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A short survey on switching costs and dynamic competition ☆

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ABSTRACT

When consumers have switching costs of changing the product that they purchase from period to period firms may compete aggressively to attract them, to potentially take advantage of the consumers' future inertia. Similarly, consumers may foresee that they may be held up, and adjust their choices. This paper considers these market forces in the literature on switching costs, while focusing on the effects of (1) firms being forward-looking, (2) consumers being forward-looking, (3) degree of stability of consumer preferences, and (4) market time horizon.

1. Introduction

In many markets consumers may incur costs of switching from one product to another in the same product category. Some of these costs can be pecuniary (e.g., the termination fees for a wireless service contract), while others are psychological (e.g., disutility of not buying a brand that a consumer is used to).

This paper presents a synthesis of various market effects that arise in markets with switching costs. In particular, we analyze a model of competition in which consumers face switching costs and describe how the effects of switching costs on product market competition are affected by the following factors: (1) firms' foresight, (2) consumers' foresight, (3) stability of consumer preferences, and (4) market time horizon. Given the dynamic nature of markets with switching costs, these factors are important determinants of product market outcomes. There is a large literature in switching costs that has looked at these market effects (see Farrell & Klemperer, 2007 for a survey). Some early papers on switching costs are, for example, Rosenthal (1982), von Weizsacker (1984), Klemperer (1987a,b), Farrell and Shapiro (1988, 1989), Beggs (1989), Wernerfelt (1991). For a recent survey on information technology and switching costs see Chen and Hitt (2006). For empirical estimates of switching costs and/or their effects in markets see the literature on loyalty and state dependent effects for packaged goods (e.g., Bucklin, Gupta, & Han, 1995; Che, Sudhir, & Seetharaman, 2007; Dubé, Hitsch, & Rossi, 2009; Guadagni & Little, 1983; Roy, Chintagunta, & Haldar, 1996), Stango (2002) for credit cards, Strombom, Buchmueller, and Feldstein (2002) for health plans, Shy (2002) for bank deposits, Shi, Chiang, and Rhee (2006) and Park (2010) for cellular phones, Viard (2007), for the telephone markets, and Hartmann and Viard (2008) for the airline industry. For the packaged goods industry, Che et al. (2007) and Dubé et al. (2009) consider empirical market equilibrium implications of switching costs.

To preview our themes, we note that in most markets with switching costs, three effects are likely to be observed: (1) Firms may want to charge higher prices to their existing consumers who are unwilling to switch to a competing product due to their switching costs, (2) Firms may compete aggressively by lowering price to acquire consumers in order to get the rents in the future from the consumers with switching costs, and (3) The first-time consumers may foresee that they might get locked into a specific product in the future, and become less price sensitive, which is a force towards higher prices. The net effect of these three market forces may lead to either higher or lower equilibrium prices and profits. As noted in Viard (2007, p. 149), "Previous theoretical work suggests that the presence of switching costs has an ambiguous effect on prices when firms charge a single price. These models imply that a change in switching costs can either lower or raise prices, depending on industry features."

Here we illustrate that if firms are more forward looking, prices and profits will tend to be lower with switching costs. Moreover, if consumers are more forward looking, prices will tend to be higher with switching costs. We also argue that if consumer preferences are less stable through time, firms will not be able to charge prices as high to the consumers that have previously bought from them as when consumer preferences are more stable, and prices and profits are lower.

In the next section we present a simple two-period model that illustrates these market forces and show the comparative statics results. Then we discuss an infinite horizon version of the model. We conclude with a taxonomy of switching costs and suggestions for future research.

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2. Two period model

We consider a two-period, two-firm model in which each firm sells a fixed product in each of the two periods. Each consumer buys at most one unit in each period. Consumers are uniformly distributed along a Hotelling segment of unit length, whereas the firms are located at the extremes of the segment. Transportation costs are t per unit and production costs are zero. Consumers who buy from firm i in the first period incur a switching cost s if buying from firm $j \neq i$ in the second period.

A fraction y of consumers has the same relative preferences for the two firms in both periods, while a fraction 1-y has preferences in the second period that are completely independent of the preferences in the first period.[1] In the first period a given consumer does not know if his/her preferences will change in the second period but know that a fraction 1-y will have different preferences in the second period. The preferences of consumers that change preferences are still uniformly distributed on the Hotelling segment. The parameter y can be seen as an index of how consumer preferences are stable over time. The possibility of consumers changing preferences is considered, for example, in von Weizsacker (1984) or Klemperer (1987a). Dubé et al. (2009) assume that a part of each consumer's preferences can change from one time period to another, which is equivalent to the case of intermediate y in our model, and numerically compute the market equilibrium with a mixed logit consumer differentiation when consumers are myopic.

Firms discount the second period with discount factor δ_F and consumers discount the second period with discount factor δ_C. Klemperer (1987a) considers a similar two-period model with the following differences: (1) The consumers and firms discount the future at the same rate, or consumers are myopic, (2) there is a set of consumers that leaves the market in the first period, and a set of consumers that enters the market in the second period; (3) All consumers have the same switching costs. Klemperer (1987a) discusses as well how different conditions may lead to lower or higher equilibrium prices depending on the market conditions (see, for example, p. 149).

We now solve this game backward, starting from the second period.

2.1. Second period equilibrium

Let q_1^i be the distance to Firm i of a consumer that is indifferent in the first period between the two firms (note $q_1^i = 1 - q_1^j$). Firm i is guaranteed a demand yq_1^i in the second period from the consumers that do not change their preferences, a demand of $(1-y)q_1^i \frac{t+s+p_2^j-p_2^i}{2t}$ from the consumers who changed preferences and who bought from Firm i in the first period, and a demand of $(1-y)(1-q_1^i)\frac{t-s+p_2^j-p_2^i}{2t}$ from the consumers who changed preferences and who bought from Firm j in the first period. Adding these demands, and maximizing profits for both firms one obtains the second period equilibrium prices as $p_2^i = t + \frac{2t}{3}\frac{y}{1-y}(1+q_1^i) + \frac{s}{3}(2q_1^i - 1)$. In a symmetric equilibrium, which we are going to focus on, we have $p_2^{i*} = \frac{t}{1-y}$. Denoting D_2^i as the demand in period 2 for firm i, we have $\frac{\partial D_2^i}{\partial p_2^i} = \frac{1-y}{2t}$ and $\frac{\partial D_2^i}{\partial q_1^i} = y + (1-y)\frac{s}{t}$ at the symmetric equilibrium, and $\frac{\partial p_2^j}{\partial q_1^i} = -\frac{2}{3}\left(\frac{ty}{1-y} + s\right)$. Denoting π_2^i as the profit of firm i in the second period, we have then at the symmetric equilibrium $\frac{\partial \pi_2^i}{\partial q_1^i} = p_2^{i*}\left(\frac{\partial D_2^i}{\partial p_2^j}\frac{\partial p_2^j}{\partial q_1^i} + \frac{\partial D_2^i}{\partial q_1^i}\right) = \frac{2}{3}\left(\frac{yt}{1-y} + s\right)$.

[1] For simplicity in the analysis, we assume that consumers that do not change preferences have high switching costs so that they buy the same product in the second period as in the first period. Alternatively one could assume a set of new consumers coming into the market in the second period.

2.2. Consumer first-period decisions

We now consider the consumers' first-period decisions. The consumer indifferent between the two firms would determine the demand for product i as

$$p_1^i - p_1^j + t\left(2q_1^i - 1\right) + \delta_C y\left[p_2^i - p_2^j + t\left(2q_1^i - 1\right)\right] + \delta_C(1-y)\left(M^i - M^j\right) = 0 \tag{1}$$

where M^i is the expected cost in the second period for a consumer that bought product i in the first period and changed preferences. The term M^i is $E_z Min[p_2^i + tz - s, p_2^j + t(1-z)]$ which is equal to $\frac{t+s+p_2^j-p_2^i}{2t}\left(p_2^i + \frac{t+s+p_2^j-p_2^i}{4t}t - s\right) + \frac{t-s+p_2^i-p_2^j}{2t}\left(p_2^j + \frac{t-s+p_2^i-p_2^j}{4t}t\right)$, and from which one can obtain $M^i - M^j = \frac{s}{t}\left(p_2^i - p_2^j\right)$. From the above analysis, the demand in the first period, q_1^i, as a function of the first period prices, is determined by

$$p_1^i - p_1^j + \left(2q_1^i - 1\right)\left[t + \delta_C \frac{2}{3}\frac{1-y}{t}\left(\frac{ty}{1-y} + s\right)^2 + \delta_C yt\right] = 0. \tag{2}$$

2.3. Firms' first-period equilibrium

The problem of each firm is to maximize the present value of profits, $p_1^i q_1^i + \delta_F \pi_2^i(q_1^i)$. The first order condition is $q_1^i + \left(p_1^i + \delta_F \frac{\partial \pi_2^i}{\partial q_1^i}\right)\frac{\partial q_1^i}{\partial p_1^i} = 0$. One can then obtain the symmetric equilibrium first-period prices as

$$p_1^{i*} = t + \frac{2}{3}\delta_C \frac{1-y}{t}\left(\frac{ty}{1-y} + s\right)^2 + \delta_C yt - \frac{2}{3}\delta_F\left(\frac{ty}{1-y} + s\right). \tag{3}$$

and we can obtain that the equilibrium present value of profits is $\frac{1}{2}\left(p_1^{i*} + \delta_F p_2^{i*}\right)$.

We now describe the comparative statics results for this model.

2.4. Forward-looking firms

From the analysis above it is clear that the more the firms are forward looking, i.e., higher the value of δ_F, the lower are the first period prices and the profits obtained in the first period, $\frac{1}{2}p_1^{i*}$, in the symmetric equilibrium (given $y < 1$). The second period prices and profits remain unchanged. This result is highlighted, for example, in Cabral and Villas-Boas (2005), but it is also present throughout the switching costs literature (e.g., Beggs, 1989; Klemperer, 1987a). The point is that, with switching costs, firms compete more aggressively for the first-period for consumers, because of the consumer lock-in in the second period.

2.5. Forward-looking consumers

From the analysis above, it is also clear that the more consumers are forward looking, i.e., higher value of δ_C, the higher the first-period prices and profits, while the second-period prices and profits remain unchanged. This effect is present and well-understood also throughout the switching costs literature. See, for example, Klemperer (1987a) or Villas-Boas (2004) for a two-period model, or Villas-Boas (2006) for an infinite version model. The intuition is that consumers in the first period are aware that a current lower price will be followed by a higher price in the future, and therefore become less price sensitive. Note that if consumers are myopic, $\delta_C = 0$, then prices in the first period are below the no switching costs case, which was noted as a possibility in the literature above. This is the case in Dubé et al. (2009) which numerically computes the market equilibrium with myopic consumers.

Furthermore, if most consumers change preferences (y is small) then the present value of profits is lower with switching costs than without switching costs.

2.6. Stability of consumer preferences

If most consumers do not change their preference (y is sufficiently high) then the firms' profits will always be higher with switching costs. If y is small, the impact of switching costs depends on the level of foresight that the firms and the consumers have. In particular, the firms' profits can be lower with switching costs if the firms are more forward-looking than the consumers, and the reverse can be obtained if the consumers are much more forward-looking than the firms. If $\delta_C = \delta_F$, then the firms' profits are lower with switching costs than without, if the s and y are small.

2.7. Switching costs

With myopic consumers ($\delta_C = 0$), the first period profits are decreasing in the switching costs s. If consumers and firms discount the future at the same rate ($\delta_C = \delta_F$) and y is small, then the present value of profits are decreasing in the switching costs s for small s and increasing for large s. Cabral (2009) presents this effect of lower profits with switching costs for small switching costs.[2] Note also that for large switching costs s, Klemperer (1987a) for a two-period model, and Beggs and Klemperer (1992), for an infinite horizon model, can be seen as showing that profits are higher if firms and consumers have the same discount factors. Note that y could also be seen as a measure of switching costs, and that increasing y leads to higher second-period prices for any δ_C, such that a small increase in s and y may lead to lower prices, while a large increase may lead to higher prices.

3. Infinite horizon

The results in Beggs and Klemperer (1992) and Villas-Boas (2006) show how the above effects may hold in an infinite horizon. In particular, Villas-Boas (2006), in the context of a consumer learning explanation for switching costs, shows that equilibrium prices can be lower if firms are more forward-looking than consumers, and that the reverse is true when consumers are more forward-looking than firms.

To illustrate the effects above in an infinite horizon model, we assume that the competing firms are facing overlapping generations of consumers, with each generation of mass one living for two periods. The consumer preferences are the same as those considered in the two-period model. One can then show that, under certain conditions, there is a Markov Perfect Equilibrium in which the prices in each period are a linear function of the market share in the previous period (the payoff-relevant state variable), and the market shares converge to the steady-state with a 50–50 division of the market. A Markov Perfect Equilibrium is a subgame perfect equilibrium where the actions of each player at each moment in time are only a function of the payoff-relevant state variables. See Maskin and Tirole (2001). For an early application of the Markov Perfect Equilibrium in marketing see Villas-Boas (1993).

We can then write the equilibrium price by firm i in period t as a function of that firm's demand in the previous period from the generation of consumers that entered the market then, q^i_{t-1}, as $p^i_t = c + dq^i_{t-1}$, where c and d are constants determined in the market equilibrium. Note that this yields $p^i_t - p^j_t = d(2q^i_{t-1} - 1)$. Denoting the equilibrium present value of profits of firm i starting in period t given q^i_{t-1} as $V(q^i_{t-1})$, and the demand for firm i in period t from the generation of consumers that came into the market in period $t-1$ as q^i_{ot} we can then have

$$V\left(q^i_{t-1}\right) = \max_{p^i_t} p^i_t \cdot \left(q^i_t + q^i_{ot}\right) + \delta_F V\left(q^i_t\right) \tag{4}$$

where both q^i_t and q^i_{ot} depend on both firms' prices, and the maximization (4) takes into account firm j's equilibrium actions. Solving for each parameter in $V(q^i_{t-1})$ for the right and left hand side of (4) one can completely characterize the Markov Perfect Equilibrium.

Using the earlier analysis, $\frac{\partial q^i_t}{\partial p^i_t} = -\frac{\partial q^i_t}{\partial p^j_t} = -\frac{1}{\Delta}$ with $\Delta \equiv 2t + \delta_C y(2t+2d) + \delta_C(1-y)\frac{2sd}{t}$, and $\frac{\partial q^i_{ot}}{\partial p^i_t} = -\frac{\partial q^i_{ot}}{\partial p^j_t} = -\frac{1-y}{2t}$. At the steady-state with a 50–50 division of the market, the equilibrium prices satisfy

$$1 - p^{i*}_t\left(\frac{1}{\Delta} + \frac{1-y}{2t}\right) + \delta_F \frac{\partial V(1/2)}{\partial q^i_{t-1}}\left(-\frac{1}{\Delta}\right) = 0. \tag{5}$$

One can then obtain that if y is close to zero, and if consumers are myopic, then the equilibrium steady-state prices are lower when the switching costs are positive, as $\frac{\partial V(1/2)}{\partial q^i_{t-1}} > 0$. Similarly, if the firms are myopic, then the equilibrium steady-state prices are higher when the switching costs are positive. As before, it can also be shown that if the firms are sufficiently more forward looking than the consumers, the equilibrium steady-state prices are lower with switching costs than without switching costs.

4. Discussion and conclusions

We have provided a synthesis of the existing literature about the effects of consumers' switching costs on equilibrium prices and profits in a variety of dynamic models focusing on the role of firm foresight, consumer foresight, preference stability, and time horizon. The papers in this stream generally assume that the switching costs are exogenous and that firms cannot discriminate between existing customers and new (i.e., competitor's existing) customers. Several scholars have relaxed one of these two assumptions and examined how the firms can strategically influence consumers switching costs. For example, Kim, Shi, and Srinivasan (2001) show that competing firms may offer inefficient rewards rather than efficient rewards in their loyalty programs as a way to reduce competition (see also Caminal & Matutes, 1990). Chen (1997) and Taylor (2003) study the possibility of price discriminating between previous and other consumers (customer recognition), paying consumers to switch or to continue purchasing from the same firm. Villas-Boas (1999) and Fudenberg and Tirole (2000) focus on the case of customer recognition without adding the additional dynamic effects of switching costs. Shaffer and Zhang (2000) consider the second period of a two period model. For a discussion of switching costs under customer recognition see Fudenberg and Villas-Boas (2006, pp. 408–413). For dynamic competition with both switching costs and network externalities see Dobos (2004) and Doganoglu and Grzybowski (2004). See also Villanueva, Bhardwaj, Balasubramanian, and Chen (2007) for similar effects considered here in the context of customer recognition.

We believe that future research can further enrich our understanding of the markets with switching costs by building models that can differentiate among different types of switching costs incurred by consumers. Nilssen (1992) and Farrell and Klemperer (2007) note that some of the switching costs are learning costs that are incurred the first time a consumer buys a firm's product but not subsequently. See Villas-Boas (2004), and the infinite-horizon model in Villas-Boas (2006), for a formal consideration of these consumer learning effects as an explanation for switching costs, with similar results to the ones presented here in terms of the effects of discount factors on equilibrium profits. If we use a general interpretation of switching costs to include all the costs that reduce a consumer's incentives to switch suppliers, we can see that the consumers' cost of switching from an existing product to a different product can be due to a variety of reasons. Sometimes the switching costs primarily arise because of termination of an existing relationship. For example, a consumer prematurely leaving a wireless service contract often has to pay a termination fee. In other cases, the consumers may not incur termination costs. But if they do not have

[2] See also Shin and Sudhir (2009).

adequate information about or expertise in a product category, they may have to engage in an extensive search and/or evaluation process to gather information about the available products and their attributes and then choose the product that gives the best match. The costs of this search and evaluation process (e.g., Iyengar & Lepper, 2000; Kuksov & Villas-Boas, 2008; Shugan, 1980) can also be seen as switching costs. Finally, adopting a new product may involve buying new equipment or accessories, learning new sets of controls and procedures or transferring information to new hardware. Thus, the sources of switching costs can be classified as: (1) termination, (2) search and evaluation, and (3) adoption. Although each of these sources can give rise to switching costs, the nature of these switching costs may be different and therefore modeling them separately may be fruitful. For example, in many cases, there will be no uncertainty about the amount of termination costs, but there can be considerable uncertainty about the amount of costs consumers need to incur in adopting a new product. This is because consumers may discover the full extent of costs of installation and accessories only after purchasing the product. It is also possible that different consumers within a given market may be affected differently by these costs. Therefore, modeling different types of switching costs separately can also allow researchers to discover interesting consumer heterogeneity. For example, it is possible that two customers in the wireless market may have the same total switching costs. But one of them could be a technologically sophisticated wireless consumer at the end of beginning of her subscription contract, who may not face any search and evaluation cost but may incur significant termination cost if she changes wireless service providers. The other customer could be a less sophisticated consumer at the end of his subscription contract, who may face very little termination cost but will need to incur significant search and evaluation costs. Finally, there is evidence (e.g., Desai, Kalra, & Murthi, 2008) that shows that consumers may see different levels of cost of adoption for different firms in the market. For example, the cost of switching to a newer firm may be higher than the cost of switching to an older firm. Each firm will need to develop a unique set of strategies to address the specific set of switching costs that different customer segments face. Modeling different types of switching costs will allow us to better identify and analyze these strategies.

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