Small Switching Costs Lead to Lower Prices

Luís Cabral*

New York University and *CEPR*

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Abstract

I argue that the numerical result obtained by Dubé, Hitsch and Rossi (2008) is fairly general: in a dynamic model of price competition with switching costs, average price in a symmetric equilibrium decreases in the value of the switching cost for low values of the switching cost.

*Stern School of Business, 44 West Forth Street, New York, NY 10012; lcabral@stern.nyu.edu.

1 Introduction

Consumers frequently must pay a cost in order to switch from their current supplier to a different supplier (Klemperer, 1995; Farrell and Klemperer, 2007). These costs motivate some interesting questions: are markets more or less competitive in the presence of switching costs? Specifically, are prices higher or lower under switching costs?

As Dubé, Hitsch and Rossi (2008) state — echoing Farrell and Klemperer (2007), among others —, we may divide the effects of switching costs into two categories: "harvesting" and "investment." The former corresponds to the idea that switching costs increase a firm's static market power, which in turn leads the firm to increase prices. The latter corresponds to the dynamic incentives a firm has to increase its market share, which lead the firm to decrease prices.

Which of the two effects dominates? Conventional wisdom and the received economics literature suggest that the harvesting effect dominates (Farrell and Klemperer, 2007). Dubé, Hitsch and Rossi (2008) cast doubt on this assertion, claiming that small levels of switching costs may actual decrease equilibrium prices.[1] In this note, I expand the theoretical argument underlying Dubé, Hitsch and Rossi's (2008) result. In doing so, I hope to clarify the intuition for the result and suggest the extent to which it generalizes. In a nutshell, while recognizing that the harvesting effect is generally positive (higher prices) and the investment effect generally negative (lower prices), I also argue that, for small values of the switching cost, the harvesting effect is of second order of magnitude, whereas the investment effect is of first order of magnitude.

This note, which summarizes some of the results in Cabral (2008), is structured as follows. In Section 2, I lay down a fairly general framework of dynamic competition and characterize the harvesting and the investment incentives present in dynamic pricing. Then in Section 3 I argue that, if switching costs are small, then their effect on harvesting is of lower order of magnitude than their effect on investment. Finally, Section 4 presents some concluding remarks.

1. See also Doganoglu (2005) and Viard (2003).

2 Harvesting and investing

Consider the dynamic optimization problem faced by a generic firm i. Its value is given by

$$V_i(\mathbf{x}, \mathbf{p}; s) = (p_i - c_i)\, q_i(\mathbf{x}, \mathbf{p}; s) + \delta\, \widetilde{V}_i(\mathbf{x}, \mathbf{p}; s)$$

where $\mathbf{x}$ denotes a vector of state variables (e.g., market shares), $\mathbf{p}$ a vector of current prices, and s the level of switching costs.[2] The variables indexed with an i are firm i specific variables: p_i is price, c_i unit cost, and q_i quantity sold; V_i is value and $\widetilde{V}_i$ continuation value. Finally, δ is the discount factor.

Maximization with respect to p_i implies

$$q_i(\mathbf{x}, \mathbf{p}; s) + (p_i - c_i)\, \frac{\partial\, q_i(\mathbf{x}, \mathbf{p}; s)}{\partial\, p_i} + \delta\, \frac{\partial\, \widetilde{V}_i(\mathbf{x}, \mathbf{p}; s)}{\partial\, p_i} = 0 \tag{1}$$

At first, this seems like a complicated expression. I will try to show that it is actually quite simple. Define

$$q_i' \equiv \frac{\partial\, q_i}{\partial\, p_i}$$
$$\widetilde{V}_i' \equiv \frac{\partial\, \widetilde{V}_i}{\partial\, q_i}$$

(Notice the first derivative is taken with respect to p_i, whereas the second is taken with respect to q_i.)

Suppose that firm i's future value only depends on current choices through firm i's output level. This is true in many models with switching costs, learning curves, etc. Then we have

$$\frac{\partial\, \widetilde{V}_i(\mathbf{x}, \mathbf{p}; s)}{\partial\, p_i} = \frac{\partial\, \widetilde{V}_i(\mathbf{x}, \mathbf{p}; s)}{\partial\, q_i}\, \frac{\partial\, q_i}{\partial\, p_i} = \widetilde{V}_i'\, \frac{\partial\, q_i}{\partial\, p_i}$$

I can now re-write the first-order condition (1) in simpler notation (also omitting the functional arguments for simplicity):

$$p_i - c_i = \left(\frac{q_i}{-q_i'} \right) - \delta\, \widetilde{V}_i' \tag{2}$$

2. Although I will be thinking about the problem of switching costs, much of what I develop in this section could be applied to other exogenous parameters, such as the degree of product differentiation or the steepness of learning curves.

The right-hand side of (2) depicts the two main incentives present in dynamic strategic pricing: the *harvesting incentive* and the *investment incentive*.[3] The harvesting incentive refers to the increase in price-cost margin that follows from a firm's market power. In (2), this increase in market power comes from a greater market share (greater q_i) and a more inelastic demand curve (lower $|\,q_i'|$).

Consider now the second term. To the extent that greater sales today increase a firm's future value, that is, $\widetilde{V}_i' > 0$, a firm will tend to lower its price cost margin. By doing so, the firm "invests" in market share: it lowers its current profit margin in exchange for a greater market share in the future. We thus have the investment incentive.

In the next section, I specialize this framework by making some additional assumptions and by examining the specific case of small switching costs.

3 Small switching costs

How do switching costs influence pricing? Since switching costs do no alter a firm's costs, from (2) we see that the question amounts to evaluating the effect of switching costs on harvesting and on investment pricing incentives. Specifically,

$$\frac{d\,p_i}{d\,s} = \frac{d}{d\,s}\left(\frac{q_i}{-q_i'}\right) - \delta\,\frac{d}{d\,s}\left(\widetilde{V}_i'\right)$$

Let us then go by parts. First, let us examine the effect of switching costs on harvesting. Such *harvesting effect* is given by

$$\frac{d}{d\,s}\left(\frac{q_i}{-q_i'}\right)$$

Intuitively, we would expect higher switching costs to lead to lower $|\,q_i'|$ and thus to higher p_i: switching costs lead to more inelastic demand, and all else being equal this leads to higher prices. What about the effect of switching costs on q_i? Suppose that, going into period t, firm 1 has a larger market share than firm 2. Then we would expect an increase in switching costs to

3. I will denote by harvesting (resp. investment) *incentive* the extent to which current profitability (resp. future profitability) influences optimal prices. I will denote by harvesting (resp. investment) *effect* the influence of switching costs on price through harvesting (resp. investment) incentives.

increase firm 1's market share in period t and decrease firm 2's market share in period t. In fact, some of the customers that firm 2 expected to attract in period t will now prefer to purchase from firm 1 because of higher switching costs. In other words, the effect of switching costs on q_i is likely to be positive for some firms and negative for others.

Consider now the effect of switching costs on $\widetilde{V}_i'$: the *investment effect.* Suppose that the only intertemporal links are due to switching costs. In the limit when switching costs are zero, we have $\widetilde{V}_i' = 0$: the firm's continuation value is independent of its current sales. The greater the value of switching costs, the more sensitive future value is to current sales. It follows that $\widetilde{V}_i'$ increases as switching costs increase. Notice that, unlike the harvesting effect of switching costs, the investment effect is positive for all firms: for large firms, $\widetilde{V}_i'$ increases because there is more to be lost from decreasing market share; for small firms, $\widetilde{V}_i'$ increases because there is more to be gained by increasing market share.

In summary, the harvesting effect of higher switching costs is positive for some firms and negative for others, whereas the investment effect is negative for all firms.

In Cabral (2008), I show that, under some additional assumptions, the overall effect is negative: higher switchings costs lead to lower average equilibrium prices. Specifically, I show that the average harvesting effect (average across all firms) is approximately equal to zero, whereas the investment effect is negative for all firms (and so is the average investment effect).

In other words, the result obtained numerically by Dubé, Hitsch and Rossi (2008) is valid more generally. Like Dubé, Hitsch and Rossi (2008), I consider the case when sellers compete for one single buyer. In one respect, I make an additional simplifying assumption: I consider the case when there are only two sellers and there is no outside option, that is, the buyer always makes a purchase from one of the sellers. Other than this, my analysis is more general than Dubé, Hitsch and Rossi (2008). In particular, I make very mild assumptions regarding the nature of product differentiation. My assumptions include as a particular case the extreme value distribution, the case considered by Dubé, Hitsch and Rossi (2008); but also many other standard distributions (normal, log-normal, uniform, t, etc).

4 Concluding remarks

Dubé, Hitsch and Rossi (2008) have shown numerically that a small level of switching costs increases the level of market competition. One limitation of numerical simulations such as theirs is that they depend on particular choices of functional forms and parameter values. By contrast, one advantage of analytical results like the ones I present in Cabral (2008) is that very mild assumptions are made regarding functional forms. An additional advantage of the analytical approach is that the intuition for the results becomes more apparent.

Having established the generality of the results in Dubé, Hitsch and Rossi (2008), I conclude by noting two important assumptions on which they rely. First, as stressed by Dubé, Hitsch and Rossi (2008) and as the title of my note suggests, the results depend on the value of switching cost being small. In fact, in Cabral (2008) I show that for higher values of the switching cost equilibrium prices are increasing in the value of switching cost and eventually become higher than they would be if there were no switching costs.[4] The case of large switching costs is perhaps closer to the conventional wisdom regarding the anti-competitive effects of switching costs. Beggs and Klemperer (1992), the standard reference in dynamic competition with switching costs, assume infinite switching costs and show that equilibrium prices are higher than if there were no switching costs.[5]

Second, the competitive effect of switching costs depends on symmetry across firms. In the argument presented in Cabral (2008) and summarized above, I show that the harvesting effect of small switching costs is small; in particular, it is of second order of magnitude. The idea is that a small switching costs leads the "incumbent" firm (the firm to whom the consumer is attached) to increase price, and the "challenger" firm (the firm with no consumer attached) to lower price. In absolute value, these price variations are of the same size. Therefore, if each firm is expected to make a sale with approximately the same probability, it follows that average price remains about constant. But if the incumbent firm has a much higher probability of sale (because, say, its product is better) than the "harvesting" price changes no longer average to zero.

To sum up, the effect of switching costs on market competitiveness is

4. This pattern was also shown by Dubé, Hitsch and Rossi (2008), though again for the particular case of preference shocks that follow an extreme value distribution.

5. See Cabral (2000, p. 218) for an elementary treatment.

largely an empirical question. For this reason, papers like Dubé, Hitsch and Rossi (2008) represent important contributions to our understanding of this phenomenon.

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