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Switching Costs, Firm Size, and Market Structure

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Abstract

In many markets homogenous goods are sold both by large global firms ("chain stores") and small local firms. Surprisingly, chain stores often charge higher prices. Examples include hotels, airlines, and coffee shops. We provide a simple model that can account for these pricing patterns. In this model, consumers face costs when switching from one supplier to another and change locations with a given probability. Consequently, chain stores insure consumers against switching costs. In equilibrium, chain stores charge higher prices, yet attract more consumers. Profits of local stores and chain stores increase with consumer mobility, but the latter do so faster.

Keywords: Firm size, switching costs, consumer mobility, market structure.

JEL-Classification: D43, L15

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1 Introduction

A bus trip from New York City to Boston is a fairly homogenous good. It takes about four hours and twenty minutes and costs US$55 at the Greyhound/Peter Pan desk and US$15 at the Fung-Wah desk.[1] Similarly, a big cup of milk coffee in the Big Cup Café on 8th Avenue in Manhattan costs US$3.60, while the largest cup of café latte in the Starbucks café on the other side of the avenue is sold at US$3.95.[2] Most strikingly perhaps, the airfare for a return flight from Berlin to Cologne-Bonn costs Euro 395 if one flies with Lufthansa and Euro 53 if one travels with German Wings.[3]

What is the common feature of these three pricing patterns? First, arguably homogenous goods are sold at sometimes substantially different prices. Second, one of the sellers is a large firm that is more or less globally active and known by almost every potential consumer, while the other seller is a small local firm that is most probably only known by customers familiar with the locality. Third, the large firm charges the high price.

The purpose of this paper is to provide a parsimonious model that explains pricing patterns such as these. As the larger firms sell at higher prices, it is clear from the outset that economies of scale *cannot* explain these patterns. What seems to be at work here is a non-convexity in the consumption technology. Potential customers of local firms must first learn about the existence of the local provider. Once they know this, they have to

[1] Prices are as of May 2005. The online price is US$28-35 for Greyhound/Peter Pan and US$15 for Fung-Wah. Greyhound/Peter Pan trips begin in Midtown Manhattan on 42nd street, while Fung-Wah trips start in Chinatown in Manhattan on Canal street. Both trips end at Boston South station.

[2] Both cafés are between 21st and 22nd street. Prices are as of spring 2005.

[3] Sources: www.lufthansa.de and www.germanwings.com. We choose return flights because these are cheaper than one-way tickets for major carriers such as Lufthansa. The price of the German Wings return ticket is the sum of two one-way tickets. The date of booking was July 21, 2005. Lufthansa's airport in Berlin is Tegel, while German Wings flies from and to Berlin Schönefeld. For an outbound flight from Berlin to Cologne-Bonn, we arbitrarily chose July 28 round 8 a.m. For the return flight, we chose August 1 round 7 p.m. Though the price differences vary as a function of various factors such as date and flexibility, there can be little doubt that German Wings is substantially cheaper than Lufthansa. It is true that German Wings is a partner of Lufthansa, but this does not refute that the two carriers set different prices and may face different demand functions.

experiment whether the goods and services provided by the local store suit their preferences. Eventually, they also have to learn how to best consume these. If this type of search and experimentation is costly, buying from a new provider involves set-up costs. Thus, these set-up costs are a kind of switching costs.

Of course, the same is true for new customers of global firms, or chain stores, as we call them. The twist, though, is that if customers are mobile and consume repeatedly, they have to incur the set-up cost only once when buying from the chain store, whereas these costs have to be borne each time they buy from another local store. Moving from one location to the other with an exogenous probability, consumers cannot always buy from the same local firm. Consequently, they risk to incur the set-up costs anew when first buying from a local firm, while buying from a chain involves no such risk.

Put in a nutshell, this is the explanation our paper puts forth. We show that in the unique equilibrium both types of stores are active. The chain store charges a higher price and attracts more consumers than do local stores. Low switching cost consumers buy from the local stores and high switching costs consumers buy from the chain store. Moreover, the relative profitability of the chain store increases as consumers become more mobile.

The remainder of the paper is structured as follows. The next section relates the paper to the existing literature. Section 3 introduces the model. Section 4 analyzes the benchmark case with two local monopolies. Section 5 derives the unique symmetric equilibrium for the market structure with two local stores competing with a chain. Section 6 then shows that the market structure with a local store in each city and a chain store active in both cities is the unique stable market structure if there is a small, positive entry cost. Section 7 concludes.

2 Related Literature

To the best of our knowledge, the idea that larger firms may gain more customers while charging higher prices than smaller firms merely because of consumers' switching costs has not been fully recognized in the previous formal literature. For example, Stahl (1982) notes that a merger of local stores to a chain store "appears exclusively connected to the input side of the retailing activity, that is, to the exhaustion of economies of scale in purchasing and distributing inputs."

Switching costs as understood in this paper are a short-cut to search and experimentation costs à la Nelson (1970), where consumers have to search and experiment so as to find their most preferred good. Insofar as our model does not allow for dynamic price competition, it is in some contrast to a part of the switching cost literature. For example, Klemperer (1987, 1995)'s major concern is with the dynamic aspects of price competition when consumers are locked in with their supplier due to switching costs, so that sellers are tempted to use 'bargains followed by ripoffs'- pricing schemes (Farrell and Klemperer, 2004). However, our approach is perfectly in line with von Weizsacker (1984), whom we follow by assuming that firms do not set different prices over time.

Two papers that deal with search costs but are not concerned with switching costs are Stahl (1982) and Wolinsky (1983). Stahl illustrates how a model of demand externalities creates agglomeration effects. Wolinsky presents a model where imperfect information creates the need to search for a suitable buy, leading firms to cluster at one location in order to reduce search costs.

Baye and Morgan (2001) provide a model with equilibrium dispersion of publicized prices, which arise because some consumers decide not to bear the cost required to become informed about prices.[4] Insofar as in our model high switching cost consumers prefer paying higher prices to bearing the switching cost, this is very similar to our model. In the model of Baye and Morgan, though, the high and low priced firms are not determined ex ante because the price dispersion stems from a mixed strategy equilibrium. Consequently, in their model firm size does not matter.

Because chain stores are physically differentiated from local stores in

[4]For empirical evidence, see Baye, Morgan, and Scholten (2004).

that they are active in more locations than local stores, the paper also relates to the product differentiation literature initiated by Hotelling (1929). Janssen, Karamychev, and van Reeven (2003) study competition between two firms with multiple outlets (chain stores) on the Salop (1979) circle, where firms sell differentiated products to heterogenous consumers. In their model, outlets from the same chain are homogenous but outlets across chains are heterogenous. Whereas Janssen, Karamychev, and van Reeven (2003) are concerned with location and pricing decisions of two chains, we are interested in the effect of homogeneity of outlets from the same chain on consumer choice if alternatively they can buy from heterogenous single outlet firms.

Aside from explaining the above mentioned price patterns, our model also provides a simple explanation for the remarkable asymmetry in firms size as observed, e.g., in the retail and hotel industries. In the equilibrium of our model, a local store's market shares is at most one third.[5] For alternative explanations for such asymmetries, see, e.g., Bagwell, Ramey, and Spulber (1997), Athey and Schmutzler (2001), Besanko and Doraszelski (2004) and Hausman and Leibtag (2004).

3 The Model

There are two cities E (East) and W (West), each hosting one unit of risk neutral consumers. Firms sell a homogenous product that generates utility u for every consumer. Every consumer is assumed to bear exogenously given switching costs $s \in [0, \sigma]$ prior to buying the good for the first time in any given type of firm or store,[6] with $u > \sigma$.

The timing is as illustrated in Figure 1. After firms choose their prices at date zero, each consumer observes the prices in his home city. Consumers

[5] For retailing, see, e.g., Bagwell and Ramey (1994), Bagwell, Ramey, and Spulber (1997), Dinlersoz (2004) or www.stores.org. According to the last source the sales of Wal-Mart, the largest retailer in the U.S., were approximately four times as large as those of the second ranked Home Depot in 2003. For the hotel industry, Michael and Moore (1995) report that 39 percent of all sales are accounted for by franchise chains.

[6] The expressions firms and stores are used interchangeably throughout the paper.

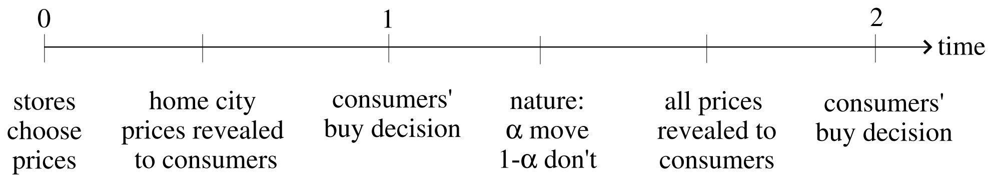

Figure 1: Time line.

then decide in $t = 1$ from which firm to buy the good. At the intermediate stage, each consumer moves to the other city with an exogenously given probability $\alpha \in (0, 1)$. Throughout it is assumed that consumers and firms know this probability but that ex ante neither firms nor consumers know whether a particular consumer will move between period one and two. Consumers who move to the other city then learn the prices prevalent in this city.[7] In period two, regardless of whether the consumer still is in the same city or not, he decides again from which firm to buy the good or whether not to buy at all. For simplicity, there is no discounting of future payoffs.

Though for the purpose of a consistent exposition we stick to the literal two-city interpretation, the basic framework also applies to many other situations. For example, if consumers commute within a metropolitan area, customers of retailers will face problems that are very similar to those in the two-city interpretation. On the other hand, it is also clear that only the literal interpretation is appropriate for hotel chains.[8]

[7] For simplicity, we assume that all consumers learn all prices in period two. But this is clearly without any loss since the period two decisions of consumers who do not move are not affected by the price of the local store in the other city.

[8] An additional or alternative interpretation is that α is the probability of a preference shock for related goods, say, cosmetics. A chain store or brand like, e.g., NIVEA, can then insure consumers against the cost of switching by offering several cosmetic products.

3.1 Interpretation of Switching Costs

The switching costs considered in this paper have the interpretation of a fixed cost of consumption. This is easily understood if one considers two different supermarkets, each of whom sells a set of products (or brands) that at most partially overlaps with those sold by its competitor. Assume also that each consumer can find his optimal consumption bundle in either one of the two supermarkets, but that finding or putting together this consumption bundle involves a fixed cost $s > 0$. This cost may be due to time spent searching for the products or to the (opportunity) cost of experimenting with different products.[9] If a consumer has invested s for one of the two supermarkets, he will no longer be indifferent between them though he would have been indifferent ex ante. Thus, the fix cost s is equivalent to a switching cost.

A similar reasoning applies in the case of hotels. Here, search costs for customers do typically not accrue when searching within a given establishment but when searching across different hotels in a given city. So as to minimize search costs, a consumer who has found a suitable hotel that is part of a chain in one city may want to go to a hotel belonging to the same chain when staying in another city.

Viewing switching costs in this way also motivates the informational assumption of the model. If consumers do not know what kind of stores to expect in a yet unfamiliar city, they are probably also uncertain about the prices prevailing in this city. Therefore, consumers only learn all prices in the other city after moving to this city. However, if a chain store is present in their home city as well as in the other city, consumers know exactly what prices to expect at the chain store in the other city. A consumer deciding whether to buy from the local or a chain store in $t = 1$ thus knows the local store's price in his home city and the chain store's price charged in both cities.

[9] Though consumers are modelled as homogenous with respect to gross utility, this assumption is not crucial because the only thing that matters is that absent switching costs, each consumer is indifferent between two different sellers if they set the same price.

3.2 Consumers

There is a continuum of consumers with heterogenous switching costs. Consumers' switching costs s are uniformly distributed on $[0, \sigma]$, so that the density is $\frac{1}{\sigma}$ for $0 \leq s \leq \sigma$ and zero otherwise. The probability $\alpha \in (0, 1)$ of moving to the other city in period two is independent of s. Consumers decide in $t = 1$ and $t = 2$ whether to buy one unit of the good, thereby generating gross utility u or not to buy, in which case they get zero utility. A consumer who buys twice from the same store at price p gets thus a net utility of $(u - p - s) + (u - p)$, while a consumer who buys from two different stores at prices p' and p'' gets a net utility of $(u - p' - s) + (u - p'' - s)$.

3.3 Firms

All firms have constant unit costs of production, which are normalized to zero. This simplifying assumption allows to disentangle the effects of consumer mobility and switching costs from the effects of increasing returns to scale. We assume also that firms are committed to charge the same prices in both periods. There are several possible and plausible justifications for this assumption. First, period length may simply be too short to make changing prices worthwhile. For example, if consumers commute and shop at different locations in a metropolitan area on a daily basis, then changing prices from day to day will probably not be optimal for retailers.[10] Second, though this is not part of the present paper, one can imagine a dynamic game where the number of newcomers in every period is sufficiently large, so that the bargain-and-ripoff strategy of low initial and high second period prices does not pay if new and old customers cannot be distinguished (see also von Weizsacker, 1984).[11] Third, for industries where chains are important the assumption of uniform prices over time seems to be more in

[10]Clearly, this argument applies much less for hotel chains because of the arguably greater time length that elapses between purchases.

[11]Note that old customers are very unlikely to reveal their type if as a "reward" for this they have to pay higher prices. However, if firms are patient enough, they may play alternating bargain-and-ripoff strategies in equilibrium; see Farrell and Klemperer (2004).

accord with casual empirical observations than bargain-and-ripoff pricing. Finally, uniform prices make the analysis much more tractable. Though we have no definite results for the alternative with time varying prices, we do not believe that the assumption of uniform prices is in any way crucial for our main finding, which is that chain stores are profitable because they help mobile consumers economize switching costs.

Firms are also restricted to charge the same price in all locations where they are active. This assumption is obviously of no consequences for local stores. It is, however, restrictive for chain stores. A chain could choose a low price in one city and a high price in the other city in order to implement a kind of bargain-and-ripoff strategy. In the present model, however, such a bargain-and-ripoff strategy as experienced by consumers, say, in W is also a ripoff-and-bargain strategy when viewed from the perspective of consumers in E. Again, in order to abstract from such behavior we assume that the chain sets a single price across locations.

4 Local Monopolies

To set the stage for analyzing the role played by a chain store, the benchmark case of a local monopolist in each city is considered first. When there are only local stores, they cannot help consumers save switching costs. Because a consumer's decision to buy from a given store will only depend on this store's price, each store acts independently of the other one.

Consider the local store in $k \in \{E, W\}$. Throughout, we use $-k$ to denote the city other than k. A consumer s in k in $t = 1$ will choose to shop at this store if his expected net utility exceeds his switching costs, i.e., if $(2-\alpha)(u-p_k^l)-s \geq 0$. If the same consumer moves to the other city in $t = 2$, he will choose the local store in $-k$, whenever $u - p_{-k}^l \geq s$. An analogous argument applies for consumer s in $-k$. The local store in k charging price p is thus confronted with a demand function consisting of three segments. If the local stores price is very low (i.e., lower than $u - \sigma$), all consumers shop and total demand is 2, consisting of the $2 - \alpha$ consumers from k and

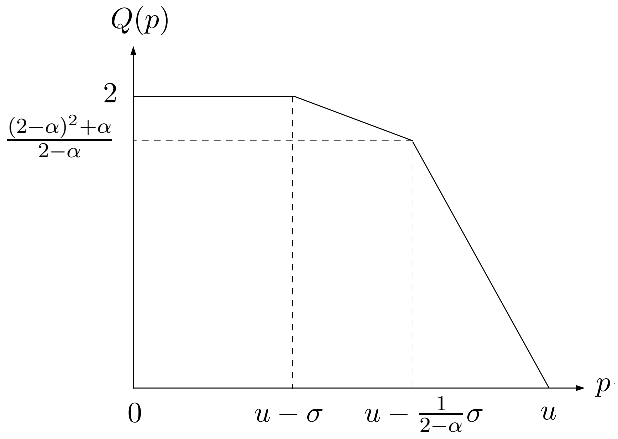

Figure 2: Demand faced by a local monopolist.

the fraction α who move from $-k$ to k.

If price is increased in k, then consumers who move from $-k$ to k shop if and only if $u-p-s>0 \Leftrightarrow s<u-p$, while still all consumers originally in k shop, i.e. $2-\alpha$. This amounts to a demand of $(2-\alpha)+\alpha(u-p)/\sigma$, where $2-\alpha$ is overall demand from the home city and $\alpha(u-p)/\sigma$ is the mass of consumers who move and who consume.

If price in k is increased further, then also some consumers originally in k prefer not to shop at all. Consumers with $(2-\alpha)(u-p)-s<0$ do not shop at all. Total demand then amounts to $(2-\alpha)(2-\alpha)(u-p)/\sigma+\alpha(u-p)/\sigma$. In sum, the local store faces the demand $Q(p)$ with

$$Q(p)=\begin{cases} 2 & p\le u-\sigma \\ 2-\alpha+\alpha\frac{u-p}{\sigma} & u-\sigma<p\le u-\frac{1}{2-\alpha}\sigma \\ \left[(2-\alpha)^2+\alpha\right]\frac{u-p}{\sigma} & u-\frac{1}{2-\alpha}\sigma<p\le u \end{cases} . \tag{1}$$

Figure 2 provides an illustration.

The optimal price is obtained by piecewise maximizing $pQ(p)$. First note that the optimal price will never be lower than $u-\sigma$. Otherwise the local store could increase its price without losing any customers. Consider next the second segment of demand which applies for prices $p\in$

$\left(u-\sigma, u-\frac{1}{2-\alpha}\sigma\right]$. Along this segment, the price elasticity of demand (defined negatively) is always greater than minus one if $\frac{u}{\sigma} < \frac{2(2-\alpha)+\alpha^2}{\alpha(2-\alpha)}$.[12] In this case, the local store always prefers a higher price, thus driving price up to the upper bound of this segment, yielding

$$\hat{p} = u - \frac{1}{2-\alpha}\sigma \tag{2}$$

as optimal price and $Q(\hat{p}) = \frac{(2-\alpha)^2+\alpha}{2-\alpha}$ as quantity demanded.

If the elasticity of demand is always smaller than minus one,[13] i.e., if $\frac{u}{\sigma} < \frac{2+\alpha}{\alpha}$, then price will be lowered until the lower bound for this segment, $u-\sigma$, is reached. For values of $\frac{u}{\sigma}$ in between these two thresholds, the optimal price is given by the first order condition from maximizing profit, yielding

$$p^* = \frac{2-\alpha}{\alpha}\frac{1}{2}\sigma + \frac{1}{2}u. \tag{3}$$

For the third segment of $Q(p)$, the elasticity of demand is smaller than minus one if $u - \frac{1}{2-\alpha}\sigma > \frac{1}{2}u \Leftrightarrow \frac{u}{\sigma} > \frac{2}{2-\alpha}$, in which case the optimal price is as low as possible, i.e., is equal to the lower bound of the segment. Otherwise, the optimal price is given by the first order condition on this segment, yielding

$$p^* = \frac{1}{2}u. \tag{4}$$

Summarizing, the optimal price p^* is given by

$$p^* = \begin{cases} u-\sigma & \frac{2+\alpha}{\alpha} < \frac{u}{\sigma} \\ \frac{2-\alpha}{\alpha}\frac{1}{2}\sigma + \frac{1}{2}u & \frac{2(2-\alpha)+\alpha^2}{\alpha(2-\alpha)} < \frac{u}{\sigma} \leq \frac{2+\alpha}{\alpha} \\ u - \frac{1}{2-\alpha}\sigma & \frac{2}{2-\alpha} < \frac{u}{\sigma} \leq \frac{2(2-\alpha)+\alpha^2}{\alpha(2-\alpha)} \\ \frac{1}{2}u & 1 \leq \frac{u}{\sigma} \leq \frac{2}{2-\alpha} \end{cases}. \tag{5}$$

[12] The elasticity is $-\frac{\alpha}{\sigma}\frac{p}{2-\alpha+\alpha\frac{u-p}{\sigma}}$. This is bigger than -1 if and only if $u > 2p - \frac{\sigma}{\alpha}(2-\alpha)$. Since p is at most $u - \frac{1}{2-\alpha}\sigma$, the right-hand side is not greater than $2u - (\frac{2}{2-\alpha} + (2-\alpha))\sigma$. Re-arranging and simplifying yields the condition in the text.

[13] From the previous footnote, $-\frac{\alpha}{\sigma}\frac{p}{2-\alpha+\alpha\frac{u-p}{\sigma}} < -1 \Leftrightarrow u < 2p - \frac{\sigma}{\alpha}(2-\alpha)$. Since p is at least $u-\sigma$, the right-hand side is larger than $2(u-\sigma) - \frac{\sigma}{\alpha}(2-\alpha)$, whence the condition in the text is obtained after some re-arranging.

Welfare Given the zero-one-nature of consumption, maximum welfare with two local monopolies is achieved when all consumers buy the good in both periods. The price then only serves a distributional function, shifting rents from consumers to firms. Note, however, that the local monopolists choose a price p^* sufficiently low to induce all consumers choose to buy the good in both periods only if $\frac{u}{\sigma} > \frac{2+\alpha}{\alpha}$. In all other cases, the local monopoly creates a welfare loss.

5 Two Local Stores Compete with a Chain Store

The previous section analyzed equilibrium when a local monopolist serves consumers in each city. The model is now extended by introducing a chain store that operates an outlet in each city and competes with local stores. The advantage of patronizing the chain store instead of local stores is that consumers can economize switching costs: Even if they move to the other city, they can visit the chain store in the new city without incurring additional set-up or switching costs if they have visited it in period one.

Let p_k^l denote the price of the local store in city $k \in \{E, W\}$ and p^c the chain store's price. Recall that consumers in k observe the price of the local store in $-k$ only in $t = 2$. Denote by Ep_{-k}^l the price of the local store in $-k$ expected by consumers living in k in $t = 1$.

Consider now what patterns firms' equilibrium prices will exhibit. If all firms charge the same price, all consumers will choose to patronize the chain because it economizes on expected switching costs, thus leaving local stores with zero profits. The next lemma shows that the chain store charges a higher price than local stores in equilibrium.

Lemma 1. *In any subgame perfect pure strategy equilibrium,*

$$0 < p_k^l < p^c < u \quad \textit{for} \quad k \in \{E, W\}. \tag{6}$$

Proof. Consider first the part $0 < p_k^l < p^c$. Suppose to the contrary that $p_k^l \geq p^c$. Then nobody in k chooses the local store in $t = 1$. In $t = 2$ new consumers arrive, who either chose the chain or local store in $-k$ in $t = 1$.

Those who chose the local store in $-k$ will choose the chain in k since it is cheaper. The same reasoning applies for the chain store customers from $-k$. The consumers who were already in k in $t = 1$ all chose the chain store in $t = 1$ or none and will do so again in $t = 2$. Therefore, with $p_k^l \geq p^c$ (assuming that everybody visits the chain in case of a tie) the local store in k will have no customers at all. The only situation where this could be part of an equilibrium is when prices are such that $p_k^l \geq p^c = 0$ because in this case (and only in this case) the local store is indifferent between having customers and having none. We now show that $p_k^l \geq p^c = 0$ cannot be an equilibrium. To see this, note that $s > 0$ for a positive measure of consumers. Consequently, the chain can make positive profits by setting a sufficiently small but positive price, whereby it attracts a positive measure of consumers. By setting a price somewhat smaller than p^c but still strictly positive, the local store attracts those consumers with very low switching costs, so that it realizes positive profits. Hence, $p_k^l \geq p^c$ cannot be.

Consider now the part $p^c < u$. Suppose to the contrary that $p^c \geq u$. In this case, no consumer will patronize the chain in $t = 2$. Given that consumers do not choose the chain in $t = 2$, they will not choose the chain in $t = 1$ either. By setting its price above u the chain thus makes zero profits. If a local store sets $p_k^l > 0$, the chain can make positive profit by lowering its price just below $\min\{p_k^l, u\}$. This proves the lemma. $\square$

Lemma 1 shows that both firms will charge positive prices that are smaller than u. Charging a price of zero is not optimal because for $\alpha > 0$ the two firms do no longer sell identical products and can thus attract different consumers: Low switching cost consumers prefer the local store while high switching cost consumers prefer the chain.

5.1 Restricting Consumers' Equilibrium Strategies

This subsection shows that consumers' optimal strategies can essentially be narrowed down to three alternatives: Consumers (1) always choose the chain, (2) always choose a local store, or (3) choose the local store in $t = 1$

and if they do not move in $t = 2$ and do not shop if they move.

The basic argument is going to be as follows. Lemma 2 shows that consumers who are inactive in period two are either inactive in both periods or patronize local stores in period one. Lemma 3 then states that whoever buys from the chain store does so in both periods. This is (1). An immediate implication of Lemma 3 is that consumers do not switch types of stores, which is the content of Corollary 1. Therefore, the relevant alternatives to (1) is to always patronize local stores (which is (2)) or to always patronize the local store in the home city and to be inactive in the other city (which is (3)).

If a consumer did not shop at all in $t = 1$, his decision problem is identical to the decision of a local shop customer who had to move to the other city. Since $p_k^l < p^c$ by Lemma 1, such a consumer will either choose the local store in $t = 2$ or not shop at all. Although it is excluded that consumers choose the chain in $t = 2$ after they chose the local in $t = 1$, they could still remain inactive in the second period. The following lemma describes the optimal behavior of consumers who are inactive in $t = 2$.

Lemma 2. *If a consumer prefers to stay inactive in $t = 2$ when he ...*

(i) ... does not move, then he also prefers to stay inactive in $t = 1$.

(ii) ... moves, then he chooses either the local store or stays inactive in $t = 1$.

Proof. (i) Whenever in $t = 2$ a consumer prefers being inactive to buying from the same store he bought from in $t = 1$ when he has not moved, then this store's price must be larger than u. But then he prefers being inactive in $t = 1$ already. (ii) Suppose to the contrary that he chooses the chain in $t = 1$. Then it must be the case that $p^c > u$. But then, as above, he prefers being inactive in $t = 1$ already. □

Lemma 3. *Whoever buys from the chain buys from it in both periods, whether he moves or not.*

Proof. Denote by $V(x, y, z)$ the expected utility of a consumer who plays the strategy (x, y, z), meaning "buy from x in $t = 1$, from y in $t = 2$ if not moved and from z if moved" with $x, y, z \in \{0, c, l\}$, where 0 stands for not buying at all, c for buying from the chain and l for buying from the local. The strategy of the proof is to show that any strategy that contains at least one c and at most two c's is dominated by a strategy that does either contain no c or by the strategy (c, c, c).

First, it is straightforward to check that (c, c, c) dominates any strategy that contains one or two c's and 0 elsewhere because by Lemma 1, $p^c < u$. Second, one can show that buying from the chain only in $t = 2$ and from at least one local in any other city or period is dominated by a strategy that does not contain any c. The proof is immediate because one can replace any c that appears in the strategy by an l: The switching cost is borne in either case, but the local's price is smaller.

Third, consider strategies where the chain is chosen in $t = 1$, but some local is chosen in $t = 2$. The basic procedure of the proof is again the same: Replace any c by an l. Complications arise only when establishing that $V(c, l, c) < \max\{V(c, c, c), V(l, l, l)\}$. To see that this indeed holds, consider a consumer who is initially in k and notice that

$$\begin{aligned} V(c,c,c) = 2(u-p^c) - s &> 2u - (1+\alpha)p^c - (1-\alpha)p_k^l - (2-\alpha)s = V(c,l,c) \\ \Leftrightarrow s &> p^c - p_k^l. \end{aligned} \tag{7}$$

On the other hand,

$$\begin{aligned} V(c,l,c) = 2u - (1+\alpha)p^c - (1-\alpha)p_k^l - (2-\alpha)s &> \\ 2u - (2-\alpha)p_k^l - \alpha E p_{-k}^l - (1+\alpha)s &= V(l,l,l) \\ \Leftrightarrow (2\alpha - 1)s &> p^c - p_k^l + \alpha(p^c - Ep_{-k}^l). \end{aligned} \tag{8}$$

Since the summands on the right-hand side are positive by Lemma 1, the condition requires s to be smaller than something negative for $\alpha < \frac{1}{2}$, which cannot be. For $\alpha > \frac{1}{2}$, the condition reads

$$s > \frac{1}{2\alpha - 1}(p^c - p_k^l) + \frac{\alpha}{2\alpha - 1}(p^c - Ep_{-k}^l). \tag{9}$$

A necessary condition for this condition to be satisfied is $s > (p^c - p^l_k)$. But if $s > (p^c - p^l_k)$ holds, then $V(c,c,c) > V(c,l,c)$ holds. Thus, either $V(c,c,c) > V(c,l,c)$ or $V(l,l,l) > V(c,l,c)$. This completes the proof. $\square$

Lemma 3 has the following immediate corollary:

Corollary 1. *Consumers do not change type of stores from $t = 1$ to $t = 2$.*

Due to Lemma 1, there will always be some consumers in each city choosing the local store in $t = 1$ in any pure strategy equilibrium. If some consumer s_0 chooses to patronize the local store in $t = 1$, then so will any consumer with $s \in [0, s_0]$. Since according to Corollary 1, consumers do not switch the type of store between $t = 1$ and $t = 2$ and since according to Lemma 3, all consumers who choose the chain in $t = 1$ will do so again in $t = 2$, there remain five relevant strategies for consumers in k:

- always patronize local stores, (l,l,l), with payoff:
  $V^k_{(l,l,l)}(s) := (2-\alpha)(u - p^l_k) - s + \alpha(u - Ep^l_{-k} - s)$,
- patronize local store in k and patronize no store in $-k$ if moved, $(l,l,0)$, with payoff:
  $V^k_{(l,l,0)}(s) := (2-\alpha)(u - p^l_k) - s$,
- always patronize the chain store, (c,c,c), with payoff:
  $V^k_{(c,c,c)}(s) := (2-\alpha)(u - p^c) - s + \alpha(u - p^c) = 2(u - p^c) - s$,
- only patronize the local store in the other city, $(0,0,l)$, with payoff:
  $V^k_{(0,0,l)}(s) := \alpha(u - p^l_{-k} - s)$, or
- always remain inactive, $(0,0,0)$, with payoff:
  $V^k_{(0,0,0)}(s) := 0$.

Note that if the strategy $(l,l,0)$ is the preferred strategy for consumer s, then it must be true that $V^k_{(l,l,0)}(s) > V^k_{(c,c,c)}(s)$, i.e.,

$$(2-\alpha)(p^c - p^l_k) > \alpha(u - p^c). \tag{10}$$

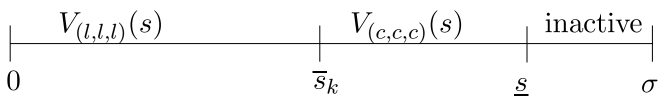

Figure 3: Partition of the set of consumers in k if (10) does not hold.

Since this condition is independent of s, no consumer at all will choose the chain store in k if it holds. Observe that condition (10) can only hold in equilibrium, if $p^l_k \neq p^l_{-k}$ for otherwise condition (10) holds in both cities and the chain has no customers at all.

Next we briefly discuss the strategies $(0,0,l)$ and $(0,0,0)$. In the proof of Proposition 1, we will show that the strategy $(0,0,0)$ is not played on the equilibrium path. Second, if the strategy $(0,0,l)$ is played in equilibrium by some consumers with s in k, then no consumer in $-k$ plays $(0,0,l)$ in equilibrium. To see this, observe that optimality of $(0,0,l)$ in k requires $u - p^l_k - s < 0$ and $u - p^l_{-k} - s > 0$, which implies $p^l_{-k} < p^l_k$. Clearly, this precludes $p^l_k < p^l_{-k}$, which would be needed for $(0,0,l)$ to be optimal for some s in $-k$. Observe that this implies that $(0,0,l)$ can only be played in an equilibrium where the two local stores set different prices. Hence, it cannot occur in a symmetric equilibrium.

5.2 Equilibrium

In a subgame perfect equilibrium (SPE) in pure strategies, consumers' expectations about the local store's price in the other city must be correct, i.e., equilibrium prices must be a solution to

$$Ep^l_k = p^l_k \quad \text{for} \quad k = E, W. \tag{11}$$

Condition (11) is a necessary condition for rational expectations. However, it does not rule out expectations such as $Ep^l_{-k} = p^l_k$. These expectations may be self-fulfilling and hence correct in a symmetric equilibrium, yet they fail the following rationality requirement. Suppose p^* is the symmetric equilibrium price set by both local stores, and consider a unilateral deviation by the local store in k to some $\hat{p} \neq p^*$. If expectations are formed according to the rule $Ep^l_{-k} = p^l_k$, then $Ep^l_{-k} \neq p^*$ after the deviation. That is, these expectations are incorrect even though the player in $-k$ about whose behavior expectations are formed has not changed his behavior. Therefore, we define rational expectations as[14]

Definition 1. *Expectations are called rational if they are correct in equilibrium and if they are correct when the player about the behavior of whom the expectations are formed does not deviate.*

Throughout, we restrict attention to expectations that are rational in this sense. This restriction has some bite insofar as there can be equilibria with self-fulfilling expectations that are not rational.

Suppose that condition (10) does not hold. As the proof of Proposition 1 will show, this is indeed the case in equilibrium. In this case the strategy to shop at the local store as long as one does not move $(l, l, 0)$ is dominated by always choosing the chain store (c, c, c). Consumers are thus divided into three groups. Low switching cost consumers with $s \leq \bar{s}_k$ always choose local stores, where

$$\bar{s}_k := \frac{2-\alpha}{\alpha}(p^c - p^l_k) + (p^c - Ep^l_{-k}). \tag{12}$$

Medium switching cost consumers with $s \in (\bar{s}_k, \underline{s}]$ always choose chain stores, where

$$\underline{s} := \min\left\{2(u - p^c),\, \sigma\right\}. \tag{13}$$

[14]Witness the similarities to, and differences from, the problem encountered in models of vertical integration and foreclosure, where an upstream monopolist offers contracts to, say, two downstream competitors (see, e.g., Chen and Riordan, 2003). Contracts being unobservable to outsiders, each downstream firm forms beliefs about the contract offered to the competitor. In equilibrium, these beliefs must be correct, but it is hard to pin down what a firm should believe about the contract offered to the competitor if the contract it receives differs from the one it should have received in equilibrium. Insofar as the downstream firm observes deviation by the upstream monopolist, the problem is similar to the problem of a consumer in k in our model who observes deviation by the local store in k. The crucial difference, though, is that the downstream firm forms expectations about the behavior of the player whose deviating it has observed, whereas in our model, the expectation concerns another player whom one has not observed to deviate and who has no incentives to do so in a Nash equilibrium.

High switching cost consumers with $s \in [\underline{s}, \sigma]$ do not shop at all; see Figure 3. The min-operator in (13) is necessary because the support of s is $[0, \sigma]$. Notice that the set of high switching cost consumers who do not shop can be empty. In deriving the demand functions below, it is assumed that all consumers shop (i.e., that this set is empty), implying $\underline{s} = \sigma$. The proof of Proposition 1 shows that this is indeed the case in equilibrium.

Given some prices $p_k^c \leq p^c$, and $Ep_k^l < p^c$ for both k, the local store in k thus faces the demand function

$$\begin{aligned} Q_k^l := (2-\alpha)\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p_k^l) + (p^c - Ep_{-k}^l)\right] \\ +\alpha\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p_{-k}^l) + (p^c - Ep_k^l)\right]. \end{aligned} \tag{14}$$

Maximizing $Q_k^l(p_k^l)p_k^l$ with respect to p_k^l for both k yields the first order condition for the local store in k

$$0 = 4p^c - 2\alpha(2-\alpha)Ep_{-k}^l - \alpha^2 Ep_k^l - 2(2-\alpha)^2 p_k^l \quad \text{with} \quad k = E, W. \tag{15}$$

A local store's best response function is

$$p_k^{l*}\left(Ep_k^l, Ep_{-k}^l\right) = \frac{4p^c - 2\alpha(2-\alpha)Ep_{-k}^l - \alpha^2 Ep_k^l}{2(2-\alpha)^2}. \tag{16}$$

The chain store faces the demand

$$Q^c(p^c) := \left(2 - Q_k^l\right) + \left(2 - Q_{-k}^l\right) \tag{17}$$

and maximizes $Q^c(p^c)p^c$ with respect to p^c. Its first order condition is

$$0 = -8p^c + 2\sigma\alpha + (2-\alpha)p_k^l + \alpha Ep_k^l + (2-\alpha)p_{-k}^l + \alpha Ep_{-k}^l. \tag{18}$$

We are now ready to state the main result of this section.

Proposition 1. *The game has a unique symmetric SPE in pure strategies with rational expectations. Equilibrium prices are*

$$p^{l*} := \frac{\alpha}{(2-\alpha)^2 + 2}\sigma \qquad\qquad p^{c*} := \frac{\alpha[(2-\alpha)^2 + 4]}{4[(2-\alpha)^2 + 2]}\sigma \tag{19}$$

with $p_k^{l*} = p_{-k}^{l*} = p^{l*}$*, and expectations satisfy*

$$Ep_k^{l*} = Ep_{-k}^{l*} = p^{l*}. \tag{20}$$

Equilibrium quantities and profits are, respectively,

$$Q^{l*} := \frac{(2-\alpha)^2}{(2-\alpha)^2+2} \qquad Q^{c*} := \frac{2[(2-\alpha)^2+4]}{(2-\alpha)^2+2} \tag{21}$$

$$\Pi^{l*} := \frac{\alpha(2-\alpha)^2}{[(2-\alpha)^2+2]^2}\sigma \qquad \Pi^{c*} := \frac{\alpha[(2-\alpha)^2+4]^2}{2[(2-\alpha)^2+2]^2}\sigma, \tag{22}$$

where $Q_k^{l*} = Q_{-k}^{l*} = Q^{l*}$ *and* $\Pi_k^{l*} = \Pi_{-k}^{l*} = \Pi^{l*}$*.*

Proof. **Existence** The three first order conditions (15) for $k = E, W$ and (18) and the two expectation consistency conditions (11) constitute a linear system of five equations in $p^c, p_k^l, p_{-k}^l, Ep_k^l$ and Ep_{-k}^l. This system of equations has a unique solution, which is given by the prices in the proposition. At these prices, all consumers shop in both cities. We thus have $\underline{s}^* = \sigma$. Since the chain store's profit function was derived under the assumption that $\underline{s} \equiv \min\{2(u - p^c), \sigma\} = \sigma$, it is necessary to verify whether the chain has an incentive to deviate, adopting a high price such that $\underline{s} < \sigma$. However, this cannot occur because when deriving the prices, too many consumers were assumed to buy from the chain store if the assumption $\underline{s} = \sigma$ does not hold. That is, we imposed a too favorable demand facing the chain store. Consequently, if under this assumption the chain does not choose a price sufficiently high to induce $\underline{s}^* < \sigma$, then it will a fortiori not choose such a high price when demand is smaller.

Next it needs to be verified whether the chain store has an incentive to deviate from equilibrium to $p^c = p^{l*}$ in order to attract all consumers, leaving the local stores with zero demand. If the chain store chooses price p^{l*}, it attracts Q^{l*} additional customers in each city. The additional revenue thereby generated is $p^{l*}Q^{l*}$ per city. However, in each city the chain store loses the revenue $(p^{c*} - p^{l*})(2 - Q^{l*})$ on the customers it would have attracted even without the deviation. Deviation to p^{l*} is therefore profitable if and only if

$$\Delta\Pi := Q^{l*}p^{l*} - \left(2 - Q^{l*}\right)(p^{c*} - p^{l*}) > 0. \tag{23}$$

Note that $p^{c*} - p^{l*} = \frac{(2-\alpha)^2}{4} \geq 1$ for all α, $2 - Q^{l*} = \frac{1}{2}Q^{c*}$ and $\frac{1}{2}Q^{c*} > Q^{l*}$. Therefore,

$$\Delta\Pi = p^{l*}\left[Q^{l*} - \frac{1}{2}Q^{c*}\frac{(2-\alpha)^2}{4}\right] \leq p^{l*}\left[Q^{l*} - \frac{1}{2}Q^{c*}\right] < 0. \tag{24}$$

Hence, it is not profitable for the chain store to deviate to p^{l*} or to any lower price.

Alternatively, a local store could deviate to a lower price in order to push the chain store out of the market completely. Fix the chain store's and the other local store's prices at p^{c*} and p^{l*} respectively. The local store in k could then set its price so low as to make condition (10) hold. To this end it must choose price $p^l_k \leq p^D$, where p^D is such that condition (10) holds with equality, i.e.,

$$(2-\alpha)(p^{c*} - p^D) = \alpha(u - p^{c*}) \Leftrightarrow p^D = \frac{2p^{c*} - \alpha u}{2-\alpha}. \tag{25}$$

But $2p^{c*} = \frac{(2-\alpha)^2+4}{2(2-\alpha)^2+4}\alpha\sigma < \alpha\sigma < \alpha u$, where the last inequality holds by assumption. Hence, $p^D < 0$ follows, proving that the deviation does not pay for a local store.

Last, we must rule out that a local firm has an incentive to deviate in such a way that some consumers play the strategy $(0, 0, l)$, i.e., do not shop in their home city but do shop after moving. Given the information structure of the model and consumers' expectations as stated in the proposition, the only way the local store in k can induce only some consumers in k to play this strategy by increasing its price. This, though, will leave the demand function it faces in period one unaffected since consumers have rational expectations, and will not increase the demand it faces in period two. But under these conditions it has already been shown that a price increase does not pay. This completes the proof that the strategy profile stated in the proposition constitutes a SPE.

Uniqueness In deriving the above equilibrium prices, two crucial assumptions on the prevailing demand structure were made: (i) all consumers shop, i.e., $\underline{s}^* = \sigma$ and (ii) that condition (10) does not hold.

(i) Suppose that $\underline{s} \equiv \min\{2(u-p^c), \sigma\} < \sigma$. That is, the set of high switching cost consumers who do not shop at all is non-empty. Notice that this does not affect the local stores' profit functions. Consequently, their first order conditions are still given by (15). With $\underline{s} = 2(u-p^c)$, the chain store's profit function is

$$\Pi^c(p^c) = \left(2\frac{2(u-p^c)}{\sigma} - Q^l_k\right)p^c + \left(2\frac{2(u-p^c)}{\sigma} - Q^l_{-k}\right), \tag{26}$$

yielding the first order condition

$$0 = 4\alpha u + 2p^l_{-k} + 2p^l_k - 8\alpha p^c + \alpha E p^l_{-k} - \alpha p^l_k + \alpha E p^l_k - \alpha p^l_{-k} - 8p^c. \tag{27}$$

In addition, conditions (11) have to be satisfied. Candidate equilibrium prices are given as solution to equations (15), (27) and (11). These prices are

$$\tilde{p}^l := \frac{2\alpha u}{6+\alpha[(2-\alpha)^2+\alpha]} \qquad \text{and} \qquad \tilde{p}^c := \frac{(2-\alpha)^2+4}{4}\tilde{p}^l. \tag{28}$$

These prices, however, imply

$$\underline{s} = 2u - \frac{\alpha(\alpha^2-4\alpha+8)}{\alpha^3-3\alpha^2+4\alpha+6}u > u > \sigma, \tag{29}$$

where the first inequality follows because the fraction is less than one for all α and the second inequality holds by assumption. Thus, there is no equilibrium with $\underline{s} < \sigma$.

(ii) Suppose that condition (10) holds. That is, assume that the chain attracts no customers in k. If the chain neither attracts consumers in $-k$, then lowering its price until it attracts some generates positive revenue. So, assume that the chain attracts some consumers in $-k$. Then condition (10) must not hold in $-k$, implying

$$p^l_{-k} > p^l_k. \tag{30}$$

The chain store's demand is then given by some consumers in $-k$ and by those of them who move from $-k$ to k. Its total demand is thus

$$Q^c(p^c) = \frac{2}{\sigma}\left[\underline{s} - \overline{s}_{-k}\right] = \frac{2}{\sigma}\left[\underline{s} - \frac{2-\alpha}{\alpha}(p^c - p^l_{-k}) - (p^c - Ep^l_k)\right]. \tag{31}$$

For the case $\underline{s} = \sigma$, the first order conditions from maximizing $p^c Q^c$ yields the chain store's reaction function

$$p^{c*}(p^l_{-k}, Ep^l_k) = \frac{1}{4}\left[\alpha\sigma + (2-\alpha)p^l_{-k} + \alpha E p^l_k\right]. \tag{32}$$

Now condition (10) for city k requires that $2p^c > \alpha u + (2-\alpha)p^l_k$. Using $Ep^l_k = p^l_k$ and inserting $p^{c*}(p^l_{-k}, Ep^l_k)$ for p^c, condition (10) reads

$$\frac{1}{4}\left[\alpha\sigma + (2-\alpha)p^l_{-k} + \alpha p^l_k\right] \quad > \quad \frac{1}{2}\left[\alpha u + (2-\alpha)p^l_{-k}\right] \tag{33}$$

$$\Leftrightarrow \alpha p^l_k > \alpha(\underbrace{2u-\sigma}_{>u}) + (2-\alpha)p^l_{-k} \quad > \quad \alpha u, \tag{34}$$

where the last inequality is due to $u > \sigma$. Condition (10) in k thus requires $p^l_k > u$. But this cannot be an equilibrium since the local store in k has no consumers in this case.

For $\underline{s} = 2(u - p^c) < \sigma$, the chain store's profit function is

$$\Pi^c(p^c) = \frac{2}{\sigma}\left[2(u-p^c) - \frac{2-\alpha}{\alpha}(p^c - p^l_{-k}) - (p^c - Ep^l_k)\right]p^c. \tag{35}$$

Thus, its reaction function is

$$p^{c*}\left(p^l_{-k}, Ep^l_k\right) = \frac{1}{4(1+\alpha)}\left[2\alpha u + (2-\alpha)p^l_{-k} + \alpha E p^l_k\right]. \tag{36}$$

Proceeding as before, one gets

$$\frac{1}{4(1+\alpha)}\left[2\alpha u + (2-\alpha)p^l_{-k} + \alpha E p^l_k\right] \quad > \quad \frac{1}{2}\left[\alpha u + (2-\alpha)p^l_{-k}\right] \tag{37}$$

$$\Rightarrow \frac{1}{4}\left[2\alpha u + (2-\alpha)p^l_{-k} + \alpha E p^l_k\right] \quad > \quad \frac{1}{2}\left[\alpha u + (2-\alpha)p^l_{-k}\right] \tag{38}$$

$$\Leftrightarrow \alpha p^l_k > (2-\alpha)p^l_{-k} \quad \Leftrightarrow \quad p^l_k > p^l_{-k} \tag{39}$$

for condition (10). But this contradicts (30). There exists thus no equilibrium with condition (10) holding.

The only demand constellation we have not yet considered is where some consumers play $(0, 0, l)$ on the equilibrium path. However, as noted above, $(0, 0, l)$ can only occur with $p^l_k \neq p^l_{-k}$ and can thus not occur in a symmetric equilibrium. Hence, the equilibrium is the unique symmetric equilibrium. □

Discussion *Market Shares and Profits.* According to Proposition 1, the chain store's profits in each city (which are equal to half of the chain store's total profit Π^{c*}) are larger than the profits of a local store. Prices and profits of both local stores and the chain store increase in α, but Π^{c*} increases faster in α than Π^{l*}. Note also that $Q^{c*}(\alpha)$ is strictly increasing in α. It equals $8/3$ for $\alpha = 0$ and is equal to $10/3$ for $\alpha = 1$. Because equilibrium demand aggregated over both periods and both cities is four, the chain store's market coverage increase from $2/3$ to $5/6$ as α increases from zero to one.

Predicted Price Differences. The model predicts also that local stores charge lower prices than chain stores. To see this, notice that

$$p^{c*} = \frac{(2-\alpha)^2 + 4}{4} p^{l*} > p^{l*} \tag{40}$$

for all α. At first sight, this may seem at odds with empirical facts if one thinks of, say, the retail industry.[15] However, this indicates only that switching costs are not the only driving factor in the retail industry, where increasing returns and market power on the input side may be at least as important. On the other hand, there are other industries where observed pricing patterns are hard to understand without the factors that our model emphasizes. As mentioned at the very beginning, a local provider of bus trips from New York City to Boston is substantially cheaper than the large chain. Similarly, the regional airline German Wings offers flights that are cheaper by orders of magnitude than those of Lufthansa. Starbucks, the largest coffee house chain, is not exactly known for providing cheap coffee, though the price differences here are certainly less striking than those for bus trips or airfares. Casual empiricism in the hotel industry also suggests that large chains are by no means cheaper than local hotels offering the same quality. More importantly, though, there is also some systematic evidence from the banking industry that is in line with the price pattern predicted by our model. Ishii (2004) estimates the effect of ATM surcharges on retail banking industry structure and welfare (see also Knittel and Stango, 2005). Surcharges for withdrawing cash from banks other than the one at which a

[15] See, e.g., Hausman and Leibtag (2004).

customer has his or her deposit account impose a cost of switching banks to the consumer. Ishii finds that consumers prefer banks with larger ATM networks, arguably because of lower expected surcharge payments. She finds that banks with larger ATM networks pay lower interest rates on deposits, which corresponds to charging a higher price in our model.

Public Prices of Local Stores. The assumption that local stores' prices are only known locally has some consequences that are worth a brief discussion. Consider the local store in k. Differentiating its best response function (16) with respect to consumers' expectations Ep_k^l yields

$$\frac{\partial p_k^{l*}(Ep_k^l)}{\partial Ep_k^l} = -\frac{1}{2}\left(\frac{\alpha}{2-\alpha}\right)^2 < 0. \tag{41}$$

That is, the lower the expected price, the higher the optimal price of the local store in k. The reason for this is straightforward. A lower expected price implies a larger demand, and the larger demand in turn induces the local store to set a higher price. However, since in equilibrium consumers cannot be fooled, $Ep_k^l = p_k^l$ must hold, implying that a high price and low expected price are not consistent.

This behavior is reminiscent of the well known problem of the durable goods seller uncovered by Coase (1972), in which consumers' (correct) expectations of lower future prices reduce demand in the presence, as a consequence of which price in the presence is reduced as well. A durable goods seller who could commit not to lower its price in the future would make a larger profit. Very similarly, the local stores in our model could gain if they could credibly communicate their prices in both cities in period one, thereby committing themselves not to "cheat" on consumers.

Having said that, we should emphasize that the assumption that local stores' prices are not completely public information is not only more realistic than assuming that they are known in both cities, but it is also without consequences for the qualitative predictions of our model. If we assumed instead that the prices of local stores are known in both cities in period one, the chain store would still set a higher price and make a larger profit than local stores.

6 Industry Equilibrium with Costly Entry

So far, we took market structures as given. In section 4, we analyzed the market structure with local monopolies, and in the previous section we analyzed the interplay of a chain store that competes with a local store in every city. An interesting question is whether one of these configurations is stable in the sense that all firms that are active make non-negative profits and that no additional firms have incentives to enter the market.

As has already been seen, though local monopolies make positive profits, the market structure with a local monopoly in each city is not stable because a chain can profitably enter. So as to show that the market structure of section 5 is stable, we thus have to show that no additional local store and no additional chain has an incentive to enter if this market structure prevails.

Lemma 4. *If there are two or more stores of the same type (local or chain) in a city, at least two of them charge a price of zero, and all stores of the this type make zero profits.*

Proof. Assume to the contrary that some firm makes positive profits. The only way that this can happen is that it charges a positive price. But given that this firm serves customers at a positive price, another firm of the same type will have an incentive to slightly undercut this price and get all the customers from this firm. Clearly, this race to the bottom will only stop if one of the firms charges a price equal to zero. So that a firm that charges a price of zero has no incentive to raise its price, it must be the case that another firm sets a price of zero as well. This proves the claim about equilibrium prices. As to profits, note first that all firms that charge a price of zero trivially make zero profits. Second, any firm that charges a higher price will have no customers and consequently will make zero profits, too. $\square$

Lemma 4 implies that the market structure with one local store in each city and one chain serving both cities is the unique market structure if entry into the industry is associated with some positive costs. Starting with no firms at all, either a local or a chain store can profitably enter the market. If a local store enters, no other local store will enter the same city, since profits would be zero. Another local store will only enter in the other city. If there is a local store in each city, a chain can still enter profitably but, due to Lemma 4, not more than one chain will enter. Thus, we have:

Proposition 2. *With small but positive entry costs, the unique stable market structure consists of a chain store with an outlet in both cities and a local store in each city.*

Regarding welfare, this market structure only achieves second-best. Since $u > \sigma$ and since production costs are zero, it is optimal that all consumers consume the good in both periods. As Proposition 1 showed, all consumers shop in equilibrium in both periods. However, some of them shop at local stores and are thus confronted with expected switching costs of $(1 + \alpha)s$. With two competing chains, prices are zero and all consumers shop in both periods. But now expected switching costs are only s for all consumers. Therefore, first-best would be achieved by two competing chains, which is not a stable market structure, though. The unique stable market structure thus generates higher welfare than do two local monopolists, yet fails to attain first-best.

7 Conclusions

We study a two city model where mobile consumers face costs of switching sellers. Since consumers change the city with an exogenous probability, they can reduce expected switching costs by shopping at a chain store rather than at a local store. If consumers differ with respect to switching costs, firm size serves as a means of product differentiation, where local stores serve low switching cost consumers and chain stores serve high switching cost consumers.

This model provides four key insights. First, the market structure with a local store and a chain store in each city is the unique stable market structure if there is a small, positive cost of entry. That is, local stores coexist in equilibrium with the chain store. Second, the chain store charges a higher price than local stores. Third, as consumers become more mobile, the market share of the chain store increases, and so do profits and prices of all stores. Finally, the chain store becomes more profitable relative to local stores as mobility increases.

References

Athey, S., and A. Schmutzler (2001): "Investment and Market Dominance," *RAND Journal of Economics*, 32(1), 1–26.

Bagwell, K., and G. Ramey (1994): "Coordination Economics, Advertising, and Search Behavior in Retail Markets," *American Economic Review*, 84(3), 498–517.

Bagwell, K., G. Ramey, and D. F. Spulber (1997): "Dynamic Retail Price and Investment Competition," *RAND Journal of Economics*, 28(2), 207–27.

Baye, M. R., and J. Morgan (2001): "Information Gatekeepers on the Internet and the Competitiveness of Homogenous Product Markets," *American Economic Review*, 91(3), 454–74.

Baye, M. R., J. Morgan, and P. Scholten (2004): "Price Dispersion in the Small and in the Large: Evidence from an Internet Comparison Site," *Journal of Industrial Economics*, LII(4), 463–496.

Besanko, D., and U. Doraszelski (2004): "Capacity Dynamics and Endogenous Asymmetries in Firm Size," *RAND Journal of Economics*, 35(1), 23–49.

Chen, Y., and M. H. Riordan (2003): "Vertical Integration, Exclusive Dealing, and Ex Post Cartelization," *Working Paper.*

Coase, R. H. (1972): "Durability and Monopoly," *Journal of Law and Economics*, 15(1), 143–149.

Dinlersoz, E. M. (2004): "Firm Organization and the Structure of Retail Markets," *Journal of Economics & Management Strategy*, 13(2), 207–40.

Farrell, J., and P. Klemperer (2004): "Coordination and Lock-In: Competition with Switching Costs and Network Effects," *Working Paper*.

Hausman, J., and E. Leibtag (2004): "Consumer Benefits from Increased Competition in Shopping Outlets," *Working Paper*.

Hotelling, H. (1929): "Stability in Competition," *The Economic Journal*, 39(153), 41–57.

Ishii, J. (2004): "Interconnection Pricing and Compatibility in Network Industries: ATM Networks in the Banking Industry," *Working Paper*.

Janssen, M. C., V. A. Karamychev, and P. van Reeven (2003): "Multi-Store Competition: Market Segmentation or Interlacing?," Tinbergen Institute Discussion Paper No. 03-033/1.

Klemperer, P. (1987): "The Competitiveness of Markets with Switching Costs," *RAND Journal of Economics*, 18(1), 138–150.

——— (1995): "Competition when Consumers Have Switching Costs," *Review of Economic Studies*, 62, 515–39.

Knittel, C., and V. Stango (2005): "Compatibility with Indirect Network Effects: Evidence from ATMs," *NBER Working Paper Nr. 10774*.

Michael, S. C., and H. J. Moore (1995): "Returns to franchising," *Journal of Corporate Finance*, 2, 133–155.

Nelson, P. (1970): "Information and Consumer Behavior," *The Journal of Political Economy*, 78, 311–329.

Salop, S. (1979): "Monopolistic Competition with Outside Goods," *Bell Journal of Eonomics*, 10, 141–56.

Stahl, K. (1982): "Location and Spatial Pricing Theory with Nonconvex Transportation Cost Schedules," *Bell Journal of Economics*, 13(2), 575–82.

von Weizsacker, C. C. (1984): "The Cost of Substitution," *Econometrica*, 52(5), 1085–1116.

Wolinsky, A. (1983): "Retail Trade Concentration Due to Consumers' Imperfect Information," *Bell Journal of Economics*, 14(1), 275–282.