welfare. Their absence leads to merchants setting prices to extract surplus from some card users resulting in lower revenue to the card issuer. In fact, when annual fees are introduced, surcharging results in no consumers using cards because merchants extract all the surplus necessary to induce consumers to hold cards in the first place. Katz (2001) argues that this extreme result is due to the assumption of inelastic demand of consumers.

For competitive merchants, Wright finds that a one-price policy does not affect welfare. Absent a one-price policy, merchants will sell goods at their cost plus the cost of the payment instrument less any transactional benefits they obtain from card acceptance. With a one-price policy, competitive merchants will divide themselves into cash-only and card-only merchants. Thus, welfare effects of one-price policies are critically dependent on the level of merchant competition.

Schwartz and Vincent (2002) study the impact of one-price policies and consumer rebates, i.e. issuers paying consumers to use cards, on consumer and total welfare. They assume that the choice to use a credit card is exogenously determined but the demand for consumption goods is elastic. They focus on the merchant discount and a per-transaction fee to consumers and ignore fixed fees such as annual membership fees. There is a

from surcharging. Such merchant-to-acquiring bank agreements enforcing a no-surcharge rule are now commonplace in Sweden.”

¹⁹ Like most of the literature, Rochet and Tirole ignore the credit component of credit cards. Many authors refer to the payment instrument as a payment card instead of a credit card. However, a significant portion of this literature resulted from legal and regulatory actions or proposed actions against credit card networks.

monopolist provider of credit card services to consumers and merchants that are local monopolists.

They have the following results. They confirm results of previous models in the absence of pricing restrictions on merchants: holding constant the sum of the fees to consumers and merchants, the share of this total sum that is made up by the merchant discount (as opposed to cardholder fee) does not affect welfare. Given a one-price policy, however, a decrease in customer fees and an equal increase in the merchant discount cause card usage to increase along with the card service provider's profit. Indeed, the card issuer always gains from a one-price policy, while the merchants and non-card consumers always lose. When rebates to card users are not feasible, one-price policies also harm card users when the number of non-card users relative to card users is sufficiently small. However, when the number of non-card users is sufficiently large, card purchases increase along with overall consumer surplus. Given linear consumer demands and zero benefits to merchants for card acceptance, when card rebates are feasible, a one-price policy generally benefits card users and harms other users. Provided the proportion of non-card users to card users is not too small, a one-price policy along with rebates reduces overall consumer surplus but increases overall welfare (thus, the gains accrue only to card users and the card company).

Chakravorti and Emmons (2003) construct a Diamond-Dybvig model to study the effects of incentives to convenience use and its impact on revolvers that use credit cards. They assume competitive markets for goods and credit card services. They also assume that all consumers are identical *ex ante* and have access to credit cards without fees. They differentiate themselves from the literature by considering the benefits of long-term credit. They consider the potential subsidization of credit card usage costs from finance charges.²⁰ Furthermore, they endogenously derive costs and benefits of card usage.

Similar to Wright (2003a), Chakravorti and Emmons find that with competitive merchants and one-price policies, two types of merchants evolve – those selling only to credit card consumers and those selling only to non-credit card consumers. They find that consumers are better off when merchants are allowed to impose credit card costs on credit card consumers. Rebates offered by issuers to convenience users are necessary for one merchant to serve both types of consumers setting a single price. They show that if consumers significantly discount future consumption, revolvers are willing to bear the cost of the system and overall welfare is improved. They also show that revolvers may be willing to pay convenience users to gain access to the credit card network.

The models surveyed provide the following conclusions about one-price policies. Chakravorti and Emmons, and Wright agree that with perfectly competitive merchants, one-price policies would result in merchants either selling only to card consumers or non-card consumers. Thus, in competitive goods markets, one-price policies do not affect overall welfare.

The welfare effects are ambiguous when merchants and issuers are less than perfectly competitive. Wright finds that one-price policies prevent monopolist merchants from setting excessive surcharges to card paying customers. Schwartz and Vincent find that under certain conditions one-price policies increase welfare by reducing double marginalization caused by a monopolist merchant and a monopolist issuer. They also find under different conditions, one-price policies may decrease welfare. Rochet and Tirole also

²⁰ Katz (2001) recognizes the omission of this potential subsidy of usage fees in most of the literature and stresses its importance.

find ambiguous welfare results for one-price policies when goods and card service markets are less than perfectly competitive. Therefore, the welfare effects of one-price policies are critically dependent on the level of competition among merchants and card-service providers. However, there is consensus that one-price policies harm non-card users when cards are more ‘costly’ for merchants to accept than other payment alternatives (when all costs and transactional benefits of different types of payments are accounted for) and one merchant is able to sell to both card and non-card consumers.

3.2 Interchange fees

There are three main issues that concern regulators about interchange fees. First, why is an interchange fee needed? Second, what are the potential adverse effects of collective setting of interchange fees? Third, how does the profit-maximizing interchange fee differ from the socially optimal one?

The level and determination of the interchange fee has received attention in various parts of the world. In the United States, National Bancard Association, a third-party processor, sued Visa arguing that interchange fees should be set to zero in 1979. The court ruled in favor of Visa allowing collective setting of interchange fees.²¹ In Australia, the Reserve Bank of Australia has imposed regulations regarding the determination of the level of interchange fees in open system credit card networks.²² The European Commission negotiated a reduction in intra-EU interchange rates.

As a result of this scrutiny, the interchange fee has received significant attention by economists. In his seminal paper, Baxter (1983) concludes that the interchange fee is necessary to balance the demand of consumers and merchants for credit card services and the costs among issuers and acquirers. He constructs a one-period model assuming competitive markets for credit card services. Furthermore, he argues that setting interchange fees centrally are less costly than those that are bilaterally negotiated between issuers and acquirers.²³ Baxter argues that the total demand for credit card services are determined by consumer and merchant demands jointly and total cost for credit card services including both issuer and acquirer costs. The equilibrium price and quantity of credit card services occurs when the joint demand for card services equals the joint cost of providing those services. Because acquirer and issuer costs and consumer and merchant demands are not usually symmetric, the interchange fee will most likely not be zero. Furthermore, the determination of interchange fees based solely on costs may not lead to the socially optimal interchange fees when consumers and merchants demand for credit card services differ. A criticism of Baxter’s model is that it does not consider merchants, issuers, and acquirers as strategic players.

Some economists have identified conditions where the interchange fee is neutral. Given competitive issuers, acquirers, and merchants, Carlton and Frankel (1995) argue that interchange fees are neutral. However, Frankel (1998) suggests that the inability of merchants to pass along credit card costs in the form of surcharges prevents interchange fees from being neutral. Furthermore, he argues that the elimination of one-price policies

²¹ For more discussion of this case, see Ahlborn, Chang, and Evans (2001), Balto (2000), Carlton and Frankel (1995), and Evans and Schmalensee (1999, pp. 275-281).

²² See Reserve Bank of Australia (2001) and (2002) for discussion of the proposed and final regulations regarding credit card networks in Australia. Gans and King (2002a) and Katz (2001) provide in-depth analyses regarding the Australian context.

²³ Small and Wright (2001) show this result more formally.

may not necessarily result in merchants setting multiple prices because of the central tendency towards price coherence in retail markets.

Schmalensee (2002) extends Baxter's analysis by considering issuers and acquirers with market power. He supports Baxter's conclusions that the interchange fee balances the costs and demands for credit card services and the socially optimal interchange fee is not likely to be zero. He finds that the profit maximizing (in terms of issuers and acquirers) interchange fee is also socially optimal for a conventional measure of social welfare with linear partial demands and a bilateral monopoly. Katz (2001) criticizes the use of merchants' willingness to pay as a measure of social surplus because it cannot capture the effect of one merchant's decision on other merchants. If merchants' willingness to pay to accept credit cards captures, in part, profits obtained at the expense of rival merchants, then this will not be an appropriate assumption. Schmalensee's model is correct if merchants are all monopolists, or if merchants compete but consumers do not consider whether a merchant accepts cards or not when deciding from which merchant to buy.

Rochet and Tirole (2002) model merchant and consumer decisions more rigorously to consider welfare implications of collective setting of interchange fees and other practices of card networks.²⁴ They find that the socially optimal interchange fee is equal to the profit-maximizing interchange fee when the equilibrium consumer fee is greater than or equal to the sum of the costs to the issuer and the acquirer minus the benefit to the merchant. However, if the equilibrium consumer fee is less than that, issuers set an interchange fee resulting in the overprovision of credit cards.

Rochet and Tirole also consider the effect of consumers' knowledge of card acceptance by merchants. When consumers have some knowledge of merchant card acceptance in advance or face no cost to walk out and purchase the good from another merchant, merchants are able to use card acceptance as a strategic tool to attract customers. Under these circumstances, merchants are willing to pay higher merchant discount fees to accept cards. Their model predicts that if there is an overprovision of card services when consumers have full information, there may exist a lower level of customer awareness of merchant credit card acceptance where the profit-maximizing interchange fee is also the socially optimal one. Finally, they find the interchange fee is neutral if one-price policies are not present.

Wright (2001) extends Rochet and Tirole's analysis by considering merchant heterogeneity. In his model, consumers make purchases from a merchant in each industry. Merchants in a given industry receive the same level of benefits but the level of benefits differs across industries. Similar to Rochet and Tirole, merchants operate in a Hotelling framework within each of the industries. The network only sets one interchange fee for all merchants regardless of their industry.

Wright compares the profit maximizing, output maximizing, and welfare maximizing interchange fees. The output maximizing and profit maximizing fees diverge if merchant fees can be increased more than cardholder fees decrease when interchange fees are increased (or vice-versa). If consumers are fully informed of which merchants accept cards, Wright finds the welfare maximizing interchange fee will be greater than the output maximizing fee if at the output maximizing interchange fee, the average transactional benefit for merchants accepting the card is greater than the merchant discount. If the average transactional benefit of card acceptance is less than the merchant discount, the

²⁴ In a one-price environment, they argue that if issuing and acquiring markets are competitive then the optimal interchange fee would be indeterminate.

socially optimal interchange fee will be less than the output maximizing interchange fee. When combined, the comparison of profit maximizing and output maximizing interchange fees, and output maximizing and welfare maximizing interchange fees, provides a full characterization of reasons why the privately set interchange fee may deviate from the socially optimal level of the interchange fee. Finally, he finds that merchants are willing to pay a higher interchange fee because of increased sales associated with business stealing.

Gans and King (2003) consider market conditions where the level of the interchange fee is neutral. They find that if competitive merchants are able to set different cash and credit prices or if cash-only merchants exist for all goods the interchange fee is neutral. This result is independent of the market power of issuers or acquirers. They argue that whether interchange fees have real effects depend on the nature of merchant competition.

In the case where one-price policies exist and merchants have significant market power, Gans and King (2002b) find ambiguous results regarding whether issuers would attempt to increase profits by raising interchange fees above the socially optimal one. A result of their model is that if acquirers have market power, issuers are competitive, a one-price policy is in place, and merchants have market power, acquirers may choose to increase interchange fees that they pay to issuers to reduce customer fees resulting in greater card usage under certain conditions.

The literature on interchange fees considers two key questions: when is the fee neutral, and if it is not neutral, is there a systematic divergence between the socially optimal and profit maximizing interchange fee? Gans and King (2003), Rochet and Tirole (2002), and Schmalensee (2002) find that the interchange fee is neutral when merchants are allowed to impose surcharges on credit card purchases.

Both Rochet and Tirole and Wright find conditions where the profit maximizing and socially optimal interchange fees diverge with one-price policies. Rochet and Tirole find interchange fees diverge when cardholder fees are below the sum of the issuer and acquirer's costs minus the benefits to merchants. They find an overprovision of cards under such conditions. Wright finds that the socially optimal interchange fee is less than the profit maximizing one, if the merchant discount is greater than the average transactional benefit to merchants.²⁵ Therefore, market conditions determine whether the profit maximizing and socially optimal interchange fees diverge and if they do, which is greater.

3.3 Merchant acceptance

Some models focus on merchant acceptance of credit cards. Wright (2002) focuses on the question of why merchants accept credit cards in a model of Cournot competition for merchants. He allows consumer demands to be elastic and free entry of merchants. He finds that competing merchants will accept credit cards when doing so enables them to earn higher margins. This result arises, to the extent consumers are willing to pay more for goods, when they have the ability to purchase by credit cards. Wright also finds that merchants that accept credit cards sell more and earn more profit than otherwise identical firms do. Industry output increases when credit cards are accepted. While the model

²⁵ In fact, for the special case in which issuers and acquirers earn no profit, Wright (2003b) shows that the socially optimal interchange fee is such that the merchant discount equals the average transactional benefit to merchants that accept cards.

ignores issuer and acquirer behavior, it does provide insight into acceptance of credit cards by merchants.

Instead of using reduced forms for consumer and merchant benefits, Chakravorti and To (2002) focus on merchant benefits resulting from sales to consumers without sufficient funds in a two-period model. In their model, there is a monopolist issuer but a continuum of monopolist merchants selling different goods to consumers facing random consumption shocks for a specific good provided by only one merchant over both periods. Consumers also face random income shocks in both periods. Consumers with sufficient funds to purchase without an extension of credit also benefit from credit cards because of the opportunity to earn float. They assume no credit card usage fees and restrict merchants from setting multiple prices. The monopolist issuer grants credit cards only to consumers that have income in the first period above a certain endogenously determined level.

Their results are as follows. Because consumers face no costs of using credit cards and all receive benefits, all purchases are made with credit cards in the first period. Merchants accept cards if their profits are equal to or greater than not accepting them. Merchants are willing to pay higher fees as the number of consumers without funds increases demonstrating the two-sided network effect in credit card services. However, for the issuer to deliver a greater number of consumers without sufficient income in period 1, it must accept less creditworthy consumers resulting in higher merchant discounts. This model is the only one to highlight this tension.

Unlike Rochet and Tirole, and Wright, in this model, business stealing is intertemporal and across industries. On average, if consumers purchase on credit today, fewer consumers will make purchases tomorrow because a consumer's first period income and a portion of second period income used to make purchases in the first period are not available for purchases in the second period. Business stealing occurs even in the presence of monopolist merchants. Because each merchant is small, has no bargaining power, and cannot affect its own future sales due to the extremely low-probability of repeat customers, all merchants accept credit cards. The issuer sets the merchant discount to capture all additional profits associated with credit card sales resulting in lower two-period profit. If merchants had significant bargaining power or sufficient repeat sales, merchants may be as well off or better off. Furthermore, greater competition in the provision of credit card services may also improve merchant welfare.

Few economic models have explicitly modeled the merchant discount with respect to the tradeoff between greater sales and greater credit risk. The addition of these features to the models discussed earlier would allow a more complete analysis of credit card networks.

3.4 Network Competition

So far, we have discussed competition at the level of merchants in terms of credit card acceptance, issuers in terms of fees and card enhancements offered, and acquirers in terms of fees and services provided. Competition also exists between card networks. This section will focus on competition among different credit card networks.

Scrutiny of MasterCard and Visa in the United States has been primarily in the form of antitrust challenges.²⁶ The U.S. Department of Justice sued MasterCard and Visa alleging

²⁶ For a discussion of these cases, see Carlton and Salop (1996), Chakravorti and Shah (2003), Evans and Schmalensee (1999), and McAndrews and Stefanadis (1999).

that two of their business practices harmed consumers. The court ruled that overlapping corporate governance, if it still existed, between MasterCard and Visa did not pose any harm to consumers and businesses. However, the court ruled that exclusive agreements imposed by the card networks on their members that they could not issue cards from competing networks violated antitrust laws and must be removed.²⁷ The card networks are appealing this part of the decision. If they lose the appeal, financial institutions issuing MasterCard and Visa products will be able to issue American Express and Discover products.

Several economists have argued that joint-venture structures coupled with no profit sharing among members prevent the card associations from earning excessive rents. They argue that if the networks are not allowed to earn profits and cannot distribute them even if they did, potential profits from market power could not be exploited.²⁸ However, MasterCard has since become a for-profit entity. Furthermore, members could benefit from market power of the network, if certain members have significant influence over the setting of fees earned. Only one model to date has investigated the effects of governance duality. Hausman, Leonard, and Tirole (2003) study the effects of overlapping governance structures for joint ventures that are non-profit entities. They find such governance structures may improve standardization and reduce research duplication costs.

Similarly, there have been few attempts to model the effects of network competition. Guthrie and Wright (2003) model competition between two identical payment networks under the assumption of one-price policies. This model extends Rochet and Tirole (2003) model of platform competition by considering strategic interactions of merchants.²⁹ The effects of network competition are dependent on whether consumers carry only one payment card or both.

First, they consider the case when consumers carry only one card. If merchants are homogenous in terms of costs and benefits of card acceptance, their model yields the same results as the Rochet and Tirole model of a single payment network. Competing card schemes set their interchange fees as high as possible provided merchants still accept cards. Their model yields a surprising result when merchants are heterogenous. They find that network competition may lead to merchants being charged more and consumers less (that is, higher interchange fees).

Second, they consider the case when consumers carry both cards. In this environment, up to a point, merchants will decline the card with less favorable terms. Card networks will lower merchant fees resulting in lower interchange fees. Their model finds that the interchange fee is lower than the socially optimal interchange fee. Thus, they conclude that network competition is not necessarily more likely to yield a socially optimal interchange fee than when card services are provided by a single network.

Unlike the issues of one-price policies and setting of interchange fees, competition among payment networks providing similar products has been understudied. A key aspect of network competition is the profit maximizing incentive of financial institutions that are providing payment products. The economic models have largely ignored strategic decisions on the part of financial institutions. Given the recent decision by a U.S. court to

²⁷ For details, see *United States v. Visa U.S.A. Inc.* (2001).

²⁸ See Chang, Evans, and Schmalensee (1998) and Evans and Schmalensee (1995) for further discussion.

²⁹ Rochet and Tirole (2003) lay the foundation for analyzing platform competition for network and two-sided goods.

allow financial institutions to issue any credit card, this issue warrants attention by economic models.

3.5 Competition from other payment instruments

Some payment system observers suggest that the incentives to use the least costly payment instrument are not properly aligned (see Chakravorti and Shah, 2003). Reserve Bank of Australia (2001) and (2002) argues that incentives to convenience users, such as loyalty points, have contributed to the increase in credit card usage and have increased the societal cost of retail payments because less costly payment alternatives exist for consumers who have immediate access to funds.³⁰ Specifically, credit cards have recently surpassed debit cards in terms of number of transactions in Australia.

Over five million retailers in the United States have recently reached a settlement with the two largest card networks regarding the tying arrangements between credit and offline debit cards. In the United States, there are two types of debit cards – online, also known as pin-based, and offline, also known as signature-based. As part of the settlement, the networks agreed to pay the merchants \$3 billion, significantly reduce offline debit interchange fees, and remove honor-all-cards rules. Honor-all-cards rules require merchants accepting a network's branded product to accept all its branded products. For example, if a merchant accepts the network's branded credit card, it must also accept the network's branded debit card.

Economic models have not rigorously investigated competition between payment networks. If priced similarly, consumers should choose the payment instrument that offers greater benefits. Merchants would like to accept the least-expensive and secure payment instrument. Financial institutions would like to encourage the most profitable payment instruments. Models should focus on specific costs and benefits for each instrument to each participant.

4 Conclusion

Regulatory changes and antitrust scrutiny of credit card and other payment networks have resulted in a promising new area of academic research. The major policy issues regarding credit card networks are the determination of interchange fees, pricing restrictions on merchants, and the level of competition within and across payment networks. The models surveyed in this article have built the foundation for future research and shed light on the effects of policies governing credit card networks specifically and payment networks generally.

Unfortunately, no one theoretical model is able to capture all of the key features of payment networks necessary to determine the socially desirable policies. However, a consensus regarding certain policies governing payment cards is starting to emerge. Most models identify card services as two-sided and network goods. Economists generally agree that equilibrium fees for credit card services are dependent on consumers and merchants' demands for card services and acquirers and issuers' costs to provide those services.

³⁰ Total social cost estimates are difficult to calculate. Humphrey and Berger (1990) estimated that credit cards were the most costly retail payment instrument. However, underlying incentives for individual participants may not result in the usage of the least costly instrument from a social cost estimate.

No-surcharge rules and one-price policies have also received quite a bit of attention from regulators and academics around the world. Economic models generally find that cash users subsidize card users when the cost to merchants is greater than the benefits received. The impact of one-price policies on overall welfare when merchants have some market power is ambiguous. Under certain conditions, one-price policies may reduce the double marginalization problem that occurs when both card service providers and merchants have market power. While under other conditions, one-price policies may reduce overall welfare.

There is also a consensus view that given competitive markets for goods, the interchange fee is neutral regardless of the competitive nature of issuer and acquirer markets. When the interchange fee is not neutral, many models investigate the difference between the socially optimal and profit maximizing interchange fee. Under certain conditions, there is no difference. Under other conditions, the socially optimal and profit-maximizing interchange fees diverge, but this does not imply that the profit-maximizing fee is necessarily higher.

There are several aspects of payment networks that still remain understudied. First, it is surprising that few authors consider the costs and benefits of credit when studying credit card networks. Chakravorti and Emmons and Chakravorti and To construct the only models that consider the benefits of credit for consumers, merchants, and financial institutions. Second, little research has been done regarding competition between different payment products. The effects of providing incentives to convenience users may distort the use of other payment instruments that may be less costly to use such as debit cards. Lastly, given the difficulties of fully modeling credit card networks, empirical studies investigating the effects of payment system regulations should be encouraged to determine the effects of various policies in different jurisdictions.

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