Chain Stores, Consumer Mobility, and Market Structure

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Abstract

In many markets the same product is sold both by large global firms ("chains") and small local firms. Surprisingly, chains often charge higher prices, be they hotels, airlines, or coffee shops. Moreover, there is a correlation between increased geographic consumer mobility and the emergence of chains during the 20th century. We provide a simple model that can account for these patterns. In this model there are both local firms and a chain. Consumers bear a setup cost whenever they visit a firm for the first time. If consumers buy from a new firm because they change location, they bear this cost anew. By definition a chain operates stores in all locations and thus insures consumers against the need to bear the setup cost repeatedly. In equilibrium, the chain charges higher prices and attracts more consumers, and therefore generates a larger profit, than local stores. As consumer mobility increases, local stores and the chain become more differentiated and thus their equilibrium profits increase but the chain's equilibrium profits increase faster.

Keywords: Firm size, 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 (chains) 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 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. Of course, the same is true for new customers of chains. The twist, though, is that if customers are mobile and consume repeatedly, they have to incur these setup costs 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,

[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.

they risk to incur setup 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 symmetric equilibrium both types of firms are active. The chain store charges a higher price and attracts more consumers than do local stores. Consumers with low setup costs buy from the local stores and consumers with high setup costs buy from the chain store. Moreover, the relative profitability of the chain store increases as consumers become more mobile.

Two salient features of the developments in modern societies initiated in the early-mid 20th century are the, by any measure, dramatic increase in consumer mobility and the emergence and then prevalence of chains. For example, hotel chains emerged first in the U.S. when automotive interstate travel became popular. In 1954, two years before the Eisenhower Interstate Act, total revenue generated by hotel chains was 22 percent of total hotel revenue. In 1992, it was 58 percent (Ingram and Baum, 1997). Though testing whether the emergence, and then dominance, of chains is caused by increased consumer mobility is beyond the scope of our paper, the model's comparative statics are broadly consistent with these developments as the chain benefits disproportionately more from increased consumer mobility than do local stores.

To further motivate, and to supplement the above anecdotes with more systematic evidence, we collected data on 99 randomly selected New York hotels. The data was taken from expedia.com and includes price per person for a standard room[4], quality level (1 to 5 stars) and area (11 categories). In addition a chain dummy was constructed which indicates whether the hotel is a member of a chain or not. Table 1 summarizes the result from a simple OLS regression. Consistent with the examples mentioned at the outset, the chain dummy is significantly positive. Depending on the specification chosen, chain affiliated hotels charge 10 to 15 percent higher prices than other hotels.[5] The appendix contains detailed estimation results.

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 derives some preliminary results. In Section 5 the unique symmetric equilibrium is derived and discussed. It is shown that the market structure with a local store in each city and a chain store active in both cities is the unique

[4]The online search on list prices was conducted on May 5, 2005 for rooms available on Wednesday November 8, 2005. To the extent that there is no systematic difference in how transaction prices differ from listed prices across types of hotels, the results still hold even when there are such differences.

[5]A similar qualitative result obtains in the Deneckere and Davidson (1985) model. However, their result applies only to outlets of a chain in the same market whereas our model applies to outlets of chains across markets. The data does not allow us to disentangle these two explanations for chains pricing higher than locals.

Variable	Dependent variable is **price**	
chain	53.10	***
low quality (no. of stars ≤ 2)	-148.93	***
high quality (no. of stars ≥ 4)	115.41	***
controlling for area	yes	
constant	356.83	***
R^2	0.56	

*** Significant at the 1% level.

Table 1: Effect of chain affiliation on hotel prices. Average price of the 99 hotels in the sample is $347. See Appendix A for more details.

stable market structure if there is a small, positive entry cost. Section 6 concludes. Proofs are in the Appendix.

2 Related Literature

We consider competition between local single outlet firms and "global" multiple outlet firms. Our analysis thus deals with competition between local stores and chain stores where a chain is defined as a firm that operates two or more stores. The existing literature recognizes several reasons for the success of chains. One prominent reason is buying power and bargaining skills. Among others, Inderst and Wey (2003) provide a theoretical explanation for increased bargaining power for larger buyers (see also Katz (1987) and Dobson and Waterson (1997)). Another explanation for the success of chains considers single ownership vs. franchising (see, e.g., Lafontaine, 1992). The basic tradeoff is that franchisees have incentives to free ride on the chain's reputation, yet also have stronger incentives to exert effort.

We delve into a particular aspect of a chain's reputation, namely the chain's ability to spread the reputation across different local markets. By standardization of appearance or operations, chain stores make it easy for customers to recognize single stores that belong to the same chain. Standardization thus tells consumers that they can expect the same type of product and service quality in all stores.[6] While building up a reputation for a certain level of quality is also feasible for local firms, chain stores can spread this reputation across different local markets through

[6]Ingram and Baum (1997), for example, note that "the strategy of hotel chains can be described with one word, standardization".

standardization. If consumers are mobile and thus leave their familiar local environment with some positive probability, the knowledge they acquired becomes worthless unless they previously visited a chain. This effect of consumer mobility on the development of retailing is pointed out e.g. by Perkins and Freedman (1999, p.130). The effect of consumer mobility on the success of chains is well documented by the history of some of the most prominent chains. For example, hotel chains grew up with automotive travel in the United States (Ingram and Baum, 1997). Although increased consumer mobility and the growth of chains appear empirically closely connected, the theoretical literature has - to the best of our knowledge - not recognized this relationship. For example, Stahl (1982, Footnote 17) 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".

We propose an oligopoly model to analyze the effect of standardization in an environment with mobile consumers. It 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.[7] 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 (2005).

As setup costs induce switching costs in $t = 2$, our model is closely related to Klemperer (1987). He analyzes a two period model with heterogeneous consumers deciding each period at which out of two firms to buy. Switching firms in the second period is assumed to be costly. In addition, a fraction of consumers changes tastes between periods. Changing tastes is equivalent to moving to a new city in our model. An important difference, though, is that in our model a consumer *chooses* whether he incurs the risk of changing tastes, which he does does when patronizing a local store, or not. Klemperer (1987) avoids solving for mixed strategies in his model by restricting parameters appropriately.[8] However, such an approach is not feasible in our model because these parameters are endogenous. In order to avoid mixed strategies we restrict firms to set stationary prices across periods,[9] which is in line with von Weizsäcker (1984). As

[7]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.

[8]See Klemperer (1987, footnote 8, p.142): "For small [parameter values], there exists no symmetric pure-strategy equilibrium, and mixed-strategy equilibria seem hard to find."

[9]Allowing for dynamic pricing in our model leads to mixed strategies for some parameter values. Such a model turned out to be intractable as did other specifications.

it deals with setup costs, which may emerge from costly search and experimentation, our paper is also related to the search literature initiated by Diamond (1971); see also Spulber (1996), Anderson and Renault (1999) and Rust and Hall (2003).

Since chain stores are physically differentiated from local stores in 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 (2005) study competition between two firms with multiple outlets (chain stores) on the Salop (1979) circle, where firms sell differentiated products to heterogeneous consumers. In their model, outlets from the same chain are homogenous but outlets across chains are heterogeneous. Whereas Janssen, Karamychev, and van Reeven (2005) 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 heterogeneous single outlet firms.

3 Model

Consider two cities E (East) and W (West), each hosting a continuum of risk neutral consumers with mass one. There are three firms: a chain operating a store in each city and two local firms (stores) so that each city hosts one chain store and one local store. Firms sell a homogenous good produced with constant unit costs, which are normalized to zero. This simplifying assumption allows to disentangle the effects of consumer mobility and setup costs from the effects of increasing returns to scale. We assume also that firms are committed to stationary prices in both periods independent of location. Commitment to stationary prices is a common simplifying assumption in the search literature (see, e.g., Spulber, 1996; Anderson and Renault, 1999; Rust and Hall, 2003).[10]

Consumers differ with respect to setup costs s. These costs are uniformly distributed on $[0, \sigma]$ and are incurred whenever a firm is visited for the first time. Consequently, 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 each period whether to buy one unit of the good, thereby generating gross utility $u > \sigma$ 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

[10] "The rigidity of prices during search is a standard assumption in search models" (Spulber, 1996, p.565). Search typically lasts infinitely long: "Middlemen are infinitely lived and set a pair of stationary bid and ask prices[...]" (Rust and Hall, 2003, p.359)

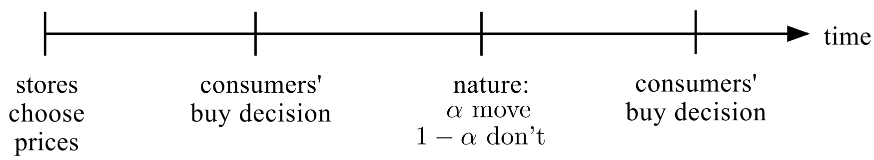

Figure 1: Time line.

$(u-p-s)+(u-p)$, while a consumer who buys from two different stores at prices p' and p'' gets a net utility of $(u-p'-s)+(u-p''-s)$.[11]

The timing is as illustrated in Figure 1. Firms choose their prices at date zero. Consumers observe all prices[12] and 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. 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.[13]

4 Preliminary Results

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. Throughout, we use $-k$ to denote the city other than k. 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 setup costs, thus leaving local stores with

[11] This assumption is the same as in Anderson and Renault (1999) and Diamond (1971).

[12] Appendix C.1 discusses the case where consumers in city k do not observe the prices of firms in $-k$.

[13] 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 can then insure consumers against the cost of switching by offering several cosmetic products.

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 equilibrium (SPE) in pure strategies,*

$$0 < p_k^l < p^c < u \quad for \quad k \in \{E, W\}. \tag{1}$$

Lemma 1 shows that both firms will charge positive prices that are smaller than u.[14] 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 setup cost consumers prefer the local store while high setup cost consumers prefer the chain.

The lemma has another interesting empirical prediction, which obtains quite generally in models with vertical product differentiation:[15] The quality advantage of a firm translates into a higher equilibrium price of that firm. This prediction is consistent with the empirical evidence in Table 1 in the Introduction for hotels in New York City (see also Appendix A).

Next, we reduce consumers' relevant strategies by eliminating those strategies which are dominated under the pricing pattern of Lemma 1. Observe that in every period a consumer has three choices: Do not buy, buy from the local store or buy from the chain. As in period two a consumer born in k can be in k or $-k$, there are two contingencies for period two. Consequently, a strategy for a consumer is triple (x, y, z), where the first element specifies what the consumer does in period one, the second what he does in period two if he does not move and the third what he does upon moving, where $x, y, z = 0$ means that the consumer does not buy at all and $x, y, z = l(c)$ means that he buys from the local store (chain store). Therefore, there are 27 (i.e. three to the power of three) possible strategies for each consumer. For example, $(c, l, 0)$ denotes the strategy of a consumer who buys from the chain in period one but switches to the local store in period two if he does not move while he does not buy at all if he moves. We denote by

[14] Note that the restriction to subgame perfect equilibria has some bite. The following strategies are a Nash equilibrium which is not subgame perfect: Consumers consume only if $p = 0$ for all firms and they consume at chains only. Firms all set prices equal to zero.

[15] Anderson, de Palma, and Thisse (1992, Ch.7) for example show that in the logit model of product differentiation a firm's equilibrium price (and profit) increases with that firm's quality level; see also Lemma 1 and Corollary 1 in Anderson and Renault (2006). A firm's quality advantage is retained in equilibrium due to higher demand for its product. However, the quality advantage is reduced in equilibrium because the lower quality firm charges a lower price than the high quality firm. In our model, the chain store has a quality advantage in the sense that consumer s saves expected setup costs αs when buying at the chain store. At equal prices all consumers thus prefer to shop at the chain store.

$V_k^s(x, y, z)$ expected net utility of a consumer born in city $k \in \{E, W\}$ with setup costs s when playing (x, y, z). For example $V_k^s(l, l, l) = (u - p_k^l - s) + (1 - \alpha)(u - p_k^l) + \alpha(u - p_{-k}^l - s)$ and $V_k^s(c, l, c) = (u - p^c - s) + (1 - \alpha)(u - p_k^l - s) + \alpha(u - p^c)$. Lemma 2 below shows that consumers' optimal strategies can be narrowed down to five relevant alternatives.

Lemma 2. *There are at most five relevant strategies for consumers in any pure strategy subgame perfect equilibrium:* $(0, 0, 0)$, $(0, 0, l)$, $(l, l, 0)$, (l, l, l) *or* (c, c, c).

Lemma 2 has the following immediate corollary.

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

Expected utility for a consumer s in k from each of the five relevant consumer strategies are

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

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

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

Since this condition is independent of s, no consumer will choose the chain store in k if it holds. Observe that condition (2) can only hold in equilibrium, if $p_k^l \neq p_{-k}^l$ for otherwise condition (2) holds in both cities and the chain has no customers at all. Let us now briefly discuss the strategy $(0, 0, l)$. If this strategy is played in equilibrium by some consumers with s in k, then

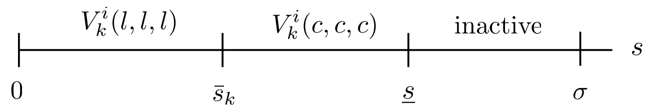

Figure 2: Partition of the set of consumers in k if (2) does not hold.

no consumer in $-k$ plays $(0,0,l)$ in equilibrium. To see this, observe that optimality of $(0,0,l)$ in k requires $u-p_k^l-s<0$ and $u-p_{-k}^l-s>0$, which implies $p_{-k}^l<p_k^l$. Clearly, this precludes $p_k^l<p_{-k}^l$, 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. We call a SPE symmetric if the two local stores set the same prices. As just shown, the strategies $(l,l,0)$ and $(0,0,l)$ can only prevail in equilibrium if the local stores' prices differ. This leads to the following corollary:

Corollary 2. *Only the strategies* (l,l,l), (c,c,c) *and* $(0,0,0)$ *are relevant in a symmetric SPE.*

5 Equilibrium

Note that due to Lemma 1 there will always be some consumers with low setup costs choosing (l,l,l). From Corollary 2 we thus know that in any symmetric equilibrium consumers are divided into at most three groups. Low setup cost consumers with $s\in[0,\bar{s}_k]$ always choose local stores, where $\bar{s}_k$ is such that $V_k^s(l,l,l)=V_k^s(c,c,c)$, i.e.

$$\bar{s}_k := \frac{2-\alpha}{\alpha}(p^c-p_k^l)+(p^c-p_{-k}^l). \tag{3}$$

Medium setup cost consumers with $s\in(\bar{s}_k,\underline{s}]$ always choose chain stores, where $\underline{s}$ is such that $V_k^s(c,c,c)=V_k^s(0,0,0)$, i.e.

$$\underline{s} := \min\left\{2(u-p^c),\ \sigma\right\}, \tag{4}$$

where the min-operator is necessary because the support of s is $[0,\sigma]$. High setup cost consumers with $s\in[\underline{s},\sigma]$ do not shop at all. Figure 2 illustrates this partition of setup costs. Notice that the set of high setup cost consumers who do not shop can be empty. In deriving the demand functions, it is assumed that the market is covered, implying $\underline{s}=\sigma$. The proof of Proposition 1 shows that this is indeed the case in equilibrium.

Given some prices $p^l_k \leq p^c$, for both k, the local store in k thus faces the demand function

$$Q^l_k := (2-\alpha)\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p^l_k) + (p^c - p^l_{-k})\right] + \alpha\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p^l_{-k}) + (p^c - p^l_k)\right]. \quad (5)$$

Maximizing $Q^l_k(p^l_k)p^l_k$ with respect to p^l_k yields the first order condition for the local store in k

$$-2p^c + \alpha(2-\alpha)p^l_{-k} + 2(2-2\alpha+\alpha^2)p^l_k = 0 \quad \text{with} \quad k = E, W. \quad (6)$$

A local store's best response function is therefore,

$$p^l_k\left(p^l_k, p^c\right) = \frac{2p^c - \alpha(2-\alpha)p^l_{-k}}{2(2-2\alpha+\alpha^2)}. \quad (7)$$

Observe that $p^l_k\left(p^l_k, p^c\right)$ increases in p^c, which is typical of price competition in models with product differentiation. Therefore, the chain's price and a local store's price are strategic complements. However, $p^l_k\left(p^l_k, p^c\right)$ decreases in the price of the other local store, p^l_{-k}. Therefore, local store prices are strategic substitutes. This has some interesting implications, which we discuss below.

The chain store faces the demand

$$Q^c(p^c) := \left(2 - Q^l_k\right) + \left(2 - Q^l_{-k}\right) \quad (8)$$

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

$$0 = \alpha\sigma + p^l_k + p^l_{-k} - 4p^c, \quad (9)$$

yielding the chain store's reaction function:

$$p^c(p^l_k, p^l_{-k}) = \frac{\mu}{2} + \frac{p^l_k + p^l_{-k}}{4}, \quad (10)$$

where $\mu := \alpha\sigma/2$ denotes expected average setup cost in period two absent the chain store. Observe that for the chain store, only the sum of local store prices matters.

Let $a = 1/(3-2\alpha+\alpha^2)$ and observe that $a < 1/2$ and $da(\alpha)/d\alpha > 0$ for all $\alpha \in (0,1)$. Denote further by p^{c*} and p^{l*}, respectively, the prices of local stores and the chain store in a symmetric SPE. Similarly, let Q^{l*} and Q^{c*} be the quantity sold of each local store and the aggregate quantity sold by the chain store in such an equilibrium, and let Π^{l*} and Π^{c*} be the corresponding profits. With this notation at hand, we can can now state our main result:

Proposition 1. *The game has a unique symmetric SPE in pure strategies. The equilibrium prices are*

$$p^{l*} = a\mu \quad \textit{and} \quad p^{c*} = \frac{1+a}{2}\mu,$$

and the equilibrium quantities and profits are, respectively,

$$Q^{l*} = 1-a, \quad Q^{c*} = 2(1+a), \quad \Pi^{l*} = (1-a)a\mu \quad \textit{and} \quad \Pi^{c*} = (1+a)^2\mu.$$

Market Shares, Prices and Profits According to Proposition 1, the chain store's profit in each city, which is equal to half of its total profit Π^{c*}, is larger than the local stores' profits. 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 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 $3/4$ as α increases from zero to one.

The model predicts also that local stores charge lower prices than chain stores. To see this, notice that $p^{c*}/p^{l*} = \frac{1}{2}\frac{1+a}{a} > \frac{3}{2}$ because $a < 1/2$ for all $\alpha \in (0,1)$. At first sight, this may seem at odds with empirical facts if one thinks of, say, the retail industry.[16] However, this indicates only that setup 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.

There is also some systematic evidence from the banking and the hotel industry which is in line with the price pattern predicted by our model. Ishii (2005) estimates the effect of ATM

[16] See, e.g., Hausman and Leibtag (2005).

surcharges on retail banking industry structure and welfare (see also Knittel and Stango, 2004). Surcharges for withdrawing cash from banks other than the one at which a 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. Our own results for the hotel industry show that hotels that are part of a chain charge significantly higher prices. These results are reported in Table 1 in the Introduction and in Appendix A.

By lowering (increasing) its price the local store in k increases (decreases) demand for the local store in $-k$. However, the local store ignores this effect on the other store when choosing its own price. As a consequence, the local stores would choose a lower price if they were allowed to collude. Therefore, colluding local stores act more competitively than non-colluding stores.

Industry Equilibrium with Costly Entry So far, we took the market structure as given. An interesting question is whether it 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. Clearly, if local stores are monopolies, they make positive profits. However, the market structure with a local monopoly in each city is not stable because a chain can profitably enter. It is easy to see that the market structure assumed in Proposition 1 is the unique stable market structure. Standard Bertrand arguments can be applied to establish that 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 this type make zero profits.[17] Therefore, 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.

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 setup costs of $(1 + \alpha)s$. With two competing chains, prices are zero and all consumers shop in both periods. But now expected setup 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.

[17] See Lemma 3 in the Appendix.

6 Conclusions

In the present paper, we study a two city model where consumers are mobile and face setup costs whenever they are in a yet unfamiliar city. Consumers have to change the city with an exogenous probability, but they can reduce expected setup costs by shopping at a chain store rather than at a local store. Since consumers differ with respect to setup costs, firm size serves as a means of product differentiation, where local stores serve low setup cost consumers and chain stores serve high setup 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. To the best of our knowledge, this is the first paper that provides a formal model that explains the emergence and superior profitability of chains with increases in consumer mobility.

Two avenues seem particularly fruitful for further research. First, the connection between advertising and consumer mobility could be explored. To see the potential of informative advertising in the present model, observe that the quality advantage of the chain store would decrease if local firms used informative advertising to decreases consumers' setup costs. On the other hand, any given level of advertisement in a given city is more valuable for a chain if consumers are mobile because its advertisement expenditure is not lost on consumers who move whereas this is the case for local firms' ads. Therefore, the overall effect of allowing for informative advertisement is not clear a priori and requires proper modelling.

Second, the fact that for each local store the other local store's price is a strategic substitute has the interesting implication that the two local stores would set lower prices than in the symmetric equilibrium we studied if they were able to collude. Thus, the model predicts price decreasing collusion. There are other plausible instances where this could occur. Consider for example competition between two local airlines, called A and B. Airline A offers flights from A to C (and from C to A) and B offers flights from B to C (and from C to B). But direct flights from A to B are only offered by a major carrier C. All else equal, passengers are likely to prefer direct flights from A to B to flying from A to B with a change at C. If passengers differ with respect to their disutility of switching flights, low switching costs customers will choose to fly with the local airlines while high switching costs consumers will fly with the major carrier. However, when pricing independently and noncooperatively, the two local airlines will set their prices too high compared to the prices that would maximize their joint profits because each of them neglects the demand externality it exerts on the other one. More rigorous theoretical and empirical analysis of this phenomenon seems very relevant, not least for antitrust policy and regulation.

Appendix

A Detailed Estimation Results

Effect of chain affiliation on hotel prices. Average price of the 99 hotels in the sample is $347 (std dev.= $28.10, median= $350).

	(1)		(2)		Descriptive stat.		
Variable	dependent variable is price				Mean	Std dev	Median
chain	33.05		53.10		0.37	0.49	0
	(15.50)	**	(18.64)	***			
linear quality							
no. of stars	132.55				3.15	0.68	3
	(11.76)	***					
quality dummies							
low quality (no. stars ≤ 2)			-148.93		0.12	0.33	0
			(29.18)	***			
high quality (no. stars ≥ 4)			115.41		0.19	0.40	0
			(23.88)	***			
area dummies							
area 1 (lwr manhattan)	10.62		3.87		0.05	0.22	0
	(53.18)		(65.00)				
area 2 (midtown)	-47.78		-35.81		0.77	0.42	1
	(42.90)		(52.02)				
area 3 (upper E side)	31.85		58.30		0.06	0.24	0
	(51.79)		(62.57)				
area 4 (upper W side)	-92.03		-110.33		0.09	0.29	0
	(49.77)	*	(60.39)	*			
constant	-39.86		356.83				
	(57.25)		(51.88)	***			
R^2	0.70		0.56				

*** 1%, ** 5%, * 10%.

Reference area: Central Park, Theater District, Chelsea.

B Proofs and an Auxiliary Result

Proof of Lemma 1. 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 in 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 setup 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. $\square$

Proof of Lemma 2. Lemma 1 shows that the chain is more expensive than local stores in any pure strategy subgame perfect equilibrium. The only reason why a consumer still buys at the chain is because he expects to economize on setup costs. This, however, is only possible if the chain is chosen in period one as well as in period two in case the consumer moves. The table below lists all possible strategies. If a strategy is dominated by another strategy, this is marked in the column “dom’ by”.

#	Strategy	dom' by	#	Strategy	dom' by	#	Strategy	dom' by
1	**(0,0,0)**	–	10	$(l, 0, 0)$	13	19	$(c, 0, 0)$	10,13
2	**(0,0,l)**	–	11	$(l, 0, l)$	14	20	$(c, 0, l)$	11,14
3	$(0, 0, c)$	2	12	$(l, 0, c)$	11,14	21	$(c, 0, c)$	27
4	$(0, l, 0)$	13	13	**(l,l,0)**	–	22	$(c, l, 0)$	13
5	$(0, l, l)$	14	14	**(l,l,l)**	–	23	(c, l, l)	14
6	$(0, l, c)$	5,14	15	(l, l, c)	14	24	(c, l, c)	see below
7	$(0, c, 0)$	4,13	16	$(l, c, 0)$	13	25	$(c, c, 0)$	13
8	$(0, c, l)$	5,14	17	(l, c, l)	14	26	(c, c, l)	14
9	$(0, c, c)$	6,14	18	(l, c, c)	17,14	27	**(c,c,c)**	–

The strategy (c, l, c) is eliminated by the following observation. For (c, l, c) to be chosen by consumer s this requires that $V_k^s(c, l, c) > V_k^s(c, c, c)$, implying

$$s < p^c - p_k^l. \tag{11}$$

But it also requires that $V_k^s(c, l, c) > V_k^s(l, l, l)$, implying $u - p^c + (1-\alpha)(u - p_k^l - s) + \alpha(u - p^c) - s > u - p_k^l + (1-\alpha)(u - p_k^l) + \alpha(u - p_{-k}^l - s) - s \Leftrightarrow p_k^l - p^c + \alpha(p_{-k}^l - p^c) > (1-2\alpha)s \Leftrightarrow p^c - p_k^l + \alpha(p^c - p_{-k}^l) < (2\alpha - 1)s$, which requires $\alpha > \frac{1}{2}$. Because $p^c > p_k^l$ for both k and $(p^c - p_k^l)/(2\alpha - 1) \geq p^c - p_k^l$, this contradicts condition (11). Therefore (c, l, c) is not played in equilibrium. Together with the above table this reduces consumer strategies to $(0, 0, 0)$, $(0, 0, l)$, $(l, l, 0)$, (l, l, l) and (c, c, c). □

Proof of Proposition 1. The prices stated in the proposition are the unique solution to the three first order conditions (6) and (9). 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 $\underline{s} < \sigma$. So suppose to the contrary that optimally p^c is such that $2(u - p^c) < \sigma \Leftrightarrow p^c > u - \sigma/2$. Given p^{l*} the chain's profit function is $\Pi^c = \frac{4}{\sigma}\left(\underline{s} - \overline{s}_k\right) p^c = \frac{4}{\sigma}\left[2(u - p^c) - \frac{2}{\alpha}(p^c - p^{l*})\right] p^c$, which is strictly concave in p^c. Therefore, $\frac{\partial \Pi^c}{\partial p^c} \mid_{p^c = u - \sigma/2} \leq 0$ is a necessary and sufficient condition for the optimal p^c not to exceed $u - \sigma/2$. Now $\frac{\partial \Pi^c}{\partial p^c} \mid_{p^c = u - \sigma/2} \leq 0$ holds if and only if

$$4\left[\frac{1 + 2\alpha}{\alpha} - \frac{2(1 + \alpha)}{\alpha}\frac{u}{\sigma}\right] - (p^c - p^{l*}) \leq 0.$$

The last term is always positive because $p^{c*} > p^{l*}$ according to Lemma 1, and the expression in square brackets is negative because $u > \sigma$. Consequently, $\frac{\partial \Pi^c}{\partial p^c} \mid_{p^c = u - \sigma/2} < 0$, so that $p^c > u - \sigma/2$ is never optimal for the chain.

Next, it is necessary to verify whether the chain store has an incentive to deviate from p^{c*} to p^{l*} in order to attract all consumers, leaving the local stores with zero demand. If the chain store chooses price p^{l*}, its profit is $4p^{l*}$. However, $\Pi^{c*} > 4p^{l*} \Leftrightarrow \frac{\alpha(4-2\alpha+\alpha^2)^2}{2(3-2\alpha+\alpha^2)^2}\sigma > 4\frac{\alpha}{2(3-2\alpha+\alpha^2)}\sigma \Leftrightarrow (4-2\alpha+\alpha^2)^2 > 4(3-2\alpha+\alpha^2) \Leftrightarrow 4 + (\alpha^2-2\alpha)^2 + 4(\alpha^2-2\alpha) > 1$, which always holds. The chain will thus not deviate to p^{l*}.

Alternatively, a local store could deviate to a lower price in order to push the chain store out of the local market completely. That is, the local store in k could set its price so low as to make condition (2) hold. To this end it must choose price $p_k^l \leq p^D$, where p^D is such that condition (2) holds with equality, i.e.,

$$(2-\alpha)(p^{c*} - p^D) = \alpha(u - p^{c*}) \Leftrightarrow p^D = \frac{2p^{c*} - \alpha u}{2-\alpha}. \tag{12}$$

But $2p^{c*} = \frac{1}{2}\frac{4-2\alpha+\alpha^2}{3-2\alpha+\alpha^2}\alpha\sigma < \alpha\sigma < \alpha u$, where the last inequality holds because of the assumption $u > \sigma$. Hence, $p^D < 0$ follows, proving that the deviation does not pay for a local store. □

Lemma 3. *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 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. □

C Supplementary Material

The material in this appendix is supplementary and not intended for publication.

C.1 The Case of Imperfect Price Information

This section shows that the results do not change qualitatively if it is assumed that consumers in k cannot observe the price of the local store in $-k$ in period 1. Denote by Ep^l_{-k} the price of the local store in $-k$ expected by consumers living in k in $t = 1$. In a 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

$$Ep^l_k = p^l_k \quad \text{for} \quad k = E, W. \tag{13}$$

Condition (13) 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[18]

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.

[18]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, 2007 (forthcoming). 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.

As in the main model, consumers are thus divided into three groups. Low setup cost consumers with $s \in [0, \overline{s}_k]$ always choose local stores, where

$$\overline{s}_k := \frac{2-\alpha}{\alpha}(p^c - p^l_k) + (p^c - Ep^l_{-k}). \tag{14}$$

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

$$\underline{s} := \min\left\{2(u - p^c),\, \sigma\right\}. \tag{15}$$

High setup cost consumers with $s \in [\underline{s}, \sigma]$ do not shop at all. It is assumed that $\underline{s} = \sigma$ and the proof of Proposition 2 shows that this is indeed the case in equilibrium.

Given some prices $p^c_k \leq p^c$, and $Ep^l_k < p^c$ for both k, the local store in k thus faces the demand function

$$\begin{aligned} Q^l_k := (2-\alpha)\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p^l_k) + (p^c - Ep^l_{-k})\right] \\ +\alpha\frac{1}{\sigma}\left[\frac{2-\alpha}{\alpha}(p^c - p^l_{-k}) + (p^c - Ep^l_k)\right]. \end{aligned} \tag{16}$$

Maximizing $Q^l_k(p^l_k)p^l_k$ with respect to p^l_k for both k yields the first order condition for the local store in k

$$0 = 4p^c - 2\alpha(2-\alpha)Ep^l_{-k} - \alpha^2 Ep^l_k - 2(2-\alpha)^2 p^l_k \quad \text{with} \quad k = E, W. \tag{17}$$

A local store's best response function is

$$p^{l*}_k\left(Ep^l_k, Ep^l_{-k}\right) = \frac{4p^c - 2\alpha(2-\alpha)Ep^l_{-k} - \alpha^2 Ep^l_k}{2(2-\alpha)^2}. \tag{18}$$

The chain store faces the demand

$$Q^c(p^c) := \left(2 - Q^l_k\right) + \left(2 - Q^l_{-k}\right) \tag{19}$$

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

$$0 = -8p^c + 2\sigma\alpha + (2-\alpha)p^l_k + \alpha Ep^l_k + (2-\alpha)p^l_{-k} + \alpha Ep^l_{-k}. \tag{20}$$

The equilibrium of the game is characterized by the following proposition.

Proposition 2. *The game has a unique symmetric rational expectations SPE in pure strategies. The equilibrium prices are*

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

with $p_k^{l*} = p_{-k}^{l*} = p^{l*}$, and expectations satisfy $Ep_k^{l*} = Ep_{-k}^{l*} = p^{l*}$. The equilibrium quantities and profits are, respectively,

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

$$\Pi^{l*} = \frac{\alpha(2-\alpha)^2}{[(2-\alpha)^2+2]^2}\sigma \qquad\qquad \Pi^{c*} = \frac{\alpha[(2-\alpha)^2+4]^2}{2[(2-\alpha)^2+2]^2}\sigma. \tag{23}$$

Proof. The three first order conditions (17) for $k = E, W$ and (20) and the two expectation consistency conditions (13) 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

$$\Delta\Pi := Q^{l*}p^{l*} - \left(2 - Q^{l*}\right)\left(p^{c*} - p^{l*}\right) > 0. \tag{24}$$

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,

$$\Delta\Pi = p^{l*}\left[Q^{l*} - \frac{1}{2}Q^{c*}\frac{(2-\alpha)^2}{4}\right] \leq p^{l*}\left[Q^{l*} - \frac{1}{2}Q^{c*}\right] < 0. \tag{25}$$

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 (2) hold. To this end it must choose price $p_k^l \leq p^D$, where p^D is such that condition (2) holds with equality, i.e.,

$$(2-\alpha)(p^{c*} - p^D) = \alpha(u - p^{c*}) \Leftrightarrow p^D = \frac{2p^{c*} - \alpha u}{2-\alpha}. \tag{26}$$

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. □

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