Enhancing Market Power by Reducing Switching Costs

JAN BOUCKAERT
HANS DEGRYSE
THOMAS PROVOOST

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Abstract

Competing firms often have the possibility to jointly determine the magnitude of consumers' switching costs. Examples include compatibility decisions and the option of introducing number portability in telecom and banking. We put forward a model where firms jointly decide to reduce switching costs before competing in prices during two periods. We demonstrate that the outcome hinges crucially on how the joint action reduces consumers' switching costs. In particular, firms will enhance their market power if they implement measures that reduce consumers' switching costs by a lump sum. Conversely, they will preserve market power by not implementing actions that reduce switching costs proportionally. Hence, when policy makers design consumer protection policies, they should not always adopt a favourable attitude towards efforts by firms to reduce switching costs.

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Jan Bouckaert
University of Antwerp
Department of Economics
Prinsstraat 13
Belgium - 2000 Antwerp
jan.bouckaert@ua.ac.be

Hans Degryse
Tilburg University
TILEC
PO Box 90153
The Netherlands - 5000 LE Tilburg
H.Degryse@uvt.nl

Thomas Provoost
University of Leuven
Naamsestraat 69
Belgium - 3000 Leuven
Thomas.Provoost@econ.kuleuven.be

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1 Introduction

Switching costs are known to bind customers to firms. Consequently, consumers' initial choices partly determine their future decisions (Klemperer (1995) and Farrell and Klemperer (2007) provide excellent overviews). The origin of switching costs may be exogenous, e.g. in situations where consumers experience shopping costs. However, firms are often tempted to influence switching costs for strategic reasons. Consequently, they assume an endogenous character (see e.g., Farrell and Gallini (1988), Matutes and Regibeau (1988), and Klemperer and Padilla (1997)).

In this paper, we consider firms that are able to *jointly* determine the magnitude of consumers' switching costs. For example, when firms agree to set uniform industry standards, they lower the switching costs for consumers who may wish to buy from a competing supplier in the aftermarket. Similarly, telecom companies who decide (mutually) to adopt number portability will in effect reduce the switching costs for any consumer who wishes to switch from one telecom supplier to another. Banks, for their part, can reduce switching costs by offering standardized "switching packs" or by introducing account number portability. Finally, competing stock exchanges may adopt a common settlement system to make it easier for firms and investors to switch from one exchange to another.

An important insight of the literature on switching costs is that, in a given market, an increase in switching costs will raise average prices and may thus result in higher profits for firms (See Farrell and Klemperer, 2006). Hence, there is a concern that firms may, for strategic reasons, forego reductions in consumer switching costs, while public policy will strive to minimize such costs. However, we are able to demonstrate that, in situations where the magnitude of switching costs varies for consumers, the competitive ef-

fect of a switching-cost reduction hinges crucially on *how* the reduction is achieved. We attribute this outcome to the kind of technology applied or action implemented in order to reduce the cost of switching. More specifically, we consider two types of switching-cost reduction, i.e. a proportional versus a lump-sum reduction.

With the proportional approach, consumers facing high switching costs will enjoy a more substantial decrease in absolute terms than those facing a lower cost of switching. This situation may arise, for example, when firms introduce a (commonly developed) user-friendly guide on how consumers can switch more easily from one supplier to the other. Consumers with low switching costs will benefit only marginally from such a guide, while those facing higher switching costs stand to benefit more substantially. An example of this approach is found in Miles (2004), who recommends it for the UK mortgage market. In his report on how to improve the functioning of this market, he concludes that, to borrowers, the process of switching may represent itself as a barrier to remortgaging. This is especially the case for borrowers who are financially illiterate and who perceive switching to a more favorable mortgage to be prohibitively expensive. This group will gain the most from a user-friendly guide on how to switch mortgages. Borrowers who are sufficiently financially literate, on the other hand, will benefit to a lesser degree.

With the lump-sum approach, the cost of switching is reduced by a fixed amount. This situation arises, for example, when enhanced compatibility cuts the cost of adapting by a certain fixed amount, irrespective of the initial level of switching costs. Consumers with low switching costs will benefit from the switching cost reduction as much as consumers experiencing large switching costs. In other words, all consumers will benefit to the same de-

gree. Number portability serves as a good example of a lump-sum reduction in switching costs. In the medical sector, patients with a complicated medical past may find it harder to switch to another practice than patients with a straightforward record. Recently, the National Health System in the UK has introduced GP2GP – an electronic transfer of health records between GP practices – that aims at reducing switching costs between medical practices for patients.

Our findings may be summarized as follows. First, approaches whereby switching costs are reduced proportionally will tend to be rejected by firms because they enhance competition. In our two-period model, a proportional decrease in switching costs is shown to cut second-period profits from poaching rival's customers. This will make firms more aggressive in the first period, resulting in tougher intertemporal competition. Hence, firms may be expected to reject any such lowering of consumers' switching costs. Second, firms are able to relax competition by cutting all consumers' switching costs with a lump sum. The underlying reason is that such a lump-sum reduction will increase profitability of second-period poaching. As a result, firms will behave less aggressive in the first period, thereby relaxing intertemporal competition. With a lump-sum decrease, both firms will see their profits increase. Third, social welfare invariably increases through proportional reduction of switching costs. Finally, our results suggest that policy makers should be careful when implementing measures that will allow firms to reduce consumers' switching costs.

Our model provides insights into situations in various industries where firms are able to jointly affect consumers' switching costs. A first example relates to compatibility decisions by enterprises. Producers of systems of goods – where consumers are required to buy different components for combined

use, as in the video games and games consoles markets– may decide to introduce technology that makes their basic products compatible. Some authors have argued that reducing switching costs by introducing compatibility will enhance oligopoly power. Matutes and Regibeau (1988), for example, consider compatibility decisions by firms producing a two-component system, but where consumers decide to buy these components simultaneously. They show that firms prefer compatibility over incompatibility, as the former leads to higher prices. Moreover, Mariñoso (2001) shows that firms may prefer compatibility because incompatibility leads to higher endogenous switching costs and increases intertemporal price competition. Our model reveals that the nature of the switching-cost reduction action is important in explaining why that action is voluntarily adopted or not.

A second example concerns number portability decisions by telecom companies.[1] Number portability reduces switching costs. With number portability, consumers can switch more easily from one telecom provider to another, without needing to inform their potential callers. Viard (2003, 2007) studies the introduction of a regulatory regime in the US that enforces 800-number portability while not allowing firms to price discriminate between old and new customers. His theoretical model shows that an increase in switching costs can make markets either more or less competitive. His empirical findings indicate that prices will drop after the introduction of number portability. This suggests that switching costs make markets less competitive and that firms will hence be opposed to number portability in the telecom sector.

[1] Gans et al. (2001) deal with the more practical side of technology choice and cost distribution in the implementation of number portability in telephony. They propose a scheme of property rights of phone numbers in order to obtain efficient technology choice. Another important issue is raised by Buehler and Haucap (2004), who state that number portability not only lowers switching costs, but also creates "consumer ignorance" on the destination of the call, which is harmful if pricing is substantially dependent on this.

Our model looks at situations where firms *are* allowed to price discriminate between "new" and "old" customers, as is the case in many sectors, and again points to the importance of the nature of the action or technology implemented in order to reduce switching costs.

A third example pertains to the retail financial sector. Retail banking market integration is high on the agenda of various public authorities (see for example European Commission (2006) for an analysis of the latest developments in these markets). Switching costs are often cited as major obstacles to market integration and enhancement of competition (see for example Miles (2004) on the UK mortgage market and Cruickshank (2000) and Gondat-Larralde and Nier (2004) on the UK deposit retail market).[2] Two policies are often considered to reduce switching costs in retail deposit banking markets. The first is the implementation of "switching packs". Consumers face less administrative burden in changing supplier when banks standardize the process of switching account number through switching packs (see for example the Netherlands, the UK and Ireland). A second, more structural way is the introduction of account number portability. For example, the ECAFS (2006) report puts forward account number portability as an ideal scenario for the Single Euro Payment Area (SEPA), which would create a pan-European market with uniform account numbers that are owned by the customer. After all, in the absence of number portability, the main drawback of switching current accounts is that the account

[2] Only few attempts have been undertaken to measure switching costs directly in banking markets. Kim et al. (2003) use data on the Norwegian loan market, and find the costs of switching to be as high as 4% of the loan value. Shy (2002) develops a quick-and-easy way of measuring costs of switching, and applies it to the Israeli cellular phone market and Finnish current account market. He finds that switching costs can amount to as much as 11% of account balance for some banks. Ioannidou and Ongena (2007) find that switching borrowers receive a loan that is 80 base points lower than similar non-switching borrowers. Many other papers have put forward methods for establishing the presence of switching costs in an indirect way (see Degryse and Ongena (2007)).

holder is required to notify all parties he or she transacts with (e.g. employer or clients in the case of enterprises). Our study shows that the competitive effect of introducing number portability hinges on how exactly it modifies consumers' switching costs.

Our paper builds on the existing literature on cost of switching. Starting with seminal works by Von Weiszäcker (1984) and Klemperer (1987), this literature mostly studied switching costs that are homogeneous for all consumers (see Klemperer (1995) for an overview). In such settings, where firms are able to price discriminate between loyal and switching customers, typically no switching occurs, and all rents are competed away ex ante. Recent work finds switching in the equilibrium when consumers exhibit sufficient heterogeneity in switching costs (as in e.g. Chen (1997)), and rents not to be competed away (see e.g. Bouckaert and degryse (2004), who study information-sharing decisions in credit markets). In a recent paper, Biglaiser et al. (2007) look at entry when the switching costs of the incumbent's consumers increase. They show that the incumbent's profits can go down when all consumers' switching costs go up with a lump sum amount since entry becomes more aggressive. We contribute to this literature by identifying how an industry-wide modification of switching costs affects actual switching behavior and intertemporal competition. In particular, we show that there are incentives for firms to apply methods whereby switching costs are reduced by a lump sum, as this makes second-period poaching more profitable. As a result, firms will compete for consumers less strongly during the first period. Hence, such a lump sum decrease will relax intertemporal competition. In contrast, if a measure affects switching costs proportionally, then firms prefer not to implement it, as such action would increase intertemporal competition.

The remainder of the paper is organized as follows: in the next section, we present the setup of the model. In section 3, we consider two choices that reduce switching costs differently, i.e. proportionally in the one instance and by a lump sum in the other. Section 4 consists in a welfare analysis. Section 5 discusses some extensions to the model and the robustness of our results. The final section concludes.

2 The model

In our model, two firms A and B must decide whether or not to take joint action to reduce switching costs before competing in price over two periods.[3] Once the initial decision on the implementation of the action has been taken, our model closely follows Chen (1997). A unit mass of consumers wishes to buy one unit of a good from firm A or B in each period considered. We assume the reservation price to be sufficiently high in order for the market to be covered in both periods.

If a consumer chooses to switch firms in period two (i.e. to buy the product from a firm other than that from which he bought in period one), he will incur a switching cost s, with s uniformly distributed in the interval $[\underline{s}, \overline{s}]$. To ensure that there is sufficient dispersion of the switching costs of the consumers, we further assume $0 < 2\underline{s} < \overline{s}$.[4] Consumers are initially unaware of the specific switching cost s that applies to them (they are, however, aware of the distribution of s), and only discover it at the end of period one. This is a natural assumption if the consumer needs to have bought the product in order to find out what cost is involved in switching

[3] Fershtman and Gandal (1994) call this semi-collusion.

[4] This condition ensures that there is always some switching in period two, when firms can price discriminate between old and new customers. Our main insights would remain qualitatively unaffected if this assumption were to be removed; see Section 5.

away from it.[5]

Firms are able to price discriminate in period two between "old" customers (i.e. customers who had already bought from that firm in period one) and "new" customers (i.e. customers who bought from the rival firm in period one). From the firms' respective points of view, this pricing behavior dissects the second-period market into a market for "loyal" customers, and one for "switchers". So the two firms simultaneously set prices p_i^1 ($i = A, B$) in period one and prices p_i^L and p_i^S, for loyal and switching customers respectively, in period two. We normalize marginal costs at zero for both firms. Consumers and firms have a common discount factor $0 < \delta < 1$ between periods one and two. In period one, consumers will choose the product with the lowest expected costs, rationally anticipating second-period behavior. If consumers are indifferent between the two firms, a proportion $0 \leq \sigma \leq 1$ will choose firm A and the remainder will opt for firm B.

The timing of the model is as follows:

- period 0: firms A and B decide jointly whether or not to lower consumers' switching costs;
- period 1: the firms simultaneously set their period-one prices p_i^1 ($i = A, B$); the consumers will opt for the lowest-priced firm, thereby taking into account expected future prices (and expected costs of switching) with a fraction σ going to A if they are indifferent between the two; consumers discover their specific switching cost s at the end of period one;
- period 2: the firms simultaneously set period-two prices p_i^L and p_i^S;

[5] For example, borrowers are generally unaware of the complexities awaiting them should they decide to remortgage. Similarly, consumers may not know beforehand what cost is involved in switching from one mobile phone service provider to another.

consumers can now optimally choose whether or not to switch.

Next we provide further details on the two approaches to switching-cost reduction we intend to study. The first approach decreases switching costs proportionally so that $s \mapsto \alpha s$, with $0 < \alpha < 1$. In other words, the higher the switching cost faced by the consumers, the more they stand to benefit. As in the example provided in the introduction, a jointly-introduced and user-friendly guide on how to switch supplier will be most beneficial to consumers with high switching costs. It will, however, be only marginally beneficial to consumers facing already very low switching costs. In the second approach, switching costs are reduced by a lump-sum, so that $s \mapsto s - \gamma$, with $0 < \gamma < \underline{s}$. In other words, the decrease is independent of the level of switching costs that the individual consumer faces. This applies, for example, when the introduction of compatibility cuts a fixed transaction cost. While examples of both approaches are encountered in reality, our main finding is that they create opposite incentives for firms to introduce the measure in the first place.

3 Analysis

3.1 Second-period competition

Let us assume firm A has served a fraction k of the market in period 1, and hence firm B has served the remaining $1 - k$.[6] We are then able to solve the game by looking separately at the two market segments, i.e. that for (potential) switchers and that for loyal customers, from the perspective of, say, firm A. The fraction k is merely a scalar factor, and of no consequence to the dynamics of the game. We therefore disregard it in the analysis, and

[6] In equilibrium we have that $k = 1, 0$, or σ.

only at the end do we multiply the resulting profits for firms A and B by the proportions k and $1-k$ respectively.

The firms maximize their profits in either market segments, namely profit Π_i^S from switchers and profit Π_i^L from the loyal consumers. Since the two firms are able to discriminate between loyal customers and switchers, they each face two separate maximization problems, through the strategic variables p_i^L and p_i^S respectively.

In what follows, we first consider the case where no action is taken to reduce switching costs. Subsequently, we solve the second period for the two different approaches to reducing switching costs.

3.1.1 No change in switching costs (base case)

If firms do not implement measures to reduce switching costs, they maximize profits

$$\begin{cases} \Pi_i^L = p_i^L q_i^L; \\ \Pi_i^S = p_i^S q_{-i}^S, \end{cases}$$

where q_i^L is the number of consumers from its first-period market that firm i retains in the second period. At the same time, firm i attracts q_{-i}^S customers from its competitor's first-period market. A consumer is indifferent between staying with firm i, or switching to its competitor $-i$ if the switching cost s^* is such that

$$p_i^L = p_{-i}^S + s^*.$$

Consumers whose switching cost exceeds s^* will remain loyal to their first-period choice. In contrast, consumers whose switching cost is lower than s^* will make the switch to the other supplier. Hence, firm i is able to retain a fraction q_i^L of its first-period market share, with (conditional on $\underline{s} \leqslant p_i^L - p_{-i}^S \leqslant \overline{s}$)

$$q_i^L = \frac{\overline{s} - s^*}{\overline{s} - \underline{s}} = \frac{\overline{s} - (p_i^L - p_{-i}^S)}{\overline{s} - \underline{s}}.$$

Consequently, the remaining fraction that will turn to firm $-i$ is

$$q_{-i}^S = \frac{s^* - \underline{s}}{\overline{s} - \underline{s}} = \frac{(p_i^L - p_{-i}^S) - \underline{s}}{\overline{s} - \underline{s}}.$$

Of course, if $\overline{s} < p_i^L - p_{-i}^S$ then $q_i^L = 0$ and $q_{-i}^S = 1$. Similarly, we have $q_i^L = 1$ and $q_{-i}^S = 0$ if $p_i^L - p_{-i}^S < \underline{s}$. In other words, excessive price differences will result in the entire population switching to the firm offering the lowest price.

Upon subsitution of q_i^L and q_{-i}^S, we obtain the firm's best-response curves to its competitor's strategic variable in the market for i's loyal customers (p_{-i}^S and p_i^L respectively). For the pricing of firm i, this yields

$$p_i^L = \begin{cases} \frac{1}{2}(p_{-i}^S + \overline{s}) & \text{if } \; p_{-i}^S \leqslant \overline{s} - 2\underline{s} \\ p_{-i}^S + \underline{s} & \text{if } \; p_{-i}^S > \overline{s} - 2\underline{s}. \end{cases}$$

Analogously, the p_{-i}^S-response function equals

$$p_{-i}^S = \begin{cases} 0 & \text{if } \; \underline{s} > p_i^L \\ \frac{1}{2}(p_i^L - \underline{s}) & \text{if } \; \underline{s} \leqslant p_i^L \leqslant 2\overline{s} - \underline{s} \\ p_i^L - \overline{s} & \text{if } \; p_i^L > 2\overline{s} - \underline{s}. \end{cases}$$

Because of the assumption that $\overline{s} - 2\underline{s} > 0$, we find that the Nash equilibrium arises with the values

$$p_i^L = \frac{1}{3}(2\overline{s} - \underline{s}); \qquad p_{-i}^S = \frac{1}{3}(\overline{s} - 2\underline{s}),$$

so that, in this market, the customers fractions are

$$q_i^L = \frac{2\overline{s} - \underline{s}}{3(\overline{s} - \underline{s})}; \qquad q_{-i}^S = \frac{\overline{s} - 2\underline{s}}{3(\overline{s} - \underline{s})}$$

and hence second-period profits are

$$\Pi_i^L = \frac{(2\overline{s} - \underline{s})^2}{9(\overline{s} - \underline{s})}; \qquad \Pi_{-i}^S = \frac{(\overline{s} - 2\underline{s})^2}{9(\overline{s} - \underline{s})}.$$

Note that our assumption of sufficient dispersion of switching costs, $\overline{s} - 2\underline{s} > 0$, ensures that firm $-i$ can still charge a positive price to switchers and thus

earn a positive profit from them. However, firm i's profit from its loyal segment (abstracting from period-one market shares) always exceeds what $-i$ reaps from consumers who switch: $\Pi_i^L > \Pi_{-i}^S$. This is due to the lock-in effect, since consumers take s into account when making their purchasing decision.

3.1.2 Switching-cost reduction method

We consider the case where two firms are jointly implementing a switching-cost reduction. First, we describe an approach whereby the switching cost is reduced proportionally. Subsequently, we turn our attention to an action resulting in a lump-sum cut.

Proportional decrease in switching costs. The implementation of such a technology or method would reduce a consumer's switching cost s to αs (with $0 < \alpha < 1$). This proportional decrease retains the dispersion, as it results in a distribution of switching costs in the interval $[\alpha\underline{s}, \alpha\overline{s}]$. The equilibrium prices become

$$p_i^L = \frac{\alpha}{3}(2\overline{s} - \underline{s}); \qquad p_{-i}^S = \frac{\alpha}{3}(\overline{s} - 2\underline{s}).$$

We observe that prices are proportional to α. Consequently, α lowers the friction in the market and sharpens second-period competition. The change does not however affect the fraction of switchers as the indifferent consumer (s^*) does not alter. In other words, the proportions of loyals and switchers remain the same:

$$q_i^L = \frac{2\overline{s} - \underline{s}}{3(\overline{s} - \underline{s})}; \qquad q_{-i}^S = \frac{\overline{s} - 2\underline{s}}{3(\overline{s} - \underline{s})}.$$

Hence, second-period profits are reduced by the same proportion as prices, so that

$$\Pi_i^L = \frac{\alpha(2\overline{s} - \underline{s})^2}{9(\overline{s} - \underline{s})}; \quad \Pi_{-i}^S = \frac{\alpha(\overline{s} - 2\underline{s})^2}{9(\overline{s} - \underline{s})}.$$

Note that the possibility of achieving the equilibrium specified above is conditional upon $0 < \alpha(\overline{s} - 2\underline{s})$, which is unaffected by α as $0 < \alpha < 1$.

Lump-sum decrease in switching costs. Let us now consider the impact on profits of strategies whereby each consumer's switching cost is lowered by a lump-sum γ (where $0 < \gamma < \underline{s}$). Notice that such a lump-sum decrease results in switching costs that are uniformly distributed over the range $[\underline{s} - \gamma, \overline{s} - \gamma]$. In other words, the relative dispersion of the highest switching cost to the lowest switching cost, $(\overline{s} - \gamma)/(\underline{s} - \gamma)$, increases in γ. Prices now become

$$p_i^L = \frac{1}{3}(2\overline{s} - \underline{s} - \gamma) \text{ and } \quad p_{-i}^S = \frac{1}{3}(\overline{s} - 2\underline{s} + \gamma).$$

We observe that the incumbent's price p_i^L drops in γ, whereas the entrant's price p_{-i}^S increases in γ. In other words, the higher relative dispersion reflected in a higher γ makes it easier to attract switchers in a more profitable way. The proportions attracted are

$$q_i^L = \frac{2\overline{s} - \underline{s} - \gamma}{3(\overline{s} - \underline{s})} \text{ and } \quad q_{-i}^S = \frac{\overline{s} - 2\underline{s} + \gamma}{3(\overline{s} - \underline{s})},$$

where the number of switchers increases in γ. Since both prices and market shares increase in γ for the switching segment, so do profits, as can be seen from

$$\Pi_i^L = \frac{(2\overline{s} - \underline{s} - \gamma)^2}{9(\overline{s} - \underline{s})} \text{ and } \quad \Pi_{-i}^S = \frac{(\overline{s} - 2\underline{s} + \gamma)^2}{9(\overline{s} - \underline{s})}.$$

It should be noted, though, that profitability of this segment can never outgrow that of loyals, as it was assumed that no switcher can have a negative cost of switching ($\gamma < \underline{s}$).

3.2 First-period competition

We continue solving the model by including period one. Our analysis is structured as follows. To begin with, we provide a general insight into the likely first-period and overall equilibrium. Subsequently, we translate this equilibrium to the specifics of the base case, and each of the two approaches to switching-cost reduction.

First we look at how consumers choose their first-period firm. As we assume consumers to be rational, they will be indifferent between firms A and B if the total expected discounted cost is equal for both. Note that, at the beginning of period one, the specific value of a consumer's s is still unknown. Consumers will therefore consider the likelihood of them switching in period two when calculating expected prices (and costs). This likelihood of switching equals the likelihood of s being lower than the relevant price difference. Since we consider a unit mass of consumers, this likelihood equals precisely the fraction q^S_{-i} obtained above. As a result, the indifferent consumer satisfies

$$p^1_A + \delta\left(q^L_A p^L_A + q^S_B\left(p^S_B + E(s < p^L_A - p^S_B)\right)\right) \\ = p^1_B + \delta\left(q^L_B p^L_B + q^S_A\left(p^S_A + E(s < p^L_B - p^S_A)\right)\right).$$

The first term on either sides of the equation reflects the price to be paid in period one. The second term on either side represent the discounted expected cost in period two. It is made up of two components: the first corresponds with the expected second-period price to be paid if a consumer remains loyal to his/her first-period provider; the second represents the expected price and costs of switching from one supplier to another.

However, since second-period markets are separated, it follows that second-period pricing is independent of period-one market shares. As a result, con-

sumers' expectations with regard to second-period prices and switching costs are the same for both firms. This simplifies the above expression to $p_A^1 = p_B^1$ so that consumers will simply call on the cheapest-priced firm in period 1.

Total profit for firm i as a function of its own price p_i^1 and its competitor's price p_{-i}^1 can then be expressed as

$$\Pi_i = \begin{cases} p_i^1 + \delta\Pi_i^L & \text{if } \; p_i^1 < p_{-i}^1 \\ \sigma_i p_i^1 + \delta\left((1-\sigma_i)\Pi_i^S + \sigma_i\Pi_i^L\right) & \text{if } \; p_i^1 = p_{-i}^1 \\ \delta\Pi_i^S & \text{if } \; p_i^1 > p_{-i}^1. \end{cases} \tag{1}$$

The first part of Eq. (1) occurs when firm i announces a lower price than its competitor. Consequently, it attracts all customers in period one, making a profit of p_i^1, and it becomes the incumbent in period two, yielding $\delta\Pi_i^L$. The middle part occurs when both firms set equal prices. In this event, firm i has a period-one market share of σ_i (equaling σ for firm A and $1-\sigma$ for B). This makes firm i the incumbent for a fraction σ_i of the period-two market. The remaining fraction $1-\sigma_i$ is the pool of potential switchers. In the final part of this profit function, firm i charges the highest price and has no customers in period one. Its period-two profits arise only from switchers. The following Proposition characterizes the period-one game and overall profit.

Proposition 1 *There is a unique Nash equilibrium in period-one prices with*

$$p_i^1 = -\delta(\Pi_i^L - \Pi_i^S).$$

Total equilibrium profits are then

$$\Pi_i = \delta\Pi_i^S.$$

Proof: see Appendix.

Intuitively, we expect the lowest first-period price that firm i would want to charge to be $-\delta(\Pi_i^L - \Pi_i^S)$. Put differently, below this price it is more

attractive to have no period-one market share at all and to generate profit only from period-two switchers. This tells us that firms incur losses in the first period up to the discounted difference of whether or not one is the only incumbent in period two. Indeed, recall that, in consequence of a lock-in effect, the incumbency profits are the highest, so that each firm will be willing to sacrifice some of its period-one profits with a view of obtaining incumbency in period two. The profit that a firm can secure itself is the discounted profit $\delta\Pi_i^S$, independent of market shares, since a higher incumbency profit in period two is exactly offset by the higher loss in period one. The proof of this proposition is given in the Appendix.

Note that prices are negative here because marginal costs were assumed to be zero; as long as marginal costs are sufficiently high, this result does not necessarily imply below-zero pricing. However, as observed in reality, consumers can be lured during the first period, not only with lower prices, but also with non-monetary supplements (such as gifts, vouchers, free calls, etc).

Let us now first consider the equilibrium when firms implement a switching-cost reduction method. In a next step, we compare the different equilibria in order to determine which will be preferred by firms. This will tell us whether the adoption of a specific cost-reduction method will be implemented as an endogenous choice.

3.2.1 Base case

Period-one prices in the base case are (for both $i = A, B$)

$$p_i^1 = -\frac{\delta}{3}(\overline{s} + \underline{s}),$$

with total discounted profits equal to $\delta\Pi_i^S$, so that

$$\Pi_i = \frac{\delta}{9}\frac{(\overline{s} - 2\underline{s})^2}{\overline{s} - \underline{s}}.$$

These profits are identical to the second-period profits for an entrant on the entire market. Next, we consider how profits change as the switching-cost reduction strategy is implemented.

3.2.2 Switching-cost reduction strategy

Proportional decrease in switching costs. If switching costs are decreased proportionally, first-period prices become

$$p_i^1 = -\frac{\delta}{3}\alpha(\overline{s} + \underline{s}),$$

where a lower factor α (and thus higher proportional decrease in s) reduces the second-period profit difference between incumbent and entrant. Hence, it raises period-one prices compared to the base case.

The total discounted profit of firm i then equals

$$\Pi_i = \frac{\delta}{9}\frac{\alpha(\overline{s} - 2\underline{s})^2}{\overline{s} - \underline{s}},$$

representing a fraction α of profits in the base case. Since $\alpha < 1$, profits drop as the switching-cost reduction approach is implemented. The profit that a firm is able to achieve declines in α, as profitability on switchers decreases. Firms will prefer not to implement measures that reduce switching costs proportionally.

Lump sum decrease in switching cost. If switching costs are decreased by a fixed amount γ, we have

$$p_i^1 = -\frac{\delta}{3}(\overline{s} + \underline{s} - 2\gamma).$$

Again, a more substantial reduction in switching costs leads to a higher p_i^1. Total discounted profits are now

$$\Pi_i = \frac{\delta}{9}\frac{(\overline{s} - 2\underline{s} + \gamma)^2}{\overline{s} - \underline{s}}.$$

Clearly, profits increase in γ. In other words, if switching costs are reduced by a lump sum, total profits increase. This result stems from a greater relative dispersion of switching costs, so that serving switchers becomes more profitable. Firms find it easier to enter one another's markets in the second period, which relaxes first-period competition substantially. So the introduction of the lump-sum reduction in switching costs increases profits. Consequently, firms will want to adopt such measures: this mode of lowering switching costs is preferred to the base case, and will hence be endogenously adopted if available.

3.3 Implementation of switching-cost-reduction strategies: proportional versus lump-sum reductions

In this subsection, we focus on the semi-collusion stage, where firms decide jointly on the adoption of a switching-cost reduction strategy, whereby they must anticipate the effect on competition in both periods. We obtain our results from comparing firms' profits in the base case with those achieved should they jointly introduce the action to reduce switching costs. The latter will only happen if both firms' profits are set to increase. Our results are summarized in the following proposition.

Proposition 2 *Firms tend to adopt approaches whereby consumers' switching costs are reduced by a lump sum. In contrast, firms tend not to adopt approaches whereby switching costs are reduced proportionally.*

Proof: follows from section 3.2.2.

So why do we obtain such diametrically opposed results in terms of firms' willingness to adopt one or the other approach? The underlying reasoning is that these different actions affect intertemporal price competition in opposite ways. While a lump-sum switching-cost reduction creates more relative dispersion of switching costs and makes second-period poaching more profitable, this is not the case for a proportional decrease in switching cost. A lump-sum decrease in consumers' switching costs implies that firms are able to secure more substantial overall profits, as the gains to be achieved through second-period poaching are greater. A proportional decrease, by contrast, will result in smaller profits and should therefore be rejected in situations where firms can decide jointly on whether or not to implement it.

4 Welfare analysis

In this section, we consider whether the social planner will want firms to adopt a switching-cost reduction strategy or not. We distinguish between total welfare (i.e. consumer and producer surplus) on the one hand and consumer welfare on the other. The first-best world for total welfare is one where no switching takes place. We measure welfare by considering its inverse, i.e. welfare costs. Assuming that demand is inelastic and that all production costs and switching-cost reduction approaches are zero, total welfare consists only of the switching costs incurred by consumers who actually switch suppliers. We discount all welfare measures with δ as switching takes place in the second period.

Let us first discuss the base case, with given switching costs. Total welfare cost TW is then

$$TW = \delta \frac{\overline{s} - 2\underline{s}}{3(\overline{s} - \underline{s})} \frac{\overline{s} + 4\underline{s}}{6},$$

with the first term after the discount rate is the market share of switchers and the second term is the average switching cost incurred by switchers, $E(s|s < p_i^L - p_{-i}^S)$. Consumer welfare cost CW represents the total amount that is paid to firms and the discounted switching costs incurred (i.e. TW), which yields

$$\begin{aligned} CW = TW + \Pi_A + \Pi_B &= \delta\left(\frac{\overline{s}-2\underline{s}}{3(\overline{s}-\underline{s})}\frac{\overline{s}+4\underline{s}}{6} + \frac{2}{9}\frac{(\overline{s}-2\underline{s})^2}{\overline{s}-\underline{s}}\right) \\ &= \frac{\delta}{9}\frac{\overline{s}-2\underline{s}}{\overline{s}-\underline{s}}\left(\frac{5}{2}\overline{s}-2\underline{s}\right). \end{aligned}$$

Next, we look at social welfare assuming that firms adopt the switching-cost reduction measure. We first consider the case where the cut in switching costs is proportional. It is easy to see that, if switching costs decrease by a proportion $(1-\alpha)$, the base case welfare measures should be multiplied by α. After all, the same fraction of consumers switches in equilibrium, and firms' profits are multiplied by α. Therefore, both total and consumer welfare will increase with the introduction of a proportional switching-cost reduction measure. So while firms will not be inclined to adopt such a strategy, the social planner would certainly be in favor of it being introduced.

Now let us consider social welfare in the case where switching costs are reduced by a lump-sum γ. Different forces now affect social welfare in different ways. Consequently, the picture obtained if switching costs are reduced by a fixed amount are not unambiguous. Intuitively, while switching costs decrease, the greater relative dispersion of switching costs entails that more people will switch and incur this cost.

If switching costs are reduced by a lump sum, the total welfare cost TW' becomes

$$TW' = \delta\frac{\overline{s}-2\underline{s}+\gamma}{3(\overline{s}-\underline{s})}\frac{\overline{s}+4\underline{s}-5\gamma}{6},$$

where the first term is the market share of switchers and the second term

the average switching cost they incur. Comparing this with TW, we find that

$$TW' < TW \Longleftrightarrow \gamma > \frac{14\underline{s} - 4\overline{s}}{5}.$$

Therefore, the social planner will only prefer a lump-sum switching-cost reduction if γ is not excessively small. Any approach that lowers switching costs by too little will increase dramatically the market share of switchers, outweighing the beneficial effect of the switching-cost reduction. However, if initially $\overline{s} > \frac{7}{2}\underline{s}$, then any value for γ improves total welfare.

If the lump-sum approach is implemented, consumer welfare cost CW' becomes

$$CW' = \frac{\delta}{9}\frac{\overline{s} - 2\underline{s} + \gamma}{\overline{s} - \underline{s}}\left(\frac{5}{2}\overline{s} - 2\underline{s} - \frac{1}{2}\gamma\right).$$

Comparing again, we find that

$$CW' > CW$$

for all γ since $\gamma < \underline{s}$. In other words, consumers ex ante prefer that the lump-sum approach not to be adopted. So if total welfare is increased by this lump-sum reduction, it stems from an increase in firm profits, not consumer welfare.

We summarize this analysis in the following proposition.

Proposition 3 *A proportional switching-cost reduction increases both total and consumer welfare. By contrast, a lump-sum reduction decreases consumer welfare, and increases total welfare only if* $\gamma > (14\underline{s} - 4\overline{s})/5$.

Proof: contained in the discussion above.

5 Discussion

In this section, we check the robustness of our results by considering a number of extensions to the model. First, it is assumed in the main analysis that the technology effects neither the marginal costs of servicing switchers nor fixed costs. Serving switchers, however, may induce a more substantial marginal cost. A bank, for example, may have to perform additional paperwork in accommodating a checking-account switcher, as some transfers may require closer inspection. Also, developing the new technology may entail a fixed cost. It is therefore not unthinkable that a measure that would reduce switching costs proportionally may be rejected by firms because of the additional cost associated with its introduction.[7] In particular, a higher marginal costs of accommodating switchers as well as an increased fixed cost in consequence of the measure being introduced may compromise profitablility. If switching costs are cut by a lump sum, however, an increase in marginal costs for switchers will counterbalance the benefits of a positive γ. Intuitively, we see that a higher marginal cost for serving switchers will reduce the second-period profits a firm can secure for itself. Therefore, a lump-sum approach that at once implies a higher marginal cost should at least result in an equally large lump-sum decrease in consumer switching costs in order for the option to be endogenously approved.

Second, our model considered a switching-cost reduction that is either lump sum or proportional. New approaches to switching-cost reduction may however involve a lump-sum as well as a proportional component. Obviously, the endogenous adoption of an approach that reduces switching costs both proportionally and by a lump sum will depend on the size of the respec-

[7] The introduction of bank account number portability at the European level has been questioned by many players in the industry of being too costly.

tive effects. In particular, modest proportional decreases combined with considerable lump-sum decreases will be endogenously adopted.[8]

Third, our model starts from sufficient dispersion of switching costs, so that some switching occurs in equilibrium. Now consider the case where $\overline{s} < 2\underline{s}$, so that initially it is not profitable to attract switchers and perfect competition ensues. It is clear that a proportional decrease in switching costs will not modify the results, as it will not create sufficient dispersion. However, a lump-sum decrease in switching cost might, so that it becomes profitable to firms to poach one another's customers. Firms will then adopt the lump-sum method as this action will relax competition. This is the case if $\overline{s} + \gamma \geqslant 2\underline{s}$.

6 Conclusion

Firms often decide jointly when setting consumers' switching costs. In various industries, we observe that firms tend to avoid switching-cost reduction strategies, whereas in others we see that enterprises do reduce switching costs, including voluntarily, by adopting uniform standards or compatible technologies. In this paper, we consider why and when firms may or may not wish to voluntarily adopt actions whereby switching costs are reduced. More specifically, we look at two approaches that reduce switching costs in a different manner.

In the first approach, consumers' switching costs are cut proportionally. That is to say, consumers' switching costs are reduced in such a way that, in absolute terms, consumers with high switching costs stand to gain more than those with low switching costs. We find that firms will not voluntarily

[8] More specifically, we find that, in the (α, γ)-plane, the border of the region where firms adopt the approach is a quadratic function, the location of which also depends on $\overline{s} - 2\underline{s}$. All combinations with high α and γ are adopted, whereas those with small α and γ cases are not voluntarily introduced.

adopt approaches whereby switching costs are decreased proportionally. The intuition for this result is that a proportional decrease in switching costs increases intertemporal competition: firms can now secure less profit by poaching switchers only in the second period. The social planner, on the other hand, will have a preference for methods leading to a proportional decrease in switching costs.

By contrast, the second approach, whereby switching costs for all consumers are cut with a lump sum, will be voluntarily adopted by firms. The lump-sum reduction makes poaching in the second period more attractive, thereby reducing intertemporal competition. The social planner, on the other hand, will not necessarily be in favor of such lump-sum reductions, as there is a tradeoff to be considered: lower switching costs increase welfare of switchers, but more consumers make the switch.

We contribute to the switching-cost literature by identifying how changes in firm profits and welfare depend on how the distribution of switching costs is modified, whereas previous research has focused mainly on the level of switching costs. In addition, our model considers how changes in switching costs affect switching behavior and intertemporal competition.

Our analysis may be applied to many industries and settings, including banks and telecom companies: they have been reluctant to introduce number portability, arguing that costs outweigh potential benefits. While this may be true, an alternative interpretation that ties in equally well with the observed outcome is that number portability implies a proportional decrease in switching costs. In other words, consumers with higher switching costs will benefit the most. Without number portability, consumers who have more correspondents or who carry out more financial transactions will, after all, also need to inform more people that they have switched to a new

bank account or phone number. Hence, they face a higher switching cost. The introduction of number portability therefore entails a greater benefit for these consumers than for those initially facing lower switching costs. Various regulatory initiatives, like the Single Euro Payment Area (SEPA) in the European Union, have been taken to enhance retail banking market integration and competition. To the extent that the costs of introducing number portability are not excessive, our social welfare results suggest that policymakers should indeed aim at making firms adopt strategies whereby switching costs are reduced proportionally.

By contrast, other industries have seen the implementation of uniform standards even though this decreases switching costs. Insofar as such standards cut switching costs uniformly across all consumers, our model would suggest that this outcome will arise endogenously. Here, policymakers face a tradeoff, as a lump-sum reduction in switching costs increases producer surplus, while decreasing consumer welfare in consequence of more switching and higher prices. Total welfare, however, may increase if the lump-sum decrease in switching cost is not too small.

A Appendix

Proof of Proposition 1.

Proof. Consider profits from (1). It is profitable to price p_i^1 below p_{-i}^1 iff.

$$\delta\Pi_i^L + p_i^1 \geqslant \delta\left((1-\sigma_i)\Pi_i^S + \sigma_i\Pi_i^L\right) + \sigma_i p_i^1 \geqslant \delta\Pi_i^S :\Longleftrightarrow: p_i^1 \geqslant -\delta(\Pi_i^L - \Pi_i^S); \tag{2}$$

for lower values, any advantages of incumbency (i.e. $\delta(\Pi_i^L - \Pi_i^S)$) are offset by the first-period price being too low. If $p_i^1 = -\delta(\Pi_i^L - \Pi_i^S)$ then $\Pi_i = \delta\Pi_i^S$ irrespective of p_{-i}^1. Dropping below this value can never yield higher profits

than $\delta\Pi_i^S$, and even holds the risk of undercutting one's rival and ending up with profits that are lower than that.

There is a unique Nash equilibrium with $p_i^1 = -\delta(\Pi_i^L - \Pi_i^S)$, leading to a profit of $\Pi_i = \delta\Pi_i^S$. Deviating from this price is never profitable: a higher price leads to a market share of zero, with no change in profits, and a lower price yields lower profits $\delta\Pi_i^L + p_i^1 < \delta\Pi_i^S$. Furthermore no other equilibrium can exist: if both i are priced above their respective $-\delta(\Pi_i^L - \Pi_i^S)$, by (2) they can both improve by lowering their price, and if the lowest-priced service is below this value, it can improve by increasing its price. Profits for both players equal δPi_i^S.

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