RETAIL MERGERS AND BUYER POWER

by

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Abstract

Supplier-retailer bargaining is analysed over alternatively linear prices and two-part tariffs in a context where retailers are horizontally differentiated. Comparing different kinds of mergers shows that what determines changes in the retailers' post-merger buyer power is the extent to which the parties are viewed by the manufacturer as alternative ways of channelling her product to final consumers. This contradicts a commonly held view that the size of the buyer is a good proxy for its buyer power. The results show that diversion ratios can provide a better indication of a merger's effect on the parties' buyer power, than market shares.

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RETAIL MERGERS AND BUYER POWER

1. INTRODUCTION

In the past ten years European antitrust authorities have been faced with a sharp increase in the trend of mergers and acquisitions within the retail sector and the food retail sector in particular[2]. The parallel increase in concentration has attracted attention within both the academic world and among antitrust practitioners. As a result a wave of theoretical work on the economics of the retail sector, with an eye to antitrust implications, has followed, in part sponsored directly by antitrust agencies and international organisations[3].

One issue that has been given particular emphasis is the one of "buyer power", that is: the market power that retailers, or buyers in general, possess vis-à-vis their suppliers. The presence of buyer power at some stage in the supply chain is now a market feature that is taken into serious consideration also in antitrust proceedings[4].

From the point of view of theoretical research a relatively big amount of attention has been devoted to the *effects* that buyer power can have on the working of manufacturing or retail industries, and to the welfare implications of its presence. Comparatively little attention, on the other hand, has been devoted to analysing the *origin* of buyer power. In other words little theoretical or empirical research has focused on what features confer to a firm more buyer power than its competitors have.

The latter is an important issue not only because it does somehow logically precede the former, but because in antitrust proceedings it is necessary to show that a firm or group of firms

[2] See Clarke et al. (2002), table 7.8 p.83.
[3] The following are just a few examples: general work sponsored by antitrust agencies include Dobson et al. (1998), Dobson Consulting (1999), OECD (1999), FTC (2000); on retailers' *countervailing power* see von Ungern-Sternberg (1996) and Dobson and Waterson (1997); on vertical restraints: Comanor and Rey (2000); on specific contractual clauses (slotting fees) see Shaffer (1991) and Sullivan (1997) and for case studies and statistical analysis see Clarke et al. (2002).
[4] See NERA (1999), the *Rewe-Meinl* Decision: Decision 1999/674/EC – *Rewe/Meinl* (OJ L 274/1, 23/10/1999) and other EC Decisions quoted therein.

actually enjoys a certain degree of buyer power before one can move on to assess its welfare implications. It is also arguably a question that needs to be addressed from a theoretical standpoint rather than an empirical one. The reason for this is that buyer power is almost intrinsically an issue that concerns intermediate markets where prices are not publicly observed, thereby ruling out the option, for example, of an empirical SSNIP test to define the relevant market.

One possible reason for the relative absence of theoretical work on the determinants of buyer power is that there has developed on this matter a "conventional view" which is more or less implicitly employed by economic theorists and antitrust practitioners alike. This view, roughly speaking, states that buyer size determines buyer power. In other words: the bigger customer pays the lower price.

In this paper I argue that this view, though having an intuitive appeal, is not fit to describe the working of modern retail purchase markets because it does not take into account the way in which retailers compete for consumers. The formal analysis that follows shows that when the localised nature of retail distribution markets is taken into account, smaller retail chains can have more bargaining power than big ones with respect to the same manufacturer if they serve a distribution market that is sufficiently more insulated from competition than the one of their larger competitors. Furthermore, it is also shown that the nature of the contracts between retailers and their suppliers can make a difference for the incentives retailers have to merge.

2. Retail Competition

Retailers do not sell a homogeneous good. In fact the "product" they offer to their consumers is a rather complex one. It incorporates various types of services (e.g. parking facilities, in-store staff, etc.) and it also differs according to the actual range of products on the shelves. There are groups of retailers, though, for which these variables are more of less homogeneous, for example supermarkets and hypermarkets. Nevertheless one variable in particular prevents treating retailers as sellers of a homogeneous good: stores location. According to numerous surveys, what is by far the most important reason for shopping at a particular outlet is not whether prices are lower or the staff is friendlier but simply where the shops are located in relation to consumers' homes or workplaces.

Table 1 below, where “convenience” is to be intended in a geographical sense as inversely related to transport costs, gives a better idea of this fact[5].

Table 1: Factors affecting the choice of grocery store

Most important factor	Proportion of respondents %
Convenience	54
Product range/ selection	14
Low price	13
Quality	9
Cleanliness	2
Friendly staff	1
Handy opening hours	1
Others	6
Total	100
Source: London Economics (1997)	

Most of the literature that treats formally the issue of buyer power does so by looking at different market structures where all retailers are symmetric, and compares situations in which there is a higher or lower number of retailers[6]. Although this framework may be a useful approximation in the analysis of some aspects of buyer-supplier relations, it does not lend itself to the analysis of the determinants of buyer power. In fact the symmetry hypothesis cannot but somewhat cloud the issue. For example, von Ungern-Sternberg states that the wholesale price equilibrium outcome in his model “[…] captures the conventional idea that large retailers have more bargaining power. The producer cannot afford to lose their high sales volume, and is thus willing to accept lower wholesale prices”. But retailers in a symmetric framework are all equally large; a symmetric framework cannot give indications as to the importance of size relative to other potential determinants of buyer power such as, for example, the intensity of downstream competition.

The model introduced in the next section will consider alternative merger scenarios in a setting where retailers are horizontally differentiated with the purpose of analysing the importance of size in determining a retailer’s buyer power. The results indicate that there can be small retailers with a higher bargaining power than their bigger competitors depending on downstream competitive conditions.

[5] Clarke et al. (2002) report figures by INSEE for France showing an even more significant role for “convenience” in consumers’ choice, see p. 101.

2.1. Formalisation of retail competition

A number n of stores are located around a circle of unit circumference so that the distance between two neighbouring stores is always the same. All stores sell one and the same good.

Consumers are uniformly distributed with density one around the circle and each point around the circle corresponds to one atomistic consumer. Preferences of each and every consumer over the good are represented by the same demand function $q(P_i)$. This function is decreasing in P_i which is the "generalised" price for the good and in turn depends positively on the price charged by store i and by transport costs: $P_i = p_i + t \cdot x$. Finally consumers buy only from the store charging the lower generalised price for their location.

Theoretical work that analyses mergers in a spatial setting such as this one, in general represents individual consumers' preferences by a unit demand[7]. This assumption does simplify the analytical setting significantly. In the present model I do not make this assumption. The reason being that contrary to most of this literature the focus here is what happens in the intermediate market (rather than in the final, or "distribution", market) after a retail merger. As will become clear later, from the manufacturer's point of view it is important how much the retailers will sell post merger at any given wholesale price. Assuming a unit demand for each individual consumer would, in other words, hide much of the action in the bargaining process.

Under assumptions that are set out in appendix 1 each store i faces a demand $Q_i(p_i, p_{i+1}, p_{i-1})$ which depends negatively on price at store i and positively on prices charged at neighbouring locations. Given this demand it is possible to write down the retailers profit function:

$$\Pi_i(p_i) = p_i \cdot Q_i(p_i, p_{i+1}, p_{i-1}) - C(Q(p_i, p_{i+1}, p_{i-1})) \qquad (1)$$

This equation simply defines profits as equal to revenues minus costs. In order to write down the cost function assumptions have to be made as to the way in which retailers trade with their suppliers.

The specific nature of contracts that are supposed to regulate supplier-retailer transactions is the subject of debate. In particular there is no general consensus on whether they are better described by a linear wholesale price or by a two-part tariff. In order to avoid dependence of the

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[6] E.g. Dobson and Waterson (1997) and von Ungern-Sternberg (1996).
[7] See for example Braid (1986) and Levy and Reitzes (1992).

results on a specific formalisation, and also because it is possible that different forms of contracts may coexist in the market, I will look in turn at a two-part tariff and at a linear price.

In any case, whether or not a retailer is supposed to pay a fixed fee to its supplier is irrelevant as far as the first order condition for profit maximisation is concerned[8]. With the further assumption that the costs of conducting a retailing business be constant and normalised to zero, the only cost that these retailers incur is the amount they pay to buy the goods they sell. This implies that under both types of contracts the First Order Condition (FOC) for maximisation at each store location is equal to:

$$\frac{\partial \Pi_i}{\partial p_i} = Q_i + \left(p_i - w_i\right) \cdot \frac{\partial Q_i}{\partial p_i} = 0; \qquad i = 1,...,n \tag{2}$$

From these n conditions equilibrium prices and quantities are derived that depend on the wholesale prices paid by each retailer. These quantities can be written as: $p_i\left(w_1,...,w_n\right)$ and $Q_i\left(p_{i-1}, p_i, p_{i+1}\right)$, and as shown in Lemma A1.1 in appendix 1 they depend respectively positively and negatively on the wholesale price paid by the same retailer *i*.

2.2. Effect of retail mergers in the final market for given contract terms[9]

Define as the status quo a situation in which each store around the circle corresponds to one firm. In this context all firms are symmetric with respect to both their costs and their demand, and therefore, given the same contract terms with the manufacturer, they will all charge the same price at equilibrium.

2.2.1. Non contiguous stores

With respect to this status quo consider the merger of two *non-contiguous* stores, say store *j* and store $j+k$ where $k \neq \pm 1$. Call the merged entity firm A. Firm A's profits are simply the sum

[8] As the first derivative of the (constant) fixed-fee is zero.
[9] "Contract terms" refer to the value of the wholesale price and, in case, of the fixed-fee that have been agreed upon in the intermediate market.

of the profits of the two stores: $\Pi_A = \Pi_j + \Pi_{j+k}$. The FOC for A's profit maximisation is $\frac{\partial \Pi_A}{\partial p_j} = \frac{\partial \Pi_A}{\partial p_{j+k}} = 0$ and can therefore be written as:

$$\frac{\partial \Pi_A}{\partial p_j} = \frac{\partial \Pi_j \left(p_j, p_{j-1}, p_{j+1}\right)}{\partial p_j} + \frac{\partial \Pi_{j+k} \left(p_{j+k}, p_{j+k-1}, p_{j+k+1}\right)}{\partial p_j} = \frac{\partial \Pi_j \left(p_j, p_{j-1}, p_{j+1}\right)}{\partial p_j} = 0$$

$$\frac{\partial \Pi_A}{\partial p_{j+k}} = \frac{\partial \Pi_j \left(p_j, p_{j-1}, p_{j+1}\right)}{\partial p_{j+k}} + \frac{\partial \Pi_{j+k} \left(p_{j+k}, p_{j+k-1}, p_{j+k+1}\right)}{\partial p_{j+k}} = \frac{\partial \Pi_{j+k} \left(p_{j+k}, p_{j+k-1}, p_{j+k+1}\right)}{\partial p_{j+k}} = 0 \tag{3}$$

The fact that the merging stores are non-contiguous means that the price level at one of the two stores does not affect profits at the other store. In formal terms the equality in the middle of the two equations (3) is due to the fact that the second term of the sum on the left hand side is zero, thereby showing that the maximisation problem is identical to the one the merging retailers face in the status quo. This implies the following:

Result 1: for given contract terms in the intermediate market, a merger between *non contiguous* stores leaves final prices, quantities and profits per-store unchanged.

2.2.2. Contiguous stores

Consider now a merger between two *contiguous* outlets, say stores *j* and $j+1$, and call this merged entity firm B. Again B's profits are the sum of the profits earned at the two outlets and maximisation is computed over this sum. The FOC is therefore:

$$\frac{\partial \Pi_B}{\partial p_j} = \frac{\partial \Pi_j \left(p_j, p_{j-1}, p_{j+1}\right)}{\partial p_j} + \frac{\partial \Pi_{j+1} \left(p_{j+1}, p_j, p_{j+2}\right)}{\partial p_j} = 0$$

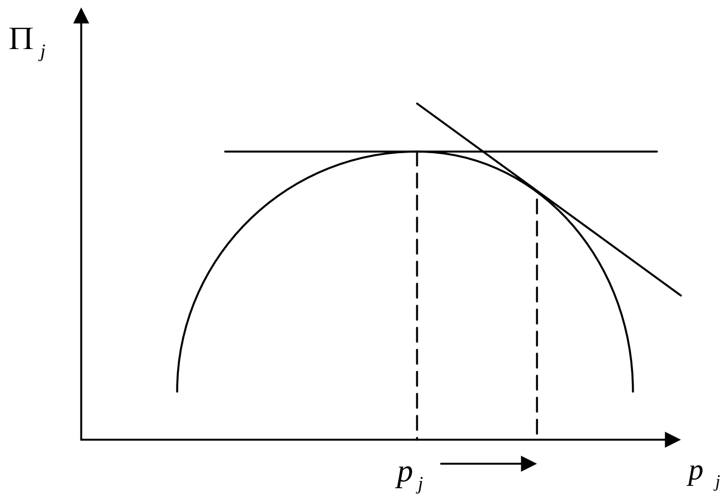
$$\frac{\partial \Pi_B}{\partial p_{j+1}} = \frac{\partial \Pi_j \left(p_j, p_{j-1}, p_{j+1}\right)}{\partial p_{j+1}} + \frac{\partial \Pi_{j+1} \left(p_{j+1}, p_j, p_{j+2}\right)}{\partial p_{j+1}} = 0 \tag{4}$$

These equations show that profits at the two stores depend on the price charged at the neighbouring location. The effect of the merger on final prices can be derived from equations (1) and (4) by writing explicitly the derivative of the profit functions:

$$\frac{\partial \Pi_B}{\partial p_j} = Q_j + \left(p_j - w_j\right) \cdot \frac{\partial Q_j}{\partial p_j} + \left(p_{j+1} - w_{j+1}\right) \cdot \frac{\partial Q_{j+1}}{\partial p_j} = 0$$

$$\frac{\partial \Pi_B}{\partial p_{j+1}} = Q_{j+1} + \left(p_{j+1} - w_{j+1}\right) \cdot \frac{\partial Q_{j+1}}{\partial p_{j+1}} + \left(p_j - w_j\right) \cdot \frac{\partial Q_j}{\partial p_{j+1}} = 0 \quad (5)$$

In the pre-merger status quo profit maximisation takes the form of the FOC given in equation (2). With respect to that equation this merger scenario brings about an extra term in the first order condition. Under the hypothesis that retailers operate with a strictly positive mark-up, and given that demand depends positively on the price charged at neighbouring locations, the third term of the sum is positive. This implies that the price that was charged pre-merger is now too low. In order to restore equality in the FOC, the first two terms of the sum, i.e. the slope of each *store* profit function has to become negative. As the following figure illustrates this means that prices have to rise:



This sums up in the following:

Result 2: for given contract terms in the intermediate market, a merger between *contiguous* stores lowers the quantity sold and raises final prices and profits per store at all neighbouring locations.

These results are consistent with the findings of most of the literature on mergers between price-setting firms. Deneckere and Davidson (1985) show that in a price setting monopolistically competitive industry, mergers will lead to higher prices and profits for all firms. In a spatial setting where consumers have inelastic unit demands Levy and Reitzes (1992) also show how prices and profits raise for all retailers following a merger between contiguous outlets, while they remain unchanged if non-contiguous stores merge. Results 1 and 2 therefore simply extend some of the findings of Levy and Reitzes (1992) to the case where consumers have downward sloping individual demands.

3. The Intermediate Market

The previous section has described the way in which retailers compete for final consumers for given contract terms. The part that follows will turn to look at how these contract terms are determined in the intermediate market.

Consider the following vertical chain of production. A single firm is the monopolist manufacturer of a good. The manufacturer can sell its product to n retailers who, in turn, will sell the same product to final consumers in the way specified in the previous section.

The assumption of a single manufacturer is common to most related literature (e.g. Dobson and Waterson, 1997 or von Ungern-Sternberg, 1996). This assumption is maintained here in order to provide a simple benchmark against which to analyse the shift in the retailers' bargaining position that can follow a retail merger[10]. The assumption of a single monopolistic manufacturer is clearly not a satisfactory approximation for all purchase markets. For example it is not an appropriate assumption when manufacturing industries are very competitive and unconcentrated, like in the case of fresh produce. On the other hand, it is a good approximation when manufacturers supply products that consumers do not perceive as easily substitutable, such as some "must-stock" branded goods.

Furthermore assume that along the hypothesised vertical chain, trade occurs in the following two stages.

1. The manufacturer and the retailers bargain over the terms of a contract.

2. The retailers compete for final consumers given the terms of that contract.

This two-stage structure is again a common feature in models that analyse buyer-supplier bargaining. It is usually considered an appropriate framework in markets where input prices are negotiated upon less frequently than final market competitive variables can be adjusted[11].

The UK's Competition Commission's recent report on Supermarkets (Competition Commission, 2000) provides some insights as of the typical duration of contracts between retail

[10] An oligopolistic upstream industry already provides a context in which smaller retailers can be in a better bargaining position than their bigger competitors, see the examples quoted in Scherer and Ross (1990).
[11] See for example Horn and Wolinsky (1988).

chains and their suppliers. The inquiry showed that "Contracts tend to be open-ended or ongoing and there is no standard length to them. Four weeks notice is normal to terminate arrangements"[12]. Furthermore it appears that in many cases oral day-to-day negotiations are used to agree on price and quantity. There appear, though, to be significant differences in the way negotiations are conducted across different manufacturing industries. The main supermarkets involved in the Commission's inquiry stated that while price and quantity of perishable goods are negotiated on a weekly basis with prices being influenced by market fluctuations, the same is not true for the producers of so-called "must stock" items. For these products negotiations seem to be significantly less frequent[13]. This evidence on the frequency of negotiations, therefore, seems to justify the use of a two-stage structure for the same categories of manufacturing industries for which the single-manufacturer hypothesis is more appropriate, that is producers of "must stock" branded goods[14].

The following formalisation of the bargaining process between the manufacturer and the retailers is divided in two parts. The first will analyse the case in which a two-part tariff is employed in trade contracts, and the second the case in which the contracts specify only a linear price. These contracts are assumed to be binding[15].

3.1. Bargaining over a two-part tariff

A "bargaining problem" is defined by three elements: a set of agents, a set of payoff pairs and a status quo or "disagreement" point. Following most of the literature that analyses similar vertical structures[16] negotiations between retailers and the manufacturer are treated here as constituting *n* independent and simultaneous bargaining problems; hence the agents in each bargaining problem are two: the manufacturer and each individual retailer. The solution concept adopted is the symmetric Nash Bargaining Solution (NBS).

3.1.1. The bargaining problem

In this setting payoff pairs coincide with the profits that can be earned by trading with the counterpart. The manufacturer is assumed to produce the good without fix costs and at a constant

[12] Competition Commission (2000) para.11.58, p.240.
[13] See Competition Commission (2000) para 11.86.
[14] Furthermore the focus here is on the differences between pre and post-merger bargaining positions, and it does not seem inappropriate to postulate that after a merger the parties would want to renegotiate the general terms of their agreement even with those suppliers with whom they might have established a tradition of day-to-day negotiations.
[15] This rules out all issues of renegotiations as raised for example by O'Brien and Schaffer (1992)
[16] For example: McAfee and Schwartz (1994), Horn and Wolinsky (1988).

marginal cost. Therefore, in the case of two-part tariff contracts, if the manufacturer trades with all retailers in the intermediate market, the profits she earns are given by the following expression:

$$\Pi^M = \sum_{j=1}^{n} w_j \cdot Q_j + F_j \tag{6}$$

Where the manufacturer's marginal cost is assumed constant and is normalised to zero without further loss of generality, w_j is the wholesale price and F_j is the fixed fee. Conversely, each retailer's profits take the following form:

$$\Pi_i^R = (p_i - w_i) \cdot Q_i - F_i \;; \qquad i = 1,\ldots,n \tag{7}$$

By definition, the coordinates of the disagreement point are the profits earned by the manufacturer and by the retailer if no agreement is reached. Since the manufacturer is in this setting the sole supplier of the only good retailers can sell, the retailers' disagreement profits are set to zero.

On the other hand if the manufacturer does not reach an agreement with any one retailer she can still sell to the other $n-1$ remaining retailers. The Manufacturer's disagreement profits can therefore be written in the following way:

$$\Pi_{-i}^M = \sum_{j \neq i} w_j \cdot \left[Q_j + d_j(i) \cdot Q_i\right] + F_j \,, \qquad \sum_{j \neq i} d_j(i) < 1,\ \forall i \tag{8}$$

The idea behind this expression is the following. If the manufacturer does not trade with retailer *i*, she will lose the sales that was previously making through that outlet. Yet, if negotiations with retailer *i* were to break down, given the assumption that retailers sell no substitutes to the manufacturer's good, the effect would be identical to retailer *i* exiting the downstream market. This in turn would impact upon the sales of the remaining retailers.

Equation (8) defines the manufacturer's disagreement payoff in a way that does not constrain the retailers' (indirect) quantity choice in the distribution market to any specific response. The terms $d_j(i)$ simply allow expressing the quantity that each remaining retailer will buy from the manufacturer, as a proportion of the sales Q_i that she would have made via retailer *i*.

The condition that the sum of these terms be less than one is required for the manufacturer to have an incentive to reach an agreement at all with any one retailer. If this condition was violated, the implication would be that the manufacturer would make more sales if *i* was not in the market and would therefore lack an incentive to trade. The parameter values for which this condition is satisfied in this particular model are derived in Appendix 2 and basically require that all retailers still be active competitors even after *i*'s exit. This is therefore assumed.

In a way these terms are analogous to what Shapiro (1995) calls "diversion ratios". These are defined with respect to any two differentiated firms in a market. If one of these two firms raises the price of its product, it will lose a certain amount of sales. The diversion ratio indicates what fraction of the lost sales will be recuperated via increased sales to the other firm. A high diversion ratio therefore indicates that the two firms are close competitors and vice versa. In equation (8) the diversion ratios are defined with respect to a firm exiting the market, or equivalently with respect to a price raise above all consumers' reservation price. The implications of this latter definition for the value these ratios can assume will be considered below.

3.1.2. The Nash Bargaining Solution (two-part tariff)

The symmetric NBS implies that agreement is reached for a wholesale price and a fixed fee such that[17]:

$$\left(w_i, F_i\right) = \arg\max_{w_i, F_i}\left\{\Delta\Pi_i^R \cdot \Delta\Pi_i^M\right\} \qquad (9)$$

[17] The second order condition for this maximisation problem is analysed in Appendix 3.

The maximand on the right hand side is the product of two quantities that correspond to the incentive that each agent has to trade, and it is commonly referred to as the Nash Bargaining Product (NBP). More precisely, these magnitudes correspond to the incremental profits that retailer and manufacturer can earn by agreeing to the terms of a contract. For the manufacturer, after some manipulation, these can be written as:

$$\Delta\Pi_i^M = \Pi^M - \Pi_{-i}^M = F_i + Q_i\left[w_i - \sum_{j\neq i} w_j d_j(i)\right] = F_i + Q_i \cdot g_i(w_i) \tag{10}$$

Here $g_i(w_i)$ is defined for convenience as the function of w_i inside the square parenthesis. Note that in the symmetric status quo this function takes low values if retailers are close competitors, e.g. if travel costs are low or the number of stores is high, so that following the exit of any one store the quantity sold by that store is almost fully absorbed by the remaining outlets and $\sum_{j\neq i} d_j(i) \approx 1$.

The incremental profits for the retailer are equal to:

$$\Delta\Pi_i^R = \Pi_i^R = (p_i - w_i)\cdot Q_i - F_i \tag{11}$$

From equation (9) the FOC with respect to the fixed-fee can be written as:

$$\Delta\Pi_i^R \cdot \frac{\partial\Delta\Pi_i^M}{\partial F_i} = -\Delta\Pi_i^M \cdot \frac{\partial\Delta\Pi_i^R}{\partial F_i} \tag{12}$$

Since the derivatives with respect to the fixed-fee of the incremental profits are, for the manufacturer and the retailer, respectively equal to 1 and –1, the FOC for the fixed-fee implies:

$$(F_i): \quad \Pi_i^R = \Delta\Pi_i^M \tag{13}$$

which states that the fixed fee is chosen to equate the incremental profits of the two agents.

The FOC with respect to the wholesale price is [18,19]:

$$(w_i): \quad \frac{\partial NBP}{\partial w_i} = \left[\frac{\partial Q_i}{\partial w_i} \cdot g_i(w_i) + Q_i\right] \cdot \Pi_i^R - Q_i \cdot \Delta\Pi_i^M = 0 \tag{14}$$

Given equation (13) this implies:

$$g_i(w_i) = \left[w_i - \sum_{j \neq i} w_j \cdot d_j(i)\right] = 0 \tag{15}$$

which in turn requires that the wholesale price be set at:

$$w_j = 0 \quad \forall j \tag{16}$$

Finally, substituting this back into equation (13) gives the value of the fixed fee:

$$F_i = \frac{p_i \cdot Q_i}{2} \tag{17}$$

Equation (17) states that the fixed fee will be set at a value exactly equal to a half of the retailer's profits. This is a standard result. A two-part tariff eliminates the double marginalization externality and restores bargaining efficiency by allowing agents to set a wholesale price equal to the marginal cost of producing the good, in this case normalised to zero, and a fixed fee so to split the profits between the bargaining parties[20].

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[18]Here $\frac{\partial g_i(w_i)}{\partial w_i} = 1$. This corresponds to the "passive beliefs" assumption used widely in related literature [e.g. McAfee and Schwartz (1994); O'Brien and Schaffer (1992); Horn and Wolinsky (1988)] according to which the bargaining between the manufacturer and each retailer takes place simultaneously and independently and holding constant at the equilibrium values the outcomes of the other bargains.

[19] Note also that the Envelope Theorem implies that $\frac{\partial \Pi_i^R}{\partial w_i} = -Q_i$.

[20] In this case the profits are split in half. The NBS can support any other ratio for different exogenously set levels of "bargaining power". This does not affect the qualitative results.

3.1.3. The effects of retail mergers on the intermediate market (two-part tariff)

The results of the previous section are sufficient to draw the first important conclusions regarding the sources of buyer power in the intermediate market. Starting from a status quo such as the one described in section 2.2, let any number, say four, of *non-contiguous* stores merge. Since the wholesale price is always set to equal the marginal cost of production, by virtue of Result 1 above, final prices, quantities and profits per store are unchanged by the merger. In terms of equation (17) this means that the new firm will pay a fixed fee, which is exactly four times higher than the one that each store used to pay individually in the status quo. In other words:

> **Result 3:** With two-part tariff contracts a merger between any number of non contiguous stores leaves wholesale prices, final prices and quantities unchanged; the fixed fee increases to leave profits per store unchanged.

On the other hand if, with respect to the same status quo, any number, say two, of *contiguous* stores is to merge, Result 2 states that the effect will be to raise final prices and profits at each neighbouring location and to reduce quantity. Equation (17) implies that the merged firm will also pay a higher fixed fee per-store, but this is down to the fact that the total profits of the vertical chain are increased. As a consequence the merged firm, although it will pay a higher fixed fee to the manufacturer, will still enjoy higher profits per store. This translates to:

> **Result 4:** With two-part tariff contracts a merger between contiguous stores leaves the wholesale price unchanged, lowers the quantity sold, raises final prices and profits per-store as well as the value per-store of the fixed fee.

When two part tariffs are employed a definition of buyer power is more difficult because the wholesale price is always left unchanged and the fixed fee is always chosen to split the profits in half. Having said this, what can be assessed in this context is whether any type of retail merger would confer to the merging parties a competitive advantage with respect to their rivals.

The conventional view on buyer power points to the conclusion that the larger buyer tends to get the “better deal”, therefore retail mergers that lead to the creation of a large player in the intermediate market are looked at suspiciously because of the advantage in terms of purchase costs that size is supposed to confer. Results 3 and 4 have strong implications with respect to these issues.

They show that, if two-part tariffs are employed, the size of the buyer is a misleading indicator when it comes to determining whether a retailer enjoys a competitive advantage. To see this, take, as above, four (or indeed any higher number) non-contiguous merging stores as opposed to only two contiguous outlets. The amount that the former purchase from the manufacturer is more than twice the one bought by the latter. Yet it is the two contiguous stores that will enjoy higher profits per store in the post merger scenario. It is them who will enjoy a competitive advantage[21].

[21] One clarification is due at this point concerning economies of scale in retailing. The types of mergers I consider here are between retail firms that are supposed to enjoy the same level of economies of scale that come from buying in large quantities, e.g. in distribution. It is a proven fact that those economies are significant and therefore there may well be cases where a merger between many non competing outlets would enable the merging parties to get better deals whereas small local monopolistic shops could pay more for their supplies because of higher purchase and distribution costs.

3.2. BARGAINING OVER A LINEAR PRICE

With respect to the two-part tariff case, the bargaining problem is here changed in the set of payoff pairs. In the absence of a fixed fee, the manufacturer's profits are:

$$\Pi^M = \sum_{j=1}^{n} w_j \cdot Q_j \tag{18}$$

and analogously the retailer's profits:

$$\Pi_i^R = \left(p_i - w_i\right)\cdot Q_i \tag{19}$$

If the manufacturer does not reach an agreement with retailer *i*, her profits will be:

$$\Pi_{-i}^M = \sum_{j \neq i} w_j \cdot \left[Q_j + d_j(i)\cdot Q_i\right] \tag{20}$$

And therefore the incremental profits that the manufacturer gains by reaching an agreement with retailer *i*, are in this case:

$$\Delta\Pi_i^M = \Pi^M - \Pi_{-i}^M = Q_i\left[w_i - \sum_{j \neq i} w_j \cdot d_j(i)\right] = Q_i \cdot g_i\left(w_i\right) \tag{21}$$

As in the previous case, the retailer's disagreement payoff is zero, implying that her incremental profits are equal to the profits given in equation (19).

3.2.1. The Nash Bargaining Solution (linear price)

Given equations (18) – (21) the outcome of the bargaining process can be computed. Adopting once more the NBS, the outcome of the bargaining process is a linear price such that[22]:

$$w_i = \arg\max\left\{\Delta\Pi_i^M \cdot \Pi_i^R\right\} \tag{22}$$

The FOC for this maximization can be written in the following way:

$$\frac{\Pi_i^R}{\partial\Pi_i^R / \partial w_i} = -\frac{\Delta\Pi_i^M}{\partial\Delta\Pi_i^M / \partial w_i} \tag{23}$$

Which, given the previous expressions, can in turn be written as:

$$p_i - w_i = \frac{Q_i \cdot g_i(w_i)}{Q_i + \dfrac{\partial Q_i}{\partial w_i} \cdot g_i(w_i)} \tag{24}$$

This equilibrium condition expresses the retailer's mark up as a function of the degree of competition between retailers. If competition is high (e.g. transport costs are low) in the symmetric status quo, then $g_i(w_i)$ is low, and to this scenario corresponds a lower mark up.

3.2.2. Retail mergers between two non-contiguous stores (linear price)

Consider a merger between stores at locations *i* and *i+k*, where $k \neq \pm 1$. Call *w* the wholesale price over which the merged entity will bargain with the manufacturer. In view of the symmetry of any two outlets around the circle the equilibrium price and quantity per store will be the same for every given wholesale price, i.e. $p_i(w) = p_{i+k}(w)$ and $Q_i(w) = Q_{i+k}(w)$.

Furthermore, given the non contiguity of the merging outlets, Result 2 implies that the equilibrium price and quantity per store will be the same function of the wholesale price as they were for each of the merging outlets in the status quo.

[22] The second order condition for this maximisation problem is analysed in Appendix 3.

In view of these considerations the new firm will maximize the following profits:

$$\Pi^{R}_{i,i+k} = (p_i - w)\cdot Q_i(w) + (p_{i+k} - w)\cdot Q_{i+k}(w) = 2\cdot(p_i - w)\cdot Q_i(w) \quad (25)$$

The merger will change the manufacturer's disagreement payoff:

$$\Pi^{M}_{-i,i+k} = \sum_{j\neq i,i+k} w_j \cdot \left[Q_j + d_j(i)\cdot Q_i + d_j(i+k)\cdot Q_{i+k}\right] \quad (26)$$

Because of the symmetry of the model, for any two stores *i* and *i+k* around the circle it has to be the case that $d_i(i+k) = d_{i+k}(i)$. Using this and equation (21) we can write the manufacturer's incentive to agree with the merged entity in a way that will make it easy to compare it to the status quo[23]:

$$\Delta\Pi^{M}_{i,i+k} = 2\cdot Q_i\left[w - \sum_{j\neq i} w_j \cdot d_j(i) + w_{i+k}\cdot d_{i+k}(i)\right] = 2\cdot Q_i\left[g_i(w) + w_{i+k}\cdot d_{i+k}(i)\right] \quad (27)$$

and its derivative is:

$$\frac{\partial \Delta\Pi^{M}_{i,i+k}}{\partial w} = 2\cdot\left\{\frac{\partial Q_i}{\partial w}\cdot\left[g_i(w) + w_{i+k}\cdot d_{i+k}(i)\right] + Q_i\right\} \quad (28)$$

These formulae, allow writing the FOC for the NBS for the merged entity as:

$$p_i(w) - w = \frac{Q_i(w)\cdot\left[g_i(w) + w_{i+k}\cdot d_{i+k}(i)\right]}{\frac{\partial Q_i}{\partial w}\cdot\left[g_i(w) + w_{i+k}\cdot d_{i+k}(i)\right] + Q_i(w)} \quad (29)$$

Comparing this condition with equation (24), referring to the status quo, shows that in the post merger scenario the right hand side of the FOC is higher for all values of the wholesale price[24]. Convexity of retailer's profits in *w* and concavity of the manufacturer's profits in *w*, are sufficient

[23] One thing to keep in mind is that because of the symmetry in the status quo $g_i(w) = g_{i+k}(w)$. Recall also that the wholesale price w_{i+k} that appears in the formula is not the wholesale price the parties are bargaining over, it is the equilibrium wholesale price paid in the status quo to retailer *i+k*.

[24] This is the case if $d_{i+k}(i) > 0$. For a discussion of the implications of this requirement see Appendix 2.

conditions for the left hand side to be a decreasing function of the wholesale price and for the right hand side to be an increasing one. On this basis it is possible to draw some conclusions about the effects of the merger.

The merged stores will operate with a higher mark up than before, and the mark up will be higher the higher the value of $d_{i+k}(i)$. In other words if the merging outlets are relatively close competitors they will operate in the post-merger scenario with a higher mark up; vice versa if the two outlets do not closely compete their post merger mark up will be only slightly higher.

This higher mark up will be achieved by a decrease in the wholesale price paid to the manufacturer. The final price will also decrease but less than proportionally to the wholesale price. To sum up:

> **Result 5:** With linear prices a merger between two non-contiguous retailers lowers the wholesale price in a measure inversely proportional to the competitive "distance" between the parties. The final price is also lower but less than proportionally to the decrease in the wholesale price.

This result shows that when bargaining is not efficient the picture changes drastically. In this case non contiguous retailers do have an incentive to merge because the merger shifts the status quo in the bargaining problem giving the manufacturer a bigger incentive to reach an agreement with the merged stores. This in turn implies that the merged retailers get a better deal in the form of a lower wholesale price.

The source of this increased buyer power resides in the term $d_{i+k}(i)$. The merger makes a difference to the manufacturer because she loses one alternative. In other words the two merging stores will get a better deal only to the extent that they represent alternative ways for the manufacturer to channel her goods to the same final consumers. If this were not the case, the term $d_{i+k}(i)$ would be zero and the bargaining problem would not change. For these reasons, again, it is not the size of their purchases from the manufacturer that improves the merged stores' bargaining position with respect to their competitors', but rather their strategic interdependence in the status quo.

One thing to note is that since they are not direct competitors but still face independent stores on each side, the lower wholesale price obtained in the intermediate market translates into lower prices for final consumers too[25]. The merger raises buyer power, but since downstream competition is still strong, part of the discount is passed on to final consumers[26].

4. CONCLUSION

In section 3 a number of different types of mergers have been analysed in their effects on the relative bargaining position of the merging parties and their supplier. The results show that in no case the conventional view on buyer power, which links its source to buyer size, is fit to give even an indicative idea of the outcome of negotiations. On the contrary it can be a seriously misleading indicator of relative bargaining strength of the merging parties or of a supposed cost advantage over their competitors.

The examples taken into examination show that it is the extent to which the merging parties represent alternative ways for the manufacturer to channel her goods to final consumers that drives a change in the retailers' bargaining position following a merger. In this sense the results extend to purchase markets the idea already widely shared for distribution markets that in the assessment of mergers between firms who sell differentiated products "diversion ratios", in Shapiro's terms, rather than market shares, is what should be taken into account.

Finally, by looking at different types of contractual arrangements it emerges that whether or not the intermediate market adopts contracts conducive to bargaining efficiency does make a difference in terms of the incentives that retailers have to merge. While with a two-part tariff a merger is only profitable if the parties are direct competitors in the distribution market, when linear prices are adopted even non-contiguous stores have an incentive to merge.

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[25] The analysis of non-contiguous merger scenarios is sufficient for deriving the main results. The analysis of a merger between contiguous outlets presents significantly higher computational difficulties without adding significant insights to the analysis, and is therefore not considered here.

[26] This result is in accordance with other work on Countervailing Power. E.g. Dobson and Waterson (1997) and von Ungern-Sternberg (1996).

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Appendix 1: Equilibrium and demand functions in retail competition

The formal analysis of competition among retailers conducted above consists of comparing different equilibria that are not explicitly derived in this paper. For a formal proof of existence of the equilibrium in this model the reader is referred to Novshek (1980).

Here the main assumptions of Novshek's paper are maintained. In particular, crucial to the existence of an equilibrium in a spatial market of this type is the fact that firms must not have the option of capturing the whole of their rival's market by undercutting their rivals' mill price. Novshek rules out this possibility by assuming a "modified" Zero Conjectural Variation strategy, that is: individual firms assume the prices charged by their rivals not to change in response to their own price changes, unless the rival is undercut at his store's location in which case (s)he replies by lowering the price. The model in section 2 of the paper follows Novshek in assuming away mill price undercutting.

Novshek also shows that if there are enough firms around the circle so that they all directly compete with one another, then there is only one equilibrium and it is symmetric in both price and location. Furthermore in equilibrium all firms are at an interior profit-maximising solution, and hence first and second order conditions can be used to characterise the equilibrium.

Here the attention is confined to the case in which all firms actively compete with one another (i.e. no firm is at a monopoly solution). In this context Novshek's results vindicate the assumption of equally spaced firms around the circle and allow the following analysis of the properties of the demand function based on first order conditions.

If each individual consumer around the circle has a demand for the good $q(P_i) = a - b \cdot P_i$, which is a downward sloping function of $P_i = p_i + t \cdot x$, that is the delivered or "generalised" price for the good at location *i*, then the marginal consumer who is indifferent between buying at the successive locations *i* and *i*+1, is identified by the following equation:

$$a - b \cdot (p_i + tx_{i+}) = a - b \cdot \left[p_{i+1} + t \cdot \left(\frac{1}{n} - x_{i+} \right) \right] \tag{A1.1}$$

which implies that:

$$x_{i+} = \frac{p_{i+1} - p_i}{2 \cdot t} + \frac{1}{2 \cdot n} \qquad \text{(A1.2)}$$

This shows how movements in firm *i*'s price and in the price of neighbouring firms affect the market area covered by the firms. This definition, together with the analogous one for the marginal consumer to the left of firm *i*, can be used to write down explicitly the demand that retailer *i* faces:

$$Q_i\left(p_i, p_{i-1}, p_{i+1}\right) = \int_0^{x_{i+}} a - b \cdot \left(p_i + tx\right) dx + \int_0^{x_{i-}} a - b \cdot \left(p_i + tx\right) dx \qquad \text{(A1.3)}$$

On the basis of equations (A1.1) and (A1.2) it is possible to derive some properties of the aggregate demand facing each retailer.

Consider first a rise in the price charged by store *i*. This has two effects: on one hand, as can be seen in eq. (A1.2), it reduces the market area served by *i* thereby shortening both integration intervals in eq. (A1.3) and on the other hand, it lowers at each point the value of the integrated function. Therefore the aggregate demand depends negatively on the own price. Conversely a rise in the price charged at either neighbouring locations extends the integration interval by shifting the marginal consumer. This raises the derived demand at store *i* by increasing the value of either of the two terms of the sum on the left hand side of equation (A1.3).

With these properties of the demand function in mind it is possible to move on to analyse some comparative statics relative to the retail-competition equilibrium quantities and prices. The first order condition for profit maximisation that was given in the main text as (3) is here repeated as (A1.4):

$$\frac{\partial \Pi_i}{\partial p_i} = Q_i + \frac{\partial Q_i}{\partial p_i}\left(p_i - w_i\right) = 0; \qquad i = 1,...,n \qquad \text{(A1.4)}$$

As mentioned above this system of equations has a unique and symmetric solution, corresponding to the equilibrium prices $p_i\left(w_1,...,w_n\right)$, $i = 1,...,n$ that depend on the wholesale prices which are, in this case, fixed and equal for all firms. In the analysis of the paper some properties of these functions are used. These are proved in the following:

Lemma A1.1:

The price charged by a retailer depends positively, and its output negatively, on the wholesale price paid to the manufacturer.

Proof:

Totally differentiating the FOC (A1.4) gives:

$$\frac{\partial^2 \Pi_i}{\partial p_i^2} \cdot dp_i + \frac{\partial^2 \Pi_i}{\partial p_i \partial w_i} \cdot dw = 0 \qquad \text{(A1.5)}$$

which implies that:

$$\frac{dp_i}{dw_i} = -\frac{-\dfrac{\partial Q_i}{\partial p_i}}{2 \cdot \dfrac{\partial Q_i}{\partial p_i} + \dfrac{\partial^2 Q_i}{\partial p_i^2} \cdot (p_i - w_i)} \qquad \text{(A1.6)}$$

where the second derivative of the profit function with respect first to the own price and then to the own wholesale price is equal to the derivative at the numerator on the right hand side by virtue of the Envelope Theorem.

The denominator of the fraction in (A1.6) is negative because the second order condition holds in equilibrium[27]. Therefore:

$$sign\left\{\frac{dp_i}{dw_i}\right\} = sign\left\{-\frac{\partial Q_i}{\partial p_i}\right\} \qquad \text{(A1.7)}$$

Since quantity, as explained above, is inversely related to the own price, this equality implies that the equilibrium price rises in response to an increase in the wholesale price paid to the manufacturer. As a corollary to this the quantity produced will fall in response to a raise in the wholesale price [**QED**].

[27] See Novshek (1980) for a formal proof.

APPENDIX 2: DIVERSION RATIOS

In the model, retail mergers change the parties' bargaining positions vis-à-vis their supplier because they change the manufacturer's disagreement payoff. An important element of the formalisation of the bargaining problem set out in section 3 is therefore the way in which the manufacturer's disagreement profits are written. The diversion ratios d_j introduced in eq. (8) and repeated below as (A2.1) reflect the fact that when retailers are horizontally differentiated they do not compete with all other retailers with the same intensity. On the contrary the intensity with which one retailer competes for final consumers against another one depends on the retailers' position in the market, i.e. its location.

$$\Pi_{-i}^{M} = \sum_{j \neq i} w_j \cdot \left[Q_j + d_j(i) \cdot Q_i\right] + F_j \,, \qquad \sum_{j \neq i} d_j(i) < 1, \ \forall i \qquad \text{(A2.1)}$$

In order to better understand the implications of this setting for the intermediate market the diversion ratios $d_j(i,t)$, implicitly defined in eq. (A2.1), can be written explicitly in the following way, where $Q_j{}'$ indicates the amount that retailer j will produce following *i*'s exit:

$$d_j(i,t) = \frac{Q_j{}' - Q_j}{Q_i} \qquad \text{(A2.2)}$$

The diversion ratios express the change in retailer *j*'s output that follows *i*'s exit in terms of the amount previously sold by *i*. From the point of view of the manufacturer, they indicate what proportion of retailer *i*'s sales would be absorbed by retailer *j* if retailer *i* was to exit the market. The fact that retailers compete more closely with some and less closely with others in the distribution market means that when a retailer stops stocking the manufacturer's product (in this model: exits the market) the retailers that were his closest competitors are also the ones that will increase their output the most.

In what follows it will be shown that after an exit the total quantity sold in the market will fall as prices are raised at all active locations. This proves that the manufacturer will always have an incentive to reach an agreement with a retailer. It should be noted that in this setting the value of the factor $d_{i+k}(i)$ is not constrained to be positive. It is conceivable that after an exit the effect of diminished competition on prices is so strong that at least some firms end up selling less than before. This marks a significant difference between diversion ratios defined relative to a prices increase that keeps the firm in the market or, as in the present case, over an exit. Nevertheless, if substantial competition is preserved in the distribution market even in absence of one particular retailer, some of the sales that were previously made by the exited retailer will be recuperated via increased sales through other outlets. This latter case is the one on which the present analysis focuses.

RETAIL COMPETITION

Consider as the status quo the one described in section 2 with *n* equally spaced outlets selling independently the same product to final consumers that are uniformly distributed around a circle of unit length.

Consider retailer *i* in the process of negotiating a contract with the manufacturer. What determines the coordinates of the status quo point in this bargaining problem, and hence the strength or the weakness of *i*'s bargaining position, is the amount the manufacturer will still be able to sell in case *i* exits the market. Sales in this latter case will only be made to retailer *i*'s competitors, who, by assumption, do not have the possibility of relocating once *i* has exited the market.

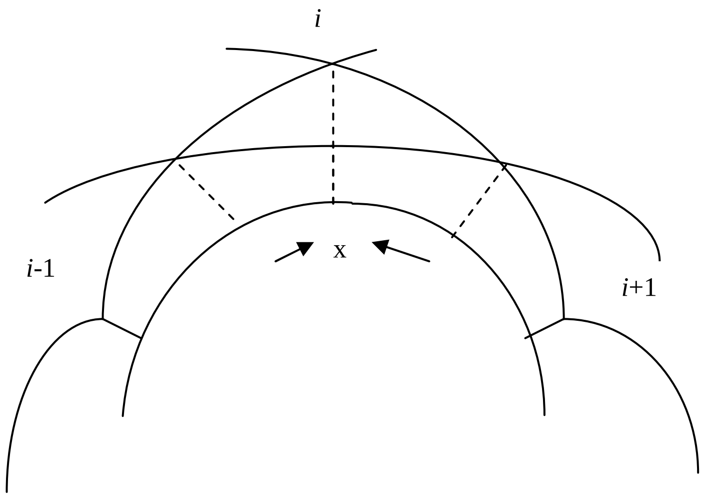
Retailer *i*, like all other retailers around the circle, has two direct competitors one on each side of its store; these are: retailer *i*-1 to its left and *i*+1 to its right. Because the status quo is symmetric in price and retailers are all at the same distance, the analysis of, say *i*-1's response to *i*'s exit will be sufficient to know *i*+1's behaviour as well.

As far as retailer *i*-1 is concerned, it is useful to think of its sales as divided in two half-markets: one to the left and the other to the right of *i*-1 store's location[28]. The left half-market will not be affected by *i*'s exit but the right one obviously will be. In particular what will happen is that at the status quo price, *i*-1 will find that it is now serving many more consumers on its right. To be more precise, if prices are unchanged from the status quo, and consumers are assumed to all purchase some quantity of the good somewhere (i.e. to have a high enough reservation price for all firms to still compete even after *i*'s exit) *i*-1 will find that the marginal consumer on its right has

[28] A similar approach is used in Lyons (2002) App.1.

now moved further away to the position previously occupied by *i*'s store. This is shown in figure A.1. below.

Figure A.1.:



where "x" represents in fig. A.1 the marginal consumer between *i*-1 and *i*+1 and the arrows indicate the direction in which the marginal consumer shifts (for *i*-1 and *i*+1) when *i* exits the market.

The effect of *i*'s exit on *i*-1 can therefore be analysed with reference to a shift to the right of the marginal consumer. More precisely, this shift to the right is caused by a reduction in the number of firms; therefore the exit can be analysed by reference to the parameter *n*.

The demand that *i*-1 faces in its right hand side half-market is:

$$Q_{i-1}^{+} = \int_{0}^{x_{i-1}^{+}} a - b\left(p_{i-1} + tx\right) dx \qquad \text{(A2.3)}$$

where $x_{i-1}^{+} = \frac{1}{2 \cdot n} + \frac{p_i - p_{i-1}}{2 \cdot t}$ is the expression indicating the marginal consumer to the right of *i*-1 when *i* is present in the market. Note that:

$$\frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} = \int_{0}^{x_{i-1}^{+}} \frac{\partial}{\partial p_{i-1}} \{q(p_{i-1} + tx)\} dx + q\left(p_{i-1} + tx_{i-1}^{+}\right) \cdot \frac{\partial x_{i-1}^{+}}{\partial pi - 1} \qquad \text{(A2.4)}$$

and:

$$\frac{\partial Q_{i-1}^{+}}{\partial n} = \frac{\partial Q_{i-1}^{+}}{\partial x_{i-1}^{+}} \cdot \frac{\partial x_{i-1}^{+}}{\partial n} = q\left(p_{i-1} + tx_{i-1}^{+}\right) \cdot \left(-\frac{1}{2n^2}\right) \qquad \text{(A2.5)}$$

and finally that:

$$\frac{\partial^2 Q_{i-1}^{+}}{\partial p_{i-1} \partial n} = \frac{\partial^2 Q_{i-1}^{+}}{\partial p_{i-1} \partial x_{i-1}^{+}} \cdot \frac{\partial x_{i-1}^{+}}{\partial n} = \left[\frac{\partial q\left(p_{i-1} + tx_{i-1}^{+}\right)}{\partial p_{i-1}} + \frac{\partial q\left(p_{i-1} + tx_{i-1}^{+}\right)}{\partial x_{i-1}^{+}} \cdot \frac{\partial x_{i-1}^{+}}{\partial p_{i-1}}\right] \cdot \left(-\frac{1}{2n^2}\right) \qquad \text{(A2.6)}$$

With these expressions it is now possible to move on to look at the price elasticity of demand in the right hand side half market for retailer *i*-1. This elasticity is, by definition:

$$\eta_{i-1}^{+} = -\frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} \cdot \frac{p_{i-1}}{Q_{i-1}^{+}} \qquad \text{(A2.7)}$$

and in order to be able to analyse the effect of *i*'s exit to the price charged and the quantity sold by *i*-1 it is necessary to calculate the derivative of this elasticity with respect to *n*, the number of firms. The formula is:

$$\frac{\partial \eta_{i-1}^{+}}{\partial n} = \frac{-p_{i-1} \cdot \frac{\partial^2 Q_{i-1}^{+}}{\partial p_{i-1} \partial n} \cdot Q_{i-1}^{+} + p_{i-1} \cdot \frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} \cdot \frac{\partial Q_{i-1}^{+}}{\partial n}}{\left(Q_{i-1}^{+}\right)^2} \qquad \text{(A2.8)}$$

In order to find the direction of change in the price level after *i*'s exit it is sufficient to know the sign of this derivative, which is given by:

$$sign\left\{\frac{\partial \eta_{i-1}^{+}}{\partial n}\right\} = sign\left\{\frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} \cdot \frac{\partial Q_{i-1}^{+}}{\partial n} - Q_{i-1}^{+} \cdot \frac{\partial^{2} Q_{i-1}^{+}}{\partial p_{i-1} \partial n}\right\} \tag{A2.9}$$

Given equations (A2.5) and (A2.6), the condition for the sign of this derivative to be positive can be written in the following way:

$$\frac{\partial q\left(p_{i-1} + tx_{i-1}^{+}\right)}{\partial p_{i-1}} + \frac{\partial q\left(p_{i-1} + tx_{i-1}^{+}\right)}{\partial x_{i-1}^{+}} \cdot \frac{\partial x_{i-1}^{+}}{\partial p_{i-1}} > \frac{q\left(p_{i-1} + tx_{i-1}^{+}\right)}{Q_{i-1}^{+}} \cdot \frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} \tag{A2.10}$$

To verify if and when this inequality holds, let's assume the same linear individual demand as in Appendix 1, that is $q(p_{i-1} + tx) = a - b(p_{i-1} + tx)$.

Consider first the sum on the left hand side. The first term of this sum is the value of the derivative of the individual consumer's function with respect to the mill price, calculated at the distance of the marginal consumer. Clearly this value is always equal to minus *b* regardless of the specific location at which it is calculated. The second term, on the other hand is always equal to $\frac{b}{2}$, which implies that the left hand side of condition (A2.10) is always equal to $-\frac{b}{2}$.

To calculate the value taken by the right hand side product it is useful to write the terms in a different way. Simple manipulation shows that, for the linear individual demand specified above, and writing $q\left(x_{i-1}^{+}\right) = q\left(p_{i-1} + tx_{i-1}^{+}\right)$ for simplicity, the following equalities hold:

$$q\left(x_{i-1}^{+}\right) = q\left(\frac{x_{i-1}^{+}}{2}\right) - \frac{bt}{2} \cdot x_{i-1}^{+} \tag{A2.11}$$

$$Q_{i-1}^{+} = x_{i-1}^{+} \cdot q\left(\frac{x_{i-1}^{+}}{2}\right) \tag{A2.12}$$

and:

$$\frac{\partial Q_{i-1}^{+}}{\partial p_{i-1}} = -\frac{1}{2t}\left[q\left(\frac{x_{i-1}^{+}}{2}\right) + 3\cdot\frac{bt}{2}\cdot x_{i-1}^{+}\right] \tag{A2.13}$$

On the basis of these last three equations it is possible to re-write the (A2.10) in the following way:

$$bt < \left[q\left(\frac{x_{i-1}^{+}}{2}\right) + 3\cdot\frac{bt}{2}\cdot x_{i-1}^{+}\right]\cdot\left[\frac{1}{x_{i-1}^{+}} - \frac{bt/2}{q\left(\frac{x_{i-1}^{+}}{2}\right)}\right] \tag{A2.14}$$

that can be further simplified to:

$$\frac{q\left(\frac{x_{i-1}^{+}}{2}\right)}{x_{i-1}^{+}} - 3\left(\frac{bt}{2}\right)^{2}\cdot\frac{x_{i-1}^{+}}{q\left(\frac{x_{i-1}^{+}}{2}\right)} > 0 \tag{A2.15}$$

This, in turn, implies that:

$$q\left(\frac{x_{i-1}^{+}}{2}\right) - \sqrt{3}\cdot\frac{bt}{2}\cdot x_{i-1}^{+} > 0 \tag{A2.16}$$

Finally, recalling equation (A2.11), the condition for the sign of the derivative to be positive expressed in the (A2.10) is equivalent, for the linear individual demand to the following:

$$q\left(x_{i-1}^{+}\right) - x_{i-1}^{+}\frac{bt}{2}\left(\sqrt{3}-1\right) = q\left(\frac{1+\sqrt{3}}{2}\cdot x_{i-1}^{+}\right) > 0 \tag{A2.17}$$

This condition imposes a restriction on the value of the individual consumer's reservation price. It requires that consumers that are further away from *i*-1 than the marginal consumer by a fraction $\frac{1+\sqrt{3}}{2}$ will still want to purchase a positive amount from *i*-1. It is therefore assumed that consumers have a high enough reservation price for (A2.17) to hold.

Under condition (A2.17), when a store exits the market its immediate competitors will see their elasticity of demand decrease and will therefore raise their prices. As a consequence, because of the strategic complementarity of prices, all firms will raise their prices post exit and therefore total quantity produced will fall.

APPENDIX 3: SECOND ORDER CONDITIONS

This appendix examines the second order conditions for the maximisation problems presented in section 3. They relate to the Nash Bargaining Products in the bargaining problems over a two-part tariff and a linear wholesale price.

TWO-PART TARIFFS

Consider the NBP for the two-part tariff case in eq. (9). The second order condition with respect to the fixed-fee is satisfied as both terms of the NBP are linear in the fixed fee and their first derivatives are equal to plus and minus one. As a consequence it is straightforward to show that:

$$\frac{\partial^2 NBP}{\partial F^2} = -2 \qquad \text{(A3.1)}$$

As for the wholesale price, the second derivative of the NBP with respect to the wholesale price, dropping for notational ease the subscripts *i*, is:

$$\frac{\partial^2 NBP}{\partial F^2} = \left[\frac{\partial^2 Q}{\partial w^2} \cdot g(w) + 2 \cdot \frac{\partial Q}{\partial w}\right] \cdot \Pi^R - 2 \cdot Q \cdot \frac{\partial \Delta\Pi^M}{\partial w} - \frac{\partial Q}{\partial w} \cdot \Delta\Pi^M \qquad \text{(A3.2)}$$

This expression can be simplified recalling that the FOC requires that $\Delta\Pi^M = \Pi^R$ and that $g = 0$, which in turn imply that $\frac{\partial \Delta\Pi^M}{\partial w} = Q$. After simple manipulation, equation (A3.2) can be re-written as:

$$\frac{\partial^2 NBP}{\partial F^2} = 3 \cdot \Pi^R \cdot \frac{\partial Q}{\partial w} - 2 \cdot Q^2 < 0 \qquad \text{(A3.3)}$$

As shown in Lemma A1.1, the derivative of quantity with respect to the wholesale price is negative, and as a consequence so is the right hand side of eq. (A3.3).

LINEAR PRICES

Consider now the NBP for the case of a linear price in eq. (22). The second derivative of the NBP with respect to the wholesale price is the same expression as in eq. (A3.2):

$$\frac{\partial^2 NBP}{\partial w^2} = \left[\frac{\partial^2 Q}{\partial w^2} \cdot g(w) + 2 \cdot \frac{\partial Q}{\partial w} \right] \cdot \Pi^R - 2 \cdot Q \cdot \frac{\partial \Delta \Pi^M}{\partial w} - \frac{\partial Q}{\partial w} \cdot \Delta \Pi^M \tag{A3.4}$$

The term in square brackets on the right hand side is the second derivative of the incremental profits earned by the manufacturer by reaching an agreement with retailer *i*. For this term to be negative it is sufficient that quantity is not too convex in the wholesale price; this is assumed.

In order to establish the sign of the second and third terms in the sum on the right hand side of eq. (A3.4), consider the FOC expressed in eq. (23). This can be written as:

$$\frac{\partial \Delta \Pi^M}{\partial w} \cdot \frac{\Pi^R}{Q} = \Delta \Pi^M \tag{A3.5}$$

Which implies that where the FOC holds, $\frac{\partial \Delta \Pi^M}{\partial w}$ has to be greater than zero as all the other terms in the equality are strictly positive. Consider the last two terms of the sum in (A3.4) in isolation. Call the sum of these two terms A. A can be written as:

$$A = -\frac{\partial \Delta \Pi^M}{\partial w} \cdot \frac{1}{Q} \cdot \left(2 \cdot Q^2 + \frac{\partial Q}{\partial w} \cdot \Pi^R \right) \tag{A3.6}$$

Given eq. (A3.5), $sign\{A\} = -sign\{B\}$ where B is defined as the terms in brackets on the right hand side. Given the first order condition for the retailer profit maximisation expressed in (A1.4), B can be re-written in the following way:

$$B = 2 \cdot Q^2 + \frac{\partial Q}{\partial w} \cdot \left(-\frac{\partial Q}{\partial p} \right)^{-1} \cdot Q^2 \qquad \text{(A3.7)}$$

This can be simplified further to obtain that:

$$sign\{B\} = sign\left\{ 2 - \frac{\partial Q}{\partial w} \cdot \frac{\partial p}{\partial Q} \right\} \qquad \text{(A3.8)}$$

This, recalling that from Lemma A1.1 price is an increasing function of the wholesale price, implies that the condition for B to be positive is that $\frac{\partial p}{\partial w} < 2$. From eq. (A1.6) it is easy to show that this condition is satisfied if the demand function is not too convex with respect to the own price. In particular if:

$$\frac{\partial^2 Q}{\partial p^2} < -\frac{3}{p - w} \cdot \frac{\partial Q}{\partial p} \qquad \text{(A3.9)}$$

Assuming this restriction on the convexity of the demand curve implies that B is positive and consequently that A is negative. In conclusion having already restricted quantity to be not too convex in the wholesale price, the (A3.9) is a sufficient condition for the second order condition to hold in the bargaining problem with a linear wholesale price.