Why do merchants accept payment cards?

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Abstract

This note explains why merchants accept expensive payment cards when merchants are Cournot competitors. The same acceptance rule as the Hotelling price competition model of Rochet and Tirole (2002) is obtained. However, unlike the Hotelling model used in the existing literature, in the Cournot setting without free entry of merchants, payment card acceptance expands merchant output and increases merchant profit in equilibrium. With free entry, payment card acceptance increases the number of merchants in the industry and industry output.

1 Introduction

Several models of payment card schemes are built on the assumption that merchants only accept payment cards when they get transactional benefits from doing so that exceed the fees they face (i.e. merchant fees).[1] For instance, see Baxter (1983), Schmalensee (2002) and Wright (2003). In such models payment card acceptance always lowers retail prices. In contrast, Frankel (1988), the Reserve Bank of Australia (2001) and other policymakers have argued that at least for credit cards, merchant fees exceed any transactional benefits merchants receive, and that consequently credit card acceptance raises retail prices.[2]

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[1]Such benefits include the cost savings of not having to handle cash and cheques, and in the case of transactions carried out over the phone, fax, or the Internet, of quicker receipt of payment.

[2]Among others, Bradford and Hayashi (2008) and Weiner and Wright (2005) review policymaker concerns.

Given that merchants typically do not set surcharges for purchases via payment cards, this raises the question why then do merchants accept these cards, especially where consumers typically have access to other means of payment?

Chakravorti and To (2007) provide a model which explains why merchants accept credit cards, based on the ability of credit cards to shift their illiquid customers' consumption forward in time and guarantee sales today versus uncertain sales tomorrow. This relies on consumers being constrained from using other means of payment. Rochet and Tirole (2002) consider a generic payment card and show, using a Hotelling model of competition between merchants, that merchants will also accept cards for strategic reasons, to attract customers who prefer to pay by cards from rivals who do not accept cards. In equilibrium, merchants accept payment cards whenever merchant fees are less than their transactional benefits of accepting cards together with the average benefit their customers get from using cards.[3] This can explain why merchants seem to have low resistance to accepting cards, and is consistent with retail prices increasing as a result of card acceptance. However, their model also implies that in equilibrium merchants do not benefit from accepting cards, and given they assume inelastic demand, card acceptance does not affect merchants' output.

This paper analyzes the incentives merchants face to accept payment cards under a Cournot model of competition. The model incorporates elastic consumer demand, fixed costs of production, and free entry by merchants. Surprisingly, despite these differences, the equilibrium condition for card acceptance is unchanged from Rochet and Tirole's model. The main insight of the model is that merchants accept cards only if doing so increases their margins. This result may seem at odds with the view sometimes expressed by policymakers that credit cards are a more expensive form of payment to accept, but the model shows it is consistent given that payment cards such as credit cards increase consumers' willingness to pay.[4] As a result, merchants that accept payment cards also sell more than otherwise identical merchants, and earn more profit. Collectively, merchants are better off as a result of payment cards, although these higher profits will be competed

[3]The same result is obtained in Wright (2004) under a different timing assumption.

[4]Rochet and Tirole (2008) reach the same conclusion in their broad analysis of payment cards, noting that accepting cards increases a merchant's quality of service by offering to its customers an additional payment option. They show the same acceptance rule holds whether merchants are perfect competitors or Hotelling-Lerner-Salop competitors. This paper shows Cournot competition can be added to their list of models of competition under which the same acceptance rule holds.

away if there is free entry. Industry output increases where payment cards are accepted (either by higher individual merchant output if there is no free entry, or by greater entry of merchants in case of free entry).

The focus in this paper is on merchants' card acceptance decisions rather than any welfare implications of this decision. The analysis of optimal fees and the issue of whether card schemes set interchange fees too high in the present setting are all left for future research. Given final demand is elastic, the welfare analysis is likely to be more complicated than the analysis in the existing literature, especially if merchants get heterogenous benefits of accepting cards as in Wright (2004).[5] Recently, Shy and Wang (2010) also provides a model of payment cards with Cournot competition between merchants. In contrast to this paper they assume constant-elasticity demand. Their focus is also quite different — they focus on explaining the use of ad-valorem card fees rather than per-transaction fees, and to do this they assume merchants either accept cards only or cash only. Nevertheless, their analysis suggests another interesting direction for future research would be to explore what happens to the merchant acceptance rule under ad-valorem fees.

2 A Cournot model of merchant acceptance

Consider a model of a given industry. There are n merchants each with constant marginal costs c of production, and fixed costs of production F. Merchants (sellers) receive transactional benefits of accepting cards b_S per transaction and face a merchant fee m per transaction.[6] Merchants are assumed to compete in quantities. Output is homogeneous in the sense that if all merchants make the same decision regarding card acceptance, consumers will be indifferent about which merchant they purchase from. The indicator variable I_i is defined to take the value 1 if merchant i accepts cards, and 0 if not.

It is assumed each consumer will buy at most one product in the given industry. Consumers willingness to pay for the product (denoted v) is uniformly distributed over $-\infty$ to A, with density one.[7] Income effects are ignored, so consumers simply maximize

[5] The welfare results from the existing literature are surveyed in several papers including Chakravorti (2010), Rochet (2003), Rochet and Tirole (2008) and Verdier (2010).

[6] Different industries can have different values of b_S as in Wright (2004).

[7] This set-up, which is used to avoid having to deal with corner solutions in which all consumers purchase, is based on Katz and Shapiro (1985). Alternatively, the distribution can be over $[-L, A]$ for L sufficiently large that there are always some consumers who do not purchase.

their surplus, buying either one or no unit. When it comes to paying for their purchase, after deciding which merchant to purchase from, consumers (buyers) obtain a specific draw of b_B, their relative transactional benefits of using the card for payment rather than cash, which is continuously distributed with a positive density $h(b_B)$ over the interval $[\underline{b}_B, \overline{b}_B]$. This term could capture the convenience to consumers of not having to obtain (or use up) cash (or cash equivalents), the value of which is determined at the time of the purchase.[8] Consumers face a fee f per transaction for using cards. This fee can be negative to reflect rebates and other financial benefits that consumers receive for using certain payment cards.

Consumers will want to pay with cards if $b_B \geq f$. We define $D(f) = 1 - H(f)$ as the probability consumers will want to use cards for a purchase, and $\beta(f) = E[b_B \mid b_B \geq f]$ as the average convenience benefit to those consumers using cards for a transaction. The *net* average convenience benefit to those consumer using cards is then $\delta(f) = \beta(f) - f > 0$.

3 Characterizing equilibrium behavior

Consumers get expected net utility of $v_i = v - p_i + D(f)\delta(f)I_i$ if they purchase from a particular merchant i, where p_i is the common price set by merchant i regardless of the method of payment.[9] Consumers will pick the merchant with the highest v_i, provided it is non-negative. Given the homogenous product assumption, the hedonic price $p_i - D(f)\delta(f)I_i$ must be the same for any two merchants that both make positive sales. This common level of hedonic price is defined as P. Given the uniform distribution over v, the number of consumers which purchase in an industry is $A-P$. Thus, if merchants produce Q units in total, prices must be set so that $A - p_i + D(f)\delta(f)I_i = Q$. The price facing merchant i is then $p_i = A + D(f)\delta(f)I_i - Q$.

Merchant i's profit is

$$\pi_i = q_i \left[A + D(f)\delta(f)I_i - Q - c - D(f)(m - b_S)I_i\right] - F \tag{1}$$

since a fraction $D(f)$ of all sales will be via cards if the merchant accepts cards. Notice

[8]This ex-post realization of b_B simplifies the strategic analysis and is further justified in Wright (2004). It has since been adopted in several subsequent works (e.g. Guthrie and Wright, 2007, Rochet and Tirole, 2009 and Rochet and Wright, 2010).

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

card acceptance (that is, $I_i = 1$) does two things. It increases the effective price faced by merchant i by $D(f)\delta(f)$, capturing the greater willingness to pay by consumers who can use payment cards. It also increases (or decreases) costs, as measured by the term $D(f)(m - b_S)$. Define the new function $\phi = D(f)(b_S + \delta(f) - m)$. Since profits can be rewritten as $\pi_i = q_i [A - Q - c + \phi I_i] - F$, the function ϕ is a measure of the increase in margins that merchants get from accepting cards.

Merchant i will choose q_i to maximize π_i which implies $q_i = A - Q - c + \phi I_i$. Aggregating this expression over individual merchants and eliminating Q implies

$$q_i^* = \frac{A - c + \phi\left(nI_i - \sum_{j \neq i} I_j\right)}{n+1} \tag{2}$$

and

$$\pi_i = (q_i^*)^2 - F. \tag{3}$$

Given (2) and (3) it follows that

Proposition 1 *Merchants will accept cards if and only if $\phi \geq 0$ or equivalently*

$$b_S \geq b_S^m \equiv m - \delta(f). \tag{4}$$

The condition in (4) defines the level of merchant transactional benefits, below which merchants will not accept cards and above which merchants will accept cards. Note the result does not depend on what other merchants decide. This is the same condition that Rochet and Tirole (2002) and Wright (2004) derive in the setting of Hotelling competition between merchants, and is also the same condition obtained by Rochet and Tirole (2008) for perfectly competitive merchants and for Hotelling-Lerner-Salop competition.[10] Since $\delta(f) > 0$, the proposition says merchants will accept cards even when they face merchant fees above their transactional benefits from doing so. Merchants will only accept cards when this increases their margins (either through an increase in consumers' willingness to pay and/or lower costs). Equations (2) and (3) show merchants will also produce more output and earn more profit as a result.

[10] To be precise, in Rochet and Tirole's (2002) model the term $\delta(f)$ in (4) is replaced by $\beta(f)$. This difference arises because in their model the cardholder fee f is a fixed fee and so arises regardless of the extent to which the card is used. Moreover, in their model a second equilibrium is possible for some values of b_S, but is ruled out. Here there is a unique equilibrium, due to our different timing assumption on b_B.

Given the symmetry of merchants within an industry, each will have the same acceptance decision (referenced with the indicator variable I). Total industry output is

$$Q^* = \frac{n}{n+1}\left[A - c + \phi I\right]. \tag{5}$$

As rival merchants increase their output in response to the higher margins obtained from card paying customers, the increase in margins each obtains is reduced. Unlike with the Hotelling model, this business stealing effect does not fully offset the direct effect of card acceptance, so margins still increase and merchants that accept cards earn higher profits. Collectively, they are better off.

The equilibrium retail price is

$$p^* = \frac{A + D(f)\delta(f)I}{n+1} + \frac{n}{n+1}(c + D(f)(m - b_S)I) \tag{6}$$

which can be higher or lower than in the absence of cards. The more benefits consumers get from being able to use cards, the higher is the price that merchants will receive for their products. At the same time, prices will also be higher (or lower) to the extent net costs $(m - b_S)$ are higher (or lower).

Allowing for free entry (and ignoring the integer constraint) implies

$$n^* = \frac{A - c + \phi I}{\sqrt{F}} - 1 \tag{7}$$

merchants will enter the industry, driving q_i^* to $\sqrt{F}$ and economic profits to zero. With free entry, card acceptance does not change each merchant's output, but it increases the number of merchants in the industry and so industry output. Substituting (7) into (5) and (6) implies $Q^* = A - c + \phi I - \sqrt{F}$ and $p^* = c + \sqrt{F} + D(f)(m - b_S)I$. Equilibrium retail prices are the same as in Proposition 1 of Rochet and Tirole (2002), where the transportation parameter t is set equal to $\sqrt{F}$. Retail prices will be higher (lower) in industries with $b_S < m$ ($b_S > m$).

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