Inefficient Buyer Mergers To Obtain Size Discounts

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Abstract

This paper analyzes the welfare implications of buyer mergers when one monopoly manufacturer sells its product to many separate and locally competitive retail markets. Assuming diseconomies of scale upstream, we show that a larger retailer gets size discounts from the supplier, i.e., it has a higher buyer power than smaller retailers. Different from the conventional argument that more buyer power reduces retail prices, we show that a larger retailer does not pass on size discounts to consumer prices when firms bargain over non-linear supply contracts. Moreover, size discounts for the larger buyer do not lead to higher tariffs for smaller buyers, i.e., there is no waterbed effect, when supply contracts are non-linear. We next illustrate that size discounts might result in inefficient buyer mergers decreasing the consumer surplus. This is found to be the case when independent stores want to merge to improve their bargaining power vis-à-vis the supplier, and thus get size discounts, even if the merger deteriorates their downstream efficiency. For policy concerns, we show that inefficient mergers are more likely to occur when retail competition is weaker, for instance, due to strict commercial zoning rules.

Keywords Buyer mergers, non-linear supply contracts, size discounts, waterbed effects, commercial zoning laws.

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1 Introduction

In recent years, the implications of buyer power have been largely discussed. One potential benefit is seen to be that the exercise of buyer power results in lower purchasing costs leading to lower consumer prices. However, as stated by the European Commission Guidelines, lower purchasing costs might not be passed on to consumers downstream. This paper supports this claim *formally* by showing that even if larger buyers obtain size discounts from the supplier, there is no pass on of lower purchasing costs to consumer prices when firms bargain over non-linear supply contracts.[1]

The EC Guidelines argue moreover that lower purchasing costs for powerful buyers are at the expense of higher costs for other buyers, since "the supplier would try to recover price reductions for one group of customers by increasing prices for other customers ..."[2] Although this mechanism, which is also known as the waterbed effect, has recently received some theoretical foundations[3], we have found no waterbed effect at work, mainly because non-linear supply contracts transfer profits between the supplier and a larger buyer without affecting retail prices. Our results therefore support the UK Competition Commission's claim that with multi-part tariffs, waterbed effects would less likely to be materialized. If waterbed effects existed, one would expect to see unambiguous evidence of an overall decline in convenience store revenue. However, the UK data on the supply of the groceries could not find such evidence.[4] Our findings in particular propose an explanation to this observation: For a given volume of sales, the revenue of smaller retailers does not decrease when a buyer merger does not improve downstream efficiency.

More policy concerns, we show that less planning restrictions in commercial zones make efficient buyer mergers more likely.

Our paper analyzes the welfare implications of buyer mergers and buyer power when one monopoly manufacturer, like in Inderst and Valetti (2008), sells to many separate and locally competitive retail markets. Each store incurs a constant marginal cost of retailing. Different from the authors, we consider *non-linear* supply contracts and upstream diseconomies of scale (i.e., *convex*

[1] Inderst and Shaffer (2008) conjecture that lower input costs might not be passed to consumer prices when "contracts between competing firms are unobservable (i.e. firms do not know for sure what terms of trade their rivals have been able to negotiate)".

[2] Guidelines in the applicability of Article 81 of the EC Treaty to horizontal cooperation agreements (2001/C3/02), paragraph 126.

[3] See Inderst and Valetti (2008), Majumdar (2006).

[4] See "The Supply of Groceries in the UK Market Investigation", Competition Commission, 30 April 2008, paragraph 5.11.

costs of production). The vertical industry is modelled as a two-stage game: First, the supplier negotiates with each retailer a quantity to be sold and a tariff to be paid by the retailer. Contracts are assumed to be immune to profitable bilateral deviations. In the second stage, retailers sell all quantity they purchased to consumers.

We measure buyer power by "size" as in Chipty and Synder (1999). Given that the cost of production is convex, a larger buyer gets size discounts from the supplier, i.e., it has a higher buyer power, because its incremental contribution to the industry profit is higher. Size discounts therefore make buyer mergers profitable. We introduce a large retailer (or buyer) by considering a merger between outlets active in independent markets. In this setup, we mainly show that availability of size discounts might result in inefficient buyer mergers reducing the consumer surplus. This is found to be the case when independent stores want to merge to improve their bargaining power vis-à-vis the supplier, and thus to get size discounts, even if the merger deteriorates their downstream efficiency. The decrease in the consumer surplus is not due to a waterbed effect, but is instead due to the downstream inefficiency produced by the buyer merger. Moreover, we have found that the profits of all retailers (regardless of their size and when they are small whether they compete with an outlet of a large retailer or not) would be higher as a result of a downstream inefficient buyer merger.

We begin by explaining why the waterbed effect mechanism does not work if the merger has no impact on the downstream efficiency. The merging parties obtain size discounts from the supplier, however, such discounts change neither production nor sales decisions. The reason is the following. In each bilateral negotiation over non-linear supply contracts, the optimal quantity is set such that the marginal revenue is equal to the marginal cost of producing and retailing that quantity (i.e., the bilateral profits are maximized). The merged entity distributes the total quantity it purchased across its independent stores optimally, i.e., by equating the marginal revenue with the marginal cost for each of its stores. As the marginal cost of production is the same across all retailers and the merger does not change the marginal cost of retailing, the equilibrium quantities after the merger would be the same as the ones before the merger. Input prices of other retailers would not change, either. Even if the large buyer obtains size discounts, there is no pass on of savings to consumer prices.

We next present conditions under which the consumer surplus is reduced by a buyer merger.

We consider two types of buyer mergers: an *efficient buyer merger* which improves downstream efficiency of the merging parties, and conversely an *inefficient buyer merger* which deteriorates downstream efficiency. An inefficient buyer merger might be profitable since it provides also size discounts to the merging parties. On the one hand, each store of the large retailer incurs a higher retailing cost than the small rival retailers, and thus has a cost disadvantage when it competes with the small retailers for final consumers, on the other hand, the large retailer negotiates lower tariffs with the supplier (size discounts). The merger therefore changes sales decisions. Small rival retailers steal customers from the stores of the large retailer, their scale thus increases, which in turn improves their bargaining position, so they negotiate lower tariffs with the supplier. Each outlet of the large retailer sells less while its rivals sell more. We moreover show that these opposite effects result in smaller quantities, and thus higher consumer prices, in each market where the large retailer has a store. Note furthermore that the small retailers in other markets (we call them as "small independent retailers") improve their bargaining position and obtain better tariffs from the supplier, because their incremental contributions are higher given that the total quantity negotiated between the other retailers and the supplier is lower (due to convex production costs). Therefore, each small independent retailer sells a greater quantity. However, we show that consumers are adversely affected, since the total industry quantity on the retail market is lower as a result of an inefficient buyer merger.

In contrast, if a buyer merger improves downstream efficiency, we show that there are waterbed effects and at the same time the consumer surplus increases. For a given volume of sales, the profits of the small retailers increase (respectively decrease) following an inefficient (efficient) merger.

Lastly, we provide some policy guidelines regarding commercial zoning rules. To prevent downstream inefficient buyer mergers, our results suggest that barriers to entry into retail activities have to be reduced since lower downstream competition in local markets makes inefficient buyer mergers more likely.

The rest of the paper is organized as follows. Section 2 states the literature related to our paper. Section 3 presents the model and derives some preliminary results. Section 4 analyzes how a larger buyer gets discounts from the supplier. Section 5 discusses and extends these results by introducing downstream cost efficiency or inefficiency generated by a buyer merger. Section 6 is policy-oriented and questions the efficiency of planning restrictions. Section 7 concludes.

2 Literature

The literature mostly measures buyer power by "size". The size of a retailer might increase its buyer power by raising the value of its outside option (Katz (1987), Sheffman and Spiller (1992)) or by reducing the supplier's outside option (Inderst and Wey (2007a)).Chipty and Snyder (1999) show that convex production costs result in discounts for larger buyers (size discounts) because larger buyers have higher marginal contribution to the industry surplus than smaller buyers. Alternatively, Chen (2003) measures buyer power by the buyer's share over the gains from trade with the supplier.

More recently, following Katz, Inderst and Valetti (2008) show that larger buyers pay lower wholesale prices than smaller buyers, because larger buyers have the leverage to reduce the average cost of their outside option by dispersing a fixed cost of an alternative supplier over a larger volume of sales. The authors moreover show that there are waterbed effects since prices of smaller buyers are increasing in the price of a larger buyer. More interestingly, they show that the prices of smaller buyers increase in the size of the larger buyer, so waterbed effects would be stronger when large buyers become larger, through, for example, the acquisition of additional stores.

Majumdar (2006) illustrates a waterbed effect by considering a large retailer which could contract with two perfectly competitive manufacturers outside of the spot market and moreover could appoint one or both of the manufacturers which then commit(s) to production by sinking a fixed cost. Majumdar shows that the large retailer wants to own more stores because this increases its rivals' costs (the spot price for smaller retailers) as there are fewer small stores over which the upstream fixed cost can be spread.

Lower purchasing costs provide a cost advantage to larger retailers when they compete with smaller retailers for final consumers. As smaller retailers lose business to larger retailers, their scale diminishes, which further deteriorates their bargaining position, so smaller retailers are even less likely to extract discounts from suppliers.[5] Whether consumers would be adversely affected depends on how much input cost reductions are passed on to consumer prices by larger retailers and how much smaller retailers pass their cost increases to consumers. For instance, Inderst and Valetti show that in the Hotelling model, consumer prices would increase as a result of the waterbed effect. With linear demand, Majumdar shows that waterbed effects decrease the total welfare. In both papers,

[5] See Dobson and Inderst (2007) for a more general policy discussion on the waterbed effect.

there is a key assumption that supply contracts are linear.

There are a few econometric studies that test whether in vertical contracts non-linear pricing is more prevalent than linear pricing. Bonnet and Dubois (2008) and Berto Villas-Boas (2007) find evidence that manufacturers and retailers use non-linear supply contracts in the markets for bottled water in France and yoghurt in the US. Parallel to their results, the supplier survey conducted on the behalf of the Competition Commission by GfK Group (Appendix 5.4., 2008) indicates that around 70 per cent of suppliers make regular or occasional payments to grocery retailers as marketing contributions or other promotional investments, 43 per cent of respondents stated also that they paid some other rebates to retailers. Overall, these findings suggest that in the trade between grocery retailers and suppliers, contracts tend to have multiple parts.

We consider *non-linear* wholesale tariffs instead of linear supply contracts used by Inderst and Valetti or Majumdar. This is the main difference between their papers and our paper. Like Chipty and Synder (1999), we assume convex costs of production which imply that a larger retailer gets size discounts from the supplier, because its incremental contribution to the industry profit is higher than smaller retailers. By contrast to Inderst and Valetti or Majumdar, we have found no waterbed effect when firms bargain over non-linear supply contracts. Alternatively, we relate the existence of a waterbed effect to downstream cost efficiency of the larger retailer. More precisely, we show that if a buyer merger leads to downstream cost efficiency, there exists waterbed effects in the sense that for a given volume of sales smaller retailers earn lower profits. By contrast, if the buyer merger leads to cost inefficiency downstream, there is no waterbed effect, but instead all retailers' profits increase after the merger. Moreover, the implications of a waterbed effect (if exists) are quite different from the ones in Inderst and Valetti or Majumdar. We find that, if a waterbed effect exists, it always increases the consumer surplus.

Generally, our analysis contributes to the ongoing debate on the implications of discounts that more powerful buyers get from their suppliers.[6] Battigalli et al. (2007), Inderst and Wey (2007b), and Vieira-Montez (2007) analyze the long-run implications of buyer power on upstream investment incentives.

Finally, we analyze the effects of commercial zoning laws on buyers' incentives to merge and on

[6]For a survey on these issues, see, for example, Inderst and Mazzarotto (2008) or Caprice and Schlippenbach (2008).

the consumer surplus. Up to our knowledge, no other paper has analyzed this point. We show that more stringent commercial zoning rules restrict retail competition, and thus make inefficient buyer mergers more likely to the detriment of consumers.

3 The model

Consider an industry with an up- and a downstream segment. Upstream, there is one producer, for which the cost of producing Q units is $C(Q)$. The cost function is assumed to be twice continuously differentiable, strictly increasing (i.e., $C'(Q) > 0$) and strictly convex (i.e., $C''(Q) > 0$). The producer sells the good to m separate local retail markets, where $m \geq 2$. Each local market has n identical retail stores competing in quantities, where $n \geq 2$. Retailers have constant marginal cost of retailing c. Each local market, denoted by h ($h = 1, ..., m$), faces the same inverse market demand $P(Q_h)$, which is twice continuously differentiable and downward sloping (i.e., $P'(Q_h) < 0$). We make the following assumption on the demand function

Assumption 1. $P'(Q) + QP''(Q) < 0$ for any Q,

to ensure that the second-order condition for existence and uniqueness of an equilibrium is satisfied.

3.1 Description of the game

The vertical industry is modeled as a two-stage game with the following sequence of events. In the first stage, supply contracts are determined in bilateral negotiations. Retailer i's contract with the producer specifies the quantity q_i to be delivered to retailer i and the money transfer t_i to be made from retailer i to the producer, for $i = 1, ..., nm$. Bilateral negotiations occur independently and simultaneously. We follow most of the literature by assuming passive beliefs in simultaneous negotiations, that is to say when a downstream firm receives an unexpected offer from the producer it does not revise its beliefs about the offers made to its rivals.[7] In the second stage of the game, retailers sell all quantity they purchased to consumers. Each retailer is thus capacity constrained by the quantity it negotiated with the producer in the previous stage. Downstream competition is therefore in Cournot fashion, where quantities are determined by bilateral negotiations between retailers

[7] See McAfee and Schwartz (1994) for example.

and the producer. We define the gross profit of retailer i as $\Pi_i(q_i, Q_{h[i]}) \equiv \left[P(Q_{h[i]} + q_i) - c\right] q_i$, where $Q_{h[i]}$ denotes the sum of all quantities for local market h except for the quantity sold by retailer i.

3.2 The contracting equilibrium

Consider the negotiation between the producer and retailer i. Let T and Q denote respectively the total transfers made and the total quantities delivered, i.e., $T = \sum_{i=1}^{nm} t_i$ and $Q = \sum_{i=1}^{nm} q_i$. $T_{[i]}$ (respectively $Q_{[i]}$) denotes the sum of all transfers (quantities) except for the tariff paid (quantity sold) by retailer i for $i = 1, ..., nm$.

Under passive beliefs, the expected profit of the upstream firm is[8]

$$\pi_U = t_i + T^*_{[i]} - C\left(q_i + Q^*_{[i]}\right),$$

whereas its disagreement payoff (or outside option) with retailer i is

$$\pi^o_U = T^*_{[i]} - C\left(Q^*_{[i]}\right).$$

The expected profit of retailer i and its disagreement payoff with the producer are respectively

$$\pi_i = \Pi_i\left(q_i, Q^*_{h[i]}\right) - t_i \text{ and } \pi^o_i = 0,$$

where $\Pi_i\left(q_i, Q^*_{h[i]}\right) = \left[P(Q^*_{h[i]} + q_i) - c\right] q_i$.

An equilibrium, (q^*_i, t^*_i) is an outcome of the Nash bargaining between retailer i and the producer solving the following problem

$$\max_{q_i, t_i} (\pi_U - \pi^o_U)^\alpha (\pi_i - \pi^o_i)^{(1-\alpha)} \qquad \textit{or}$$
$$\max_{q_i, t_i} \left[t_i - \left(C\left(q_i + Q^*_{[i]}\right) - C\left(Q^*_{[i]}\right)\right)\right]^\alpha \left[\Pi_i\left(q_i, Q^*_{h[i]}\right) - t_i\right]^{1-\alpha}$$

where the parameter α, for $0 < \alpha < 1$, is used as an exogenous measure of the supplier's intrinsic bargaining power vis-à-vis each retailer.

[8] Note that we denote all equilibrium variables by superscript *.

The first-order conditions yield the optimal quantities:

$$P'\left(Q_h^*\right) q_i^* + P\left(Q_h^* + q_i^*\right) = c + C'\left(Q^*\right),$$

which maximize the bilateral profits by equating the marginal revenue to the marginal cost of the vertical pair. The optimal tariffs are used to share the bilateral profits with respect to the relative bargaining power:

$$t_i^* = \alpha \Pi_i \left(q_i^*, Q_{h[i]}^*\right) + (1-\alpha)\left[C\left(Q^*\right) - C\left(Q^* - q_i^*\right)\right],$$

The equilibrium is unique.[9] Using the fact that all markets are symmetric, in equilibrium each retailer sells q^* such that

$$P'\left(nq^*\right) q^* + P\left(nq^*\right) = c + C'\left(mnq^*\right) \tag{1}$$

and pays transfer t^* satisfying

$$t^* = \alpha\left[P\left(nq^*\right) - c\right] q^* + (1-\alpha)\left[C\left(mnq^*\right) - C\left((mn-1)\, q^*\right)\right].$$

Each retailer gets

$$\pi^* = (1-\alpha)\left[\left[P\left(nq^*\right) - c\right] q^* - \left[C\left(mnq^*\right) - C\left((mn-1)\, q^*\right)\right]\right],$$

i.e., $(1-\alpha)$ times its incremental contribution to the industry profit.

The equilibrium total quantity in local market h and of the industry are respectively $Q_h^* = nq^*$ and $Q^* = mnq^*$.

4 Buyer Merger and Size Discounts

We extend the model by introducing a single large retailer L as a result of a merger between l independent outlets, where $2 \leq l \leq m$. The merged entity (or *the large retailer*, L) now operates l outlets which are active in independent retail markets. The large retailer negotiates a quantity with the supplier to distribute it through l outlets. A small retailer negotiates a quantity with the

[9] The proof of the second-order condition, where we show that the Hessian matrix is strictly negative definite is available on request.

supplier to distribute it at 1 outlet.

Let q_L denote the total quantity delivered by the large retailer. If a retailer is a rival of an outlet of L (i.e., in a local market where the large retailer operates an outlet), we call it as a *small rival retailer* and denote its quantity by q_R. If a retailer is active in a local market where the merged entity is not present, we call it as a *small independent retailer* and denote its quantity by q_I. Let $Q_{h,L}$ (respectively $Q_{h,\phi}$) denote the total quantity sold in a local market where L has an outlet (where L is not present).

First-order conditions yield equilibrium quantities q_L^{**}, q_R^{**}, and q_I^{**} such that

$$P'\left(Q_{h,L}^{**}\right)\frac{q_L^{**}}{l}+P\left(Q_{h,L}^{**}\right)=P'\left(Q_{h,L}^{**}\right)q_R^{**}+P\left(Q_{h,L}^{**}\right)=P'\left(Q_{h,\phi}^{**}\right)q_I^{**}+P\left(Q_{h,\phi}^{**}\right)=c+C'\left(Q^{**}\right) \quad (2)$$

where $Q_{h,L}^{**}=\frac{q_L^{**}}{l}+(n-1)\,q_R^{**}$, $Q_{h,\phi}^{**}=nq_I^{**}$, and $Q^{**}=lQ_{h,L}^{**}+(m-l)\,Q_{h,\phi}^{**}$.

By comparing the first-order conditions, it is easy to see that quantities sold at each store are equal and the same as the quantities sold before the merger:

$$\frac{q_L^{**}}{l}=q_R^{**}=q_I^{**}=q^*.$$

Equilibrium transfers t_L^{**}, t_R^{**} and t_I^{**} are such that the large retailer pays a lower average tariff than the small retailers, which pay exactly the same tariff as that they were paying before the merger:

$$t_L^{**}=\alpha l\left[P\left(nq^*\right)-c\right]q^*+(1-\alpha)\left[C\left(mnq^*\right)-C\left((mn-l)\,q^*\right)\right]\ <\ lt^*,$$

$$t_R^{**}=t_I^{**}=t^*.$$

As a result, the merging parties earn more than they would get if they were separated and the small retailers earn the same profit as that they would get before the merger.

$$\pi_L^*=(1-\alpha)\left[\left[P\left(nq^*\right)-c\right]lq^*-\left[C\left(mnq^*\right)-C\left((mn-l)\,q^*\right)\right]\right]\ >\ l\pi^*,$$

$$\pi_R^{**}=\pi_I^{**}=\pi^*,$$

Inequalities $t_L^{**} < lt^*$ and $\pi_L^* > l\pi^*$ come from the convexity of the upstream cost function $C(Q)$. Intuitively, the large retailer negotiates a larger quantity with the supplier which has a convex cost function, and thus have a higher incremental contribution to the industry profit than the small retailers. As a result, the large retailer pays a lower average tariff, i.e., gets size discounts.

These results are summarized in Proposition 1.[10]

Proposition 1 *A buyer merger is always profitable since it brings size discounts. However, size discounts for the large retailer does not alter equilibrium quantities, i.e., there is no waterbed effect.*

Since we consider non-linear wholesale prices and passive beliefs, the buyer merger results in a transfer of profits from the supplier to the large buyer without affecting quantities and retail prices. The parties always want to merge to increase their size and negotiate a better deal with the supplier. This effect, presented in details by Chipty and Snyder (1999), comes from the convexity of the producer' cost function. When the supplier has strictly increasing incremental costs of production, a small buyer negotiates "at the margin", where incremental costs are high. In contrast, if some small buyers merged, they would then account for a larger fraction of the supplier's total sales, and thus negotiate less at the margin, thereby pay a lower price per unit. This *size effect* of a buyer merger extends from a setup of locally monopolist stores to our model with downstream competition in each local market, because supply contracts are assumed to be immune to profitable bilateral deviations.[11]

The size effect increases the profit of the merged entity, L, and does not affect the small (rival and independent) retailers, R and I (See Table 1).

Table 1. Size discounts generated by a buyer merger.

The profits of retailer	*size effect*
L	$+$
R	$\emptyset$
I	$\emptyset$

Size discounts to the large retailer do not change equilibrium quantities, i.e., are not passed on to final consumers. Moreover, there is no scope for a waterbed effect to arise. Inderst and Shaffer

[10] All proofs are presented in Annex, except for the proof of Proposition 1, which can be found in the text.

[11] This is the case under the "passive beliefs" requirement. It would still be the case under the "contract equilibrium" concept used in O'Brien and Shaffer (1992).

(2008) conjecture that if non-linear supply contracts are negotiated simultaneously, an increase in buyer power would not affect equilibrium quantities or prices. However, this conjecture has not been documented formally in the literature. The UK investigation (2008) stated: "The use of contracts with multi-part tariffs in the UK grocery sector tends to militate against the possibility of the waterbed effect operating in a material fashion".[12] Our results support formally both of these predictions by showing that there is no scope for a waterbed effect to materialize when supply contracts are non-linear and negotiated simultaneously. In the next section, we show a possible welfare distortion arising from inefficient buyer mergers aiming to obtain size discounts.

5 Inefficient Buyer Merger

Suppose now that the merger affects not only the size but also the downstream efficiency of the merging parties. Let $c+\mu$ be the marginal cost of retailing at each outlet of the large retailer. When $\mu < 0$ (respectively $\mu > 0$), the merger improves (deteriorates) downstream efficiency. For instance, the merger could result in some economies of scale downstream or other types of synergies and/or increase the costs of communication and coordination within the merged entity. If the efficiencies generated by the merger are higher (lower) than the inefficiencies produced by the merger, we say that $\mu < 0$ ($\mu > 0$). For the rest of the retailers the marginal cost of retailing is still equal to c.

When $\mu < 0$, the parties always want to merge for two reasons: To extract discounts from the supplier and to benefit from the efficiencies generated by the merger. On the other hand, if the merger deteriorates downstream efficiency, $\mu > 0$, it might still be profitable. This would be the case, for example, when the inefficiency produced by the merger is low enough to be compensated by the gains from size discounts.

Lemma 1. *There exists $\tilde{\mu} > 0$ such that for any $\mu < \tilde{\mu}$, a buyer merger is profitable.*

A buyer merger affecting downstream efficiency is going to change the equilibrium quantities due to the efficiency impact of the merger.

Proposition 2 *If a buyer merger generates downstream efficiency, $\mu < 0$, we have*

$q_R^{**} < q_I^{**} < q^* < \frac{q_L^{**}}{l}$, $Q_{h,\phi}^{**} < Q_h^* < Q_{h,L}^{**}$ *and* $Q^* < Q^{**}$,

[12] See appendix 5.4, "The waterbed effect in supplier pricing", paragraph 42.

Inversely, if a buyer merger produces downstream inefficiency, $\mu > 0$, we have $\frac{q_L^{**}}{l} < q^* < q_I^{**} < q_R^{**}$*,* $Q_{h,L}^{**} < Q_h^* < Q_{h,\phi}^{**}$ *and* $Q^{**} < Q^*$*.*

To understand the underlying intuition of our results, assume that each local market is monopolist ($n = 1$) and consider a change in the marginal cost of retailing for l retailers deteriorating downstream efficiency ($\mu > 0$). We first assume that each one of the l retailers continues to negotiate separately. There are two types of retailers in terms of differences in their retailing costs: l high cost retailers and $m - l$ low cost retailers. Because the high cost retailers sell lower quantities, the low cost retailers negotiate better tariffs with the supplier. We have this effect since the incremental contribution of each low cost retailer to the total surplus is higher when the total quantity negotiated by the high cost retailers is lower (due to the convexity of the cost of production). Conversely, each high cost retailer has to pay a higher price now, since all low cost retailers negotiate greater quantities with the supplier. We call this effect as *cost effect*, because it results from the convexity of the upstream cost function when some retailers become less efficient in retailing. The cost effect decreases the profits of the high cost retailers and increases the profits of the low cost retailers.[13] Now suppose that the l high cost retailers merge, and thus negotiate jointly with the supplier. They would then obtain size discounts from the supplier, i.e., enjoy the positive *size effect*. An inefficient buyer merger thus brings two countervailing effects creating a trade-off for the merging parties. First, higher retailing costs translate into a bargaining disadvantage (which is the cost effect lowering the profits of the merging parties), and second, a larger size brings a bargaining advantage (which is the size effect increasing the profits of the merging parties) (See Table 2). Even though the merger produces downstream inefficiency, it might be profitable if size discounts compensate the losses from the inefficiency. This would be the case, in particular, when the inefficiencies produced by the merger are not very significant.

Table 2. Possible effects of an inefficient buyer merger, for $n = 1$,

Profits of retailer	*size effect*	*cost effect*
L	+	-
I	$\emptyset$	+

[13] A symmetric effect would arise if some retailers became more efficient. The cost effect would then be positive for these retailers and negative for the others.

Suppose now that in each local market there are $n \geq 2$ competing retailers. First, consider l retailers which have become less efficient due to some exogenous reasons. Each high cost retailer would sell a lower quantity because its low cost rivals would steal some of its business. Each of the l high cost retailers, say retailer i, gets lower gross profits, $\Pi_i(q_i, Q_{h[i]}) \equiv \left[P(Q_{h[i]} + q_i) - (c + \mu)\right] q_i$, whereas a rival of a high cost retailer, say retailer j, earns higher gross profits, $\Pi_j(q_j, Q_{h[j]}) \equiv \left[P(Q_{h[j]} + q_j) - c\right] q_j$. Their incremental contributions are affected in a similar way.[14] We call this effect as *competition* effect since it results from the competition in a local market where a high cost retailer competes with low cost retailers.[15] Given that the high cost retailers sell lower quantities, the low (respectively high) cost retailers negotiate lower (higher) tariffs with the supplier, which is the cost effect. The competition effect and the cost effect work in the same direction; they both decrease the profits of the high cost retailers and increase the profits of their rivals. Suppose next that the l high cost retailers merge, and thus negotiate jointly with the supplier. In addition to the competition and cost effects described, the merger generates a size effect such that the high cost retailers could obtain size discounts. An inefficient buyer merger would be profitable if the size effect dominates the sum of the cost and competition effects.

Furthermore, consider the small independent retailers, i.e. the retailers which are not competitors of the high cost outlets. From the cost effect, we know that they improve their bargaining positions since the total quantity sold in the markets where the high cost stores are active decreases $\left(Q^{**}_{h,L} < Q^{*}_{h}\right)$. That is because the decrease in the quantities sold by the high cost outlets (first-order effect) is higher than the increase in the quantities sold by their rivals (second-order effect). The incremental contributions of the small independent retailers are thus higher (due to the convex production cost) implying higher quantities on these markets. To sum up, the cost and competition effects are negative for the l high cost outlets (the merging parties) whereas the cost effect is positive for the small (rival and independent) retailers, and the competition effect is null for the small independent retailers and positive for the small rival retailers. The quantities are lower and prices are higher in the markets where high cost outlets are active, while the quantities are higher and prices are lower where only small independent retailers are active. Table 3 summarizes all effects of

[14] A symmetric effect would arise if some retailers became more efficient. The effect would then be positive for these retailers and negative for their rivals.

[15] Note that this effect would still exist if upstream cost function was linear. However, in this case, an inefficient merger would not be profitable since the size effect and the cost effect would be null given that the upstream cost function is linear.

an inefficient buyer merger:

Table 3. Possible effects of an inefficient buyer merger, for $n \geq 2$,

Profits of retailer	*size effect*	*cost effect*	*competition effect*
L	+	-	-
R	$\emptyset$	+	+
I	$\emptyset$	+	$\emptyset$

Let $t_i^{**}(q_i)$ (respectively $t_i^{*}(q_i)$) denote retailer i's transfer for any q_i when the quantities of other retailers are at their equilibrium levels after the merger (respectively before the merger), i.e., $q_{-i} = q_{-i}^{**}$ (respectively $q_{-i} = q_{-i}^{*} = q^*$), for $i = R, I$. For example, for a given volume of sales q_I, a small independent retailer pays

$$t_I^{**}(q_I) = \alpha \left[P\left((n-1)q^* + q_I\right) - c\right] q_I + (1-\alpha)\left[C\left(Q^* - q^* + q_I\right) - C\left(Q^* - q^*\right)\right].$$

before the merger and it pays

$$t_I^{**}(q_I) = \alpha \left[P((n-1)q_I^{**} + q_I) - c\right] q_I + (1-\alpha)\left[C\left(Q^{**} - q_I^{**} + q_I\right) - C\left(Q^{**} - q_I^{**}\right)\right]$$

after the merger.

Lemma 2. *As a result of an efficient (respectively inefficient) buyer merger, each small independent retailer pays a higher (lower) tariff for a given volume of sales. Each small rival retailer pays a higher (lower) tariff for a given volume of sales when the supplier has a very low bargaining power vis-à-vis its retailers. Otherwise, each small rival retailer pays a lower (higher) tariff after the merger.*

A buyer merger affecting the efficiency of merging parties changes the tariffs paid by the other retailers at a given volume of sales. Consider for instance the changes after an efficient merger ($\mu < 0$). A small independent retailer pays more for any volume of sales q_I because its contribution to the industry profit is lower when the other retailers negotiate a greater quantity with the supplier, which is the cost effect:

$$C(Q^{**} - q_I^{**} + q_I) - C(Q^{**} - q_I^{**}) > C(Q^* - q^* + q_I) - C(Q^* - q^*)$$

since $Q^{**} > Q^*$ and $q_I^{**} < q^*$ for $\mu < 0$ (from Proposition 2) and $C''(Q) > 0$ (by assumption). Consider the tariff of a small rival retailer for any volume of sales q_R. Similar to a small independent retailer, the cost effect increases its tariffs since the total quantity that the other retailers negotiate with the supplier is larger. On the other hand, the competition effect reduces its tariff because a small rival retailer earns a lower gross profit when competing with a more efficient rival:

$$\left[P\left(Q_{h,L}^{**} - q_R^{**} + q_R\right) - c\right] q_R < \left[P\left(Q_h^* - q^* + q_R\right) - c\right] q_R$$

since $Q_{h,L}^{**} > Q_h^*$ and $q_R^{**} < q^*$ for $\mu < 0$ (from Proposition 2) and $P'(Q) < 0$ (by assumption).

When the supplier's bargaining power vis-à-vis its retailers, α, is low enough, the cost effect dominates the competition effect so that the small rival retailer pays a higher tariff for a given volume of sales. In particular, when $\alpha = 0$, retailers have all bargaining power, and thus pay only the production costs of their sales to the supplier. Tariffs then depend only on the cost effect, and thus for any q_R, a small rival retailer pays more after an efficient merger. When $\alpha = 1$, the supplier has all bargaining power, and thus gets the entire gross profit of its retailers. In this case, tariffs depend only on the competition effect and in particular a small rival retailer pays less because it earns a lower gross profit after an efficient merger.

Let $\pi_i^{**}(q_i)$ (respectively $\pi_i^*(q_i)$) denote retailer i's profits for any q_i when the quantities of other retailers are at their equilibrium levels after the merger (respectively before the merger), i.e., $q_{-i} = q_{-i}^{**}$ (respectively $q_{-i} = q_{-i}^* = q^*$), for $i = R, I$. For example, for a given volume of sales q_R, a small rival retailer gets

$$\pi_R^*(q_R) = (1-\alpha)\left[\left[P\left(Q_h^* - q^* + q_R\right) - c\right] q_R - \left[C\left(Q^* - q^* + q_R\right) - C\left(Q^* - q^*\right)\right]\right].$$

before the merger and after the merger.

$$\pi_R^{**}(q_R) = (1-\alpha)\left[\left[P\left(Q_{h,L}^{**} - q_R^{**} + q_R\right) - c\right] q_R - \left[C\left(Q^{**} - q_R^{**} + q_R\right) - C\left(Q^{**} - q_R^{**}\right)\right]\right]$$

Considering the effects of a buyer merger on the other retailers, we say that there is a waterbed effect on a small retailer when the small retailer earns a lower profit for a given volume of sales after the merger. As a result of an inefficient merger, the profits of each small (rival and independent) retailer increase for any quantity q_i, for $i = R, I$, since its incremental contribution to the industry profit is higher when the less efficient merged entity negotiates a smaller quantity with the supplier. In this case, we say that there is no waterbed effect. In contrast, if a buyer merger improves downstream efficiency of the merging parties, we show that there are waterbed effects.[16] The following proposition summarizes our results on waterbed effects.

Proposition 3 *If a buyer merger generates downstream efficiency, i.e., when $\mu < 0$, there are waterbed effects on the small (rival and independent) retailers. If a buyer merger produces downstream efficiency, i.e., when $\mu > 0$, there is no waterbed effect, indeed the small retailers earn higher profits for a given volume of sales after the merger.*

The UK Competition Commission (2008) argues that there is no significant evidence of waterbed effects since we do not see an overall decline in convenience store revenue as a result of buyer mergers. Our results provide an alternative explanation to the Commission's observation. When a buyer merger is downstream efficient, our results anticipate to see an overall decline in small store revenue post-merger, however, when the merger is downstream inefficient, we anticipate to have an overall increase in small store revenue. Our results therefore could be used as a tool to identify the efficiency of a buyer merger if one could estimate how the post-merger profits differ from the pre-merger profits.

The following corollary shows that an efficient (respectively inefficient) buyer merger reduces (respectively increases) the retail prices in the markets where the merged entity is active and increases (respectively decreases) retail prices in the independent markets. Since the total quantity sold is higher (respectively lower), and thus the consumer surplus is greater (respectively smaller), after an efficient (respectively inefficient) merger.

Corollary 1. *If $\mu < 0$, $P\left(Q^{**}_{h,\phi}\right) > P\left(Q^*_h\right) > P\left(Q^{**}_{h,L}\right)$ and $CS(Q^{**}) > CS(Q^*)$; and if $\mu > 0$, $P\left(Q^{**}_{h,L}\right) > P\left(Q^*_h\right) > P\left(Q^{**}_{h,\phi}\right)$ and $CS(Q^{**}) < CS(Q^*)$.*

[16] We moreover compare the equilibrium tariffs and profits before the merger with those after the merger. For cost functions which are not very convex, e.g., for $C(Q) = \frac{b}{2}Q^2$, we show that at equilibrium quantities the small retailers earn lower (respectively higher) profits after an efficient (inefficient) buyer merger.

, and thus increases (respectively decreases) the consumer welfare. Different from the literature, we therefore conclude that if there is a waterbed effect, it always results in an increase in the consumer surplus since the total quantity sold in the markets where the merged entity is active increases more than the reduction of the total quantity sold in the independent markets.

Remark. Waterbed effect is solely due to the increase in the downstream efficiency.

To see this, let us compare the equilibrium quantities following an efficient merger ($\mu < 0$) of l independent outlets with the equilibrium quantities where l independent firms benefit from some exogenous innovation (without any merger) which reduces their retailing costs by $|\mu|$.

Recall that q_L is the quantity delivered by the large buyer, and let q_{DI} denote the quantity delivered by an independent firm benefiting from the downstream innovation. We have a waterbed effect only due to the changes in the relative efficiencies of the retailers if $q_L = lq_{DI}$.

The equilibrium quantity for the large firm is given by the following FOC:

$$P'\left(\frac{q_L}{l} + (n-1)\,q_R\right)\frac{q_L}{l} + P\left(\frac{q_L}{l} + (n-1)\,q_R\right) = c + \mu + C'\left(q_L + l\,(n-1)\,q_R + (m-l)\,nq_I\right)$$

The equilibrium quantity for an independent firm benefiting from the downstream innovation is given by the following FOC (using symmetry of l firms):

$$P'\left(q_{DI} + (n-1)\,q_R\right)q_{DI} + P\left(q_{DI} + (n-1)\,q_R\right) = c + \mu + C'\left(lq_{DI} + l\,(n-1)\,q_R + (m-l)\,nq_I\right)$$

From these FOCs, it is straightforward to see that $q_L = lq_{DI}$.

6 Incentives To Merge and Retail Competition

We now study the relation between incentives to merge and local retail competition. We know that an inefficient merger ($\mu > 0$) would be profitable if the size effect dominates the sum of the cost and competition effects. This is the case when the inefficiency created by the merger is not very important or when the merging firms lose not so much business to their low cost rivals. Hence, intuitively, we anticipate that less downstream competition in local markets would decrease competition effect, and thus would make profitable inefficient mergers more likely.

To see this, consider the pre-merger and post-merger profits, which respectively are

$$\begin{aligned}
l\pi_i^* &= l\left[\Pi^* - t^*\right] \\
&= l\left(1-\alpha\right)\left[\left[P\left(Q^*_{h[i]} + q^*\right) - c\right]q^* - \left[C\left(Q^*_{[i]} + q^*\right) - C\left(Q^*_{[i]}\right)\right]\right], \\
\pi_L^{**} &= \Pi_L^{**} - t_L^{**} \\
&= \left(1-\alpha\right)\left[\left[P\left(Q^{**}_{h,L[L]} + \frac{q_L^{**}}{l}\right) - (c+\mu)\right]q_L^{**} - \left[C\left(Q^{**}_{[L]} + q_L^{**}\right) - C\left(Q^{**}_{[L]}\right)\right]\right].
\end{aligned}$$

Let $\tilde{\mu}(n)$ be the threshold in μ such that the pre-merger profits are equal to the post-merger profits:

$$l\pi_i\left(q^*(n), Q^*_{h[i]}(n), Q^*_{[i]}(n)\right) = \pi_L\left(\tilde{\mu}(n), q_L^{**}(n), Q^{**}_{h,L[L]}(n), Q^{**}_{[L]}(n)\right).$$

Let c_L denote the retailing cost of the large retailer, so $c_L = c + \mu$. We make the following assumption on the equilibrium profit of the large retailer.

Assumption 2. $\partial_{c_L n}\pi_L^{**} > 0$,

saying that a decrease in the firm's marginal cost is less valuable when the competition in the local market is stronger.[17]

We can explain this assumption as the following. When a firm decides whether to invest in a cost reducing technology, it considers its expected sales over which it could enjoy the benefits of its investment, i.e., the expected value of investing in cost reduction. If there is more competition, the firm anticipates a lower value from its investment in cost reduction because its sales would be lower, and thus the firm spends less in cost reducing technology ex-ante. This effect suggests that more competition leads to less investment in cost reduction. On the other hand, an investment in cost reduction has a strategic commitment value. By investing in cost reduction a firm is credibly committing to an aggressive production strategy in the future. Therefore, a firm's cost reduction decision decreases the outputs of its rivals decreasing the level of competition. If the direct effect is larger than the strategic commitment value of investing in cost reduction, there is a negative relationship between competition and the amount of investment in cost reducing technology (see, e.g., Dixit (1980), Fudenberg and Tirole (1983) and Spence (1984)).

[17] Note that Assumption 2 is satisfied in most of the models. In our model, linear demand and quadratic upstream cost function satisfy this assumption.

In our setup, these effects could be decomposed as:

$$\partial_{c_L n}\pi_L^{**} = (1-\alpha)\left(\underbrace{-\partial_n q_L^{**}}_{[1]>0} + \underbrace{\partial_n\left[\partial_{Q_{h,L[L]}}\pi_L^{**}\partial_{c_L}Q_{h[L]}^{**} + \partial_{Q_{[L]}}\pi_L^{**}\partial_{c_L}Q_{[L]}^{**}\right]}_{[2]<0}\right)$$

where [1] corresponds to the direct effect of reducing costs, which is positive since the profitability of a cost reduction decrease in competition, i.e., $\partial_n q_L^{**} < 0$. Term [2] corresponds to the indirect effect of reducing costs, which is negative due to the strategic commitment value of the firm's cost reduction decision on the outputs of its rivals. Our assumption states that the direct effect, [1], dominates the indirect effect, [2], so that the firm's benefit from a cost reduction decreases in the level of competition.

Considering an inefficient merger, we now show that incentives to merge are lower when there is more competition in the retail market.

Proposition 4 *More retail competition in local markets makes profitable inefficient mergers less likely, i.e.,* $\partial_n\widetilde{\mu} < 0$.

This result would let us question existing commercial zoning rules which restrict number of competing retailers in local markets. We suspect that the significant process of downstream consolidation in most of the European countries in the 1980s-1990s is due to stringent commercial zoning rules. Moreover, retail price increases during the same period might be due to a large number of inefficient buyer mergers resulting from those restrictive commercial zoning rules. These are interesting empirical questions one could raise using our results. However, answering these questions go beyond the scope of our paper.

To sum up, we showed that inefficient buyer mergers could take place since the merging parties obtain size discounts and lower retail competition in local markets makes such inefficient buyer mergers more likely.

7 Conclusion

During the last decades the retail industry has become increasingly consolidated in most of the European countries. This process has given rise to many large retail chains, improving retailers' bargaining position vis-à-vis their suppliers. The European Commission has identified two potential concerns following these changes: first, lower purchasing costs for powerful buyers might not be passed on to final consumers; second, there might be waterbed effects, i.e., lower purchasing costs for powerful buyers might be at the expense of higher purchasing costs for less powerful buyers.

Our paper supports the first concern by showing formally that even if a larger buyer obtains size discounts from the supplier, there is no pass on of lower purchasing costs to consumer prices when firms bargain over non-linear supply contracts. With regard to the second concern, we show that a waterbed effect exists if and only if a buyer merger increases the retail efficiency of merging parties. Different from Inderst and Valetti (2008) and Majumdar (2006), if a waterbed effect exists, it always increases the consumer surplus.

Moreover, our findings propose an explanation to the UK Competition Commission's observation that there is no unambiguous evidence of an overall decline in convenience store or small retailer revenues.[18]

We next show that the availability of size discounts might give rise to buyer mergers reducing retail efficiency. If this is the case, we illustrate that an increase in smaller retailers' revenues are higher post-merger. In contrast, when the merger is downstream efficient, we show a decline in smaller retailers' revenues. Our results therefore suggest that through estimating how smaller retailers' revenues change after a buyer merger, competition authorities could identify whether the buyer merger is downstream efficient.

This study illustrates also that less intense retail competition increases the likelihood of inefficient buyer mergers. We thereby argue that more stringent commercial zoning regulations result in a greater number of inefficient buyer mergers by lowering the level of retail competition in local markets. Our results thus suggest that retail competition has to be enhanced at local level to circumvent inefficient buyer mergers.

Our work could be extended to deal with the long run implications of buyer power on upstream investment. Following Inderst and Wey (2007b), we might conjecture that buyer power tends to increase supplier's incentives to invest since an innovation will make it easier to sell through various alternative channels. An innovation allows powerful strategic bargaining effect by increasing the loss that the supplier is able to inflict on a retailer when it supplies its rivals. Other promising

[18] See the UK Competition Commission's investigation.

opportunities for additional research include allowing for upstream competition (See, for instance, de Fontenay and Gans, 2007).

8 Appendix

8.1 Proof of Lemma 1

Claim: There exists $\tilde{\mu} > 0$ such that for any $\mu < \tilde{\mu}$, a buyer merger is profitable.

In equilibrium the large retailer gets

$$\pi_L^{**} = (1-\alpha)\left[\begin{array}{c} \left[P\left(\frac{q_L^{**}}{l} + (n-1)\, q_R^{**}\right) - (c+\mu)\right] q_L^{**} \\ -\left[C\left(q_L^{**} + l\,(n-1)\, q_R^{**} + (m-l)\, n q_I^{**}\right) - C\left(l\,(n-1)\, q_R^{**} + (m-l)\, n q_I^{**}\right)\right] \end{array}\right].$$

Differentiating π_L^{**} with respect to μ and applying the envelope theorem (by using the FOC for q_L^{**}), we derive

$$\frac{d\pi_L^{**}}{d\mu} = \frac{\partial \pi_L^{**}}{\partial q_R}\frac{\partial q_R^{**}}{\partial \mu} + \frac{\partial \pi_L^{**}}{\partial q_I^{**}}\frac{\partial q_I^{**}}{\partial \mu} - q_L^{**}$$

We have respectively,

$$\frac{\partial \pi_L^{**}}{\partial q_R} = (n-1)\, P'\left(Q_{h,L}^{**}\right) q_L^{**} - l\,(n-1)\left[C'\left(Q^{**}\right) - C'\left(Q^{**} - q_L^{**}\right)\right] < 0$$

since $P'(Q) < 0$ and $C''(Q) > 0$;

$$\frac{\partial \pi_L^{**}}{\partial q_I^{**}} = -\,(m-l)\, n\left[C'\left(Q^{**}\right) - C'\left(Q^{**} - q_L^{**}\right)\right] < 0$$

since $C''(Q) > 0$.

Moreover, $\frac{\partial q_R^{**}}{\partial \mu} = \frac{\partial q_R^{**}}{\partial q_L^{**}} . \frac{\partial q_L^{**}}{\partial \mu} > 0$ and $\frac{\partial q_I^{**}}{\partial \mu} = \frac{\partial q_I^{**}}{\partial q_L^{**}} . \frac{\partial q_L^{**}}{\partial \mu} > 0$, since $\frac{\partial q_L^{**}}{\partial \mu}, \frac{\partial q_R^{**}}{\partial q_L^{**}}, \frac{\partial q_I^{**}}{\partial q_L^{**}} < 0$ (which can be proved by using the FOCs). We therefore show that $\frac{d\pi_L^{**}}{d\mu} < 0$.

Note that a buyer merger is always profitable if $\mu = 0$ (see Proposition 1). By continuity, there exists $\tilde{\mu} > 0$ such that buyer merger is profitable for $\mu < \tilde{\mu}$. ∎

8.2 Proof of Proposition 2

We do the proof for $\mu > 0$. A symmetric argument would show the claim for $\mu < 0$.

First step: $Q_{h,L}^{**} < Q_{h,\phi}^{**}$

Equilibrium quantities for the large firm (L), a rival of an outlet of the large firm (R) and a firm in a market independent of the large firm (I) are respectively given by the FOCs (given in (2)):

$$\begin{aligned} P'\left(Q_{h,L}^{**}\right)\frac{q_L^{**}}{l}+P\left(Q_{h,L}^{**}\right) &= c+\mu+C'\left(Q^{**}\right) \\ P'\left(Q_{h,L}^{**}\right)q_R^{**}+P\left(Q_{h,L}^{**}\right) &= c+C'\left(Q^{**}\right) \\ P'\left(Q_{h,\phi}^{**}\right)q_I^{**}+P\left(Q_{h,\phi}^{**}\right) &= c+C'\left(Q^{**}\right) \end{aligned}$$

Summing the conditions for a market where the large firm is active and for a market where it is not present, we obtain the following equality:

$$P'\left(Q_{h,L}^{**}\right)Q_{h,L}^{**}+nP\left(Q_{h,L}^{**}\right)-\mu=P'\left(Q_{h,\phi}^{**}\right)Q_{h,\phi}^{**}+nP\left(Q_{h,\phi}^{**}\right).$$

From our assumptions, $P''(Q)Q+P'(Q)<0$ and $P'(Q)<0$, we deduce that $P''(Q)Q+(n+1)P'(Q)<0$, which implies that $P'(Q)Q+nP(Q)$ is decreasing in Q, we therefore have $Q_{h,L}^{**}<Q_{h,\phi}^{**}$.

Second step: $Q^{**}<Q^{*}$

We show the claim by contradiction:

Suppose that $Q^{**}>Q^{*}$.

Before the merger, the FOC for equilibrium quantity q^{*} is given by

$$P'\left(Q_h^{*}\right)q^{*}+P\left(Q_h^{*}\right)=c+C'\left(Q^{*}\right)$$

where $Q_h^{*}=nq^{*}$ and $Q^{*}=mQ_h^{*}$.

Summing the condition for all retailers in a local market gives:

$$P'\left(Q_h^{*}\right)Q_h^{*}+nP\left(Q_h^{*}\right)=nc+nC'\left(Q^{*}\right) \tag{3}$$

After the merger, consider an independent market where the large firm is not active, the FOC for q_I^{**} is

$$P'\left(Q_{h,\phi}^{**}\right)q_I^{**}+P\left(Q_{h,\phi}^{**}\right)=c-C'\left(Q^{**}\right)$$

Summing the conditions for all retailers in an independent market, we obtain

$$P'\left(Q_{h,\phi}^{**}\right)Q_{h,\phi}^{**}+nP\left(Q_{h,\phi}^{**}\right)=nc+nC'\left(Q^{**}\right) \tag{4}$$

Since we assume convex costs, $C''(Q)>0$, we have, for $Q^{**}>Q^{*}$,

$$nC'\left(Q^{**}\right)>nC'\left(Q^{*}\right)$$

Comparing expressions (3) and (4), we then obtain

$$P'\left(Q_{h,\phi}^{**}\right)Q_{h,\phi}^{**}+nP\left(Q_{h,\phi}^{**}\right)>P'\left(Q_{h}^{*}\right)Q_{h}^{*}+nP\left(Q_{h}^{*}\right).$$

As we have already shown that $P'(Q)Q+nP(Q)$ is decreasing in Q (see the first step), we get

$$Q_{h,\phi}^{**}<Q_{h}^{*}.$$

Using this inequality together with $Q_{h,L}^{**}<Q_{h,\phi}^{**}$ (from the first step) and $Q^{*}=mQ_{h}^{*}$ (by definition), we obtain $Q^{**}<Q^{*}$, as $Q^{**}=lQ_{h,L}^{**}+(m-l)\,Q_{h,\phi}^{**}$, i.e., we come up with a result that contradicts with the assumption at the beginning. Therefore, by contradiction we obtain $Q^{**}<Q^{*}$.

Third step: $Q_{h}^{*}<Q_{h,\phi}^{**}$

From $Q^{**}<Q^{*}$, we have

$$nC'\left(Q^{**}\right)<nC'\left(Q^{*}\right)$$

as $C''(Q)>0$. Using this inequality together with expressions (3) and (4), we obtain

$$P'\left(Q_{h,\phi}^{**}\right)Q_{h,\phi}^{**}+nP\left(Q_{h,\phi}^{**}\right)<P'\left(Q_{h}^{*}\right)Q_{h}^{*}+nP\left(Q_{h}^{*}\right).$$

Since $P'(Q)Q+nP(Q)$ is decreasing in Q (as shown in the first step), we have $Q_{h}^{*}<Q_{h,\phi}^{**}$.

Fourth step: $Q_{h,L}^{**}<Q_{h}^{*}$

From $Q_{h}^{*}<Q_{h,\phi}^{**}$ and $Q^{**}<Q^{*}$, we deduce that $Q_{h,L}^{**}<Q_{h}^{*}$.

Hence, we show that $Q_{h,L}^{**}<Q_{h}^{*}<Q_{h,\phi}^{**}$ and $Q^{**}<Q^{*}$.

Fifth step: $q_{I}^{**}<q_{R}^{**}$

From the FOCs for q_I^{**} and q_R^{**} we have

$$P'\left(Q_{h,\phi}^{**}\right)q_I^{**}+P\left(Q_{h,\phi}^{**}\right)=P'\left(Q_{h,L}^{**}\right)q_R^{**}+P\left(Q_{h,L}^{**}\right)$$

Given our assumptions that $P''(Q)Q+P'(Q)<0$ and that $P'(Q)<0$, we first get that $P''(Q)q+P'(Q)<0$ for $0<q<Q$[19]. Therefore, $P'(Q)q+P(Q)$ is decreasing in both Q and q. Since we have $Q_{h,L}^{**}<Q_{h,\phi}^{**}$ (from the first step), we necessarily have $q_I^{**}<q_R^{**}$.

Sixth step: $q^*<q_I^{**}$

Recall that $Q_h^*=nq^*$ and that $Q_{h,\phi}^{**}=nq_I^{**}$. As we have $Q_h^*<Q_{h,\phi}^{**}$(from the third step), we necessarily have $q^*<q_I^{**}$

Seventh step: $\frac{q_L^{**}}{l}<q^*$

Inequalities $Q_{h,L}^{**}<Q_h^*$ (from the fourth step) and $q^*<q_R^{**}$ (from the previous step) imply that $\frac{q_L^{**}}{l}<q^*$.

We therefore show that for $\mu>0$, $\frac{q_L^{**}}{l}<q^*<q_I^{**}<q_R^{**}$. ■

8.3 Proof of Lemma 2

Claim: *After an inefficient merger ($\mu>0$), the small independent retailers pay lower tariffs for a given volume of sales, i.e., $t_I^{**}(q_I)<t_I^*(q_I)$ for any $q_I>0$. Considering, small rival retailers, there exists $\tilde{\alpha}>0$ such that for any $\alpha<\tilde{\alpha}$, they pay lower tariffs for a given volume of sales, i.e., $t_R^{**}(q_R)<t_R^*(q_R)$ for any $q_R>0$.*

We define $t_I\left(q_I,\widetilde{Q_h}\right)$ as the tariff of a small independent retailer as a function of its sales when the total quantity sold in each market affected by the merger is $\widetilde{Q_h}$:

$$t_I\left(q_I,\widetilde{Q_h}\right)=\alpha\Pi_I(q_I)+(1-\alpha)\left[C\left(l\widetilde{Q_h}+(m-l)\,nq_I\right)-C\left(l\widetilde{Q_h}+((m-l)\,n-1)\,q_I\right)\right]$$

where $\Pi_I(q_I)=[P(nq_I)-c]\,q_I$. Before the merger $\widetilde{Q_h}=Q_h^*$ and after the merger $\widetilde{Q_h}=Q_{h,L}^{**}$. By

[19] If $P''(Q)<0$, it is trivial as $P'(Q)<0$ (by assumption). If $P''(Q)>0$, given that $P''(Q)Q+P'(Q)<0$ and $0<q<Q$, we must have $P''(Q)q+P'(Q)<0$.

differentiating $t_I\left(q_I, \widetilde{Q_h}\right)$ with respect to $\widetilde{Q_h}$, we obtain

$$\frac{\partial t_I\left(q_I, \widetilde{Q_h}\right)}{\partial \widetilde{Q_h}} = (1-\alpha)\, l \left[C'\left(l\widetilde{Q_h} + (m-l)\, nq_I\right) - C'\left(l\widetilde{Q_h} + ((m-l)\, n - 1)\, q_I\right)\right] > 0$$

since $C''(Q) > 0$. We know from Proposition 2 that $Q^{**}_{h,L} < Q^*_h$ when $\mu > 0$, which implies that $t^{**}_I(q_I) = t_I\left(q_I, Q^{**}_{h,L}\right) < t_I\left(q_I, Q^*_h\right) = t^*_I(q_I)$ for any q_I if $\mu > 0$.

Let $t_R\left(q_R, q_L, Q_{h,\phi}\right)$ refer to the tariff of a small retailer as a function of its sales when the total quantity sold by the merging parties (or the large retailer after the merger) is q_L and the total quantity sold in each independent market is $Q_{h,\phi}$:

$$t_R\left(q_R, q_L, Q_{h,\phi}\right) = \alpha \Pi_R\left(q_R, (n-1)\, q_R + \frac{q_L}{l}\right) + (1-\alpha)\left[\begin{array}{c} C\left(q_L + (m-l)Q_{h,\phi} + l\,(n-1)\, q_R\right) \\ -C\left(q_L + (m-l)Q_{h,\phi} + (l\,(n-1)-1)\, q_R\right) \end{array}\right]$$

Before the merger $q_L = nq^*$, $Q_{h,\phi} = Q^*_h$, and after the merger $q_L = q^{**}_L$, $Q_{h,\phi} = Q^{**}_{h,\phi}$.We re-write $t_R\left(q_R, q_L, Q_{h,\phi}\right)$ as $t_R\left(q_R, q_L, Q_{h,\phi}\right) = \alpha A1 + (1-\alpha)\, A2$ where

$$\begin{aligned} A1 &= \Pi_R\left(q_R, (n-1)\, q_R + \frac{q_L}{l}\right) = \left[P\left((n-1)\, q_R + \frac{q_L}{l}\right) - c\right] q_R \\ A2 &= C\left(q_L + (m-l)Q_{h,\phi} + l\,(n-1)\, q_R\right) - C\left(q_L + (m-l)Q_{h,\phi} + (l\,(n-1)-1)\, q_R\right) \end{aligned}$$

Differentiating $A1$ with respect to $\frac{q_L}{l}$ gives

$$\frac{\partial\left[A1\right]}{\partial\left(\frac{q_L}{l}\right)} = P'\left((n-1)\, q_R + \frac{q_L}{l}\right) q_R < 0$$

since $P'(Q) < 0$. The change in $A1$ with respect to $\frac{q_L}{l}$ corresponds to the effect of the merger on the gross profit of a small rival retailer, which we call as the *competition effect.* After an inefficient merger, the competition effect increases the gross profit of a small rival retailer, and thus its tariff, since $\frac{q^{**}_L}{l} < q^*$ (from Proposition 2) and $P'(Q) < 0$ (by assumption). Differentiating $A2$ with respect to $q_L + (m-l)Q_{h,\phi}$ brings

$$\frac{\partial\left[A2\right]}{\partial\left(q_L + (m-l)Q_{h,\phi}\right)} = \left[\begin{array}{c} C'\left(q_L + (m-l)Q_{h,\phi} + l\,(n-1)\, q_R\right) - \\ C'\left(q_L + (m-l)Q_{h,\phi} + (l\,(n-1)-1)\, q_R\right) \end{array}\right] > 0$$

since $C''(Q) > 0$. The change in $A2$ with respect to $q_L + (m-l)Q_{h,\phi}$ corresponds to the effect of the merger on the production costs of the small rival retailer's sales, which we call as the *cost effect*. We know from Proposition 2 that $Q^{**} = q_L^{**} + (m-l)Q_{h,\phi}^{**} + l(n-1)q_R^{**} < Q^* = mnq^*$ and $q_R^{**} > q^*$ when $\mu > 0$. We thus have $q_L^{**} + (m-l)Q_{h,\phi}^{**} < lq^* + (m-l)\,Q_h^*$, which implies that the cost effect decreases the costs of the small rival retailer's sales, and thus its tariff. The sign of $t_R^{**}(q_R) - t_R^*(q_R)$ is therefore ambiguous. In particular, $t_R^{**}(q_R) < t_R^*(q_R)$ if $\alpha = 0$ (that is when only the cost effect, $A2$, is at work) and $t_R^{**}(q_R) > t_R^*(q_R)$ if $\alpha = 1$ (that is when only the competition effect, $A1$, is at work). Since $\alpha\frac{\partial[A1]}{\partial\left(\frac{q_L}{l}\right)} + (1-\alpha)\frac{\partial[A2]}{\partial\left(q_L+(m-l)Q_{h,\phi}\right)}$ is decreasing in α, by continuity, there exists $\tilde{\alpha} \in \,]0,1[$ such that, for $\mu > 0$, $t_R^{**}(q_R) < t_R^*(q_R)$ if $\alpha < \tilde{\alpha}$ and $t_R^{**}(q_R) \geq t_R^*(q_R)$ otherwise.■

8.4 Proof of Proposition 3

Claim: *If a buyer merger produces inefficiency ($\mu > 0$), it increases the profits of both small independent and small rival retailers (for a given volume of sales), i.e., we have $\pi_I^{**}(q_I) > \pi_I^*(q_I)$ and $\pi_R^{**}(q_R) > \pi_R^*(q_R)$ for any $q_I, q_R > 0$.*

Let $\pi_I\left(q_I, \widetilde{Q_h}\right)$ refer to the profit of a small independent retailer as a function of its sales when the total quantity sold in each market affected by the merger is $\widetilde{Q_h}$:

$$\pi_I\left(q_I, \widetilde{Q_h}\right) = \Pi_I(q_I) - t_I\left(q_I, \widetilde{Q_h}\right)$$

where $\Pi_I(q_I)$ and $t_I\left(q_I, \widetilde{Q_h}\right)$ are respectively its gross profit and tariff as defined in the proof of Lemma 2. Before the merger $\widetilde{Q_h} = Q_h^*$ and after the merger $\widetilde{Q_h} = Q_{h,L}^{**}$. Since $t_I^{**}(q_I) < t_I^*(q_I)$ (from Lemma 2), we have $\pi_R^{**}(q_R) > \pi_R^*(q_R)$ for any $q_R > 0$ when $\mu > 0$.

Let $\pi_R(q_R, q_L, Q_{h,\phi})$ refer to the profits of a small rival retailer as a function of its sales when the total quantity sold by the merging parties (or the large retailer after the merger) is q_L and the total quantity sold in each independent market is $Q_{h,\phi}$:

$$\pi_R(q_R, q_L, Q_{h,\phi}) = \Pi_R\left(q_R, (n-2)\,q_R + \frac{q_L}{l}\right) - t_R(q_R, q_L, Q_{h,\phi})$$

where $\Pi_I\left(q_R, (n-2)\,q_R + \frac{q_L}{l}\right)$ and $t_R(q_R, q_L, Q_{h,\phi})$ are respectively its gross profit and tariff as defined in the proof of Lemma 2. Before the merger $q_L = nq^*$, $Q_{h,\phi} = Q_h^*$, and after the merger

$q_L = q_L^{**}$, $Q_{h,\phi} = Q_{h,\phi}^{**}$. Using the proof of Lemma 2, we re-write the profit of the small rival retailer as $\pi_R\left(q_R, q_L, Q_{h,\phi}\right) = (1-\alpha)\left(A1 - A2\right)$. The *competition effect,*

$$\frac{\partial\left[A1\right]}{\partial\left(\frac{q_L}{l}\right)} = P'\left(\left(n-1\right)q_R + \frac{q_L}{l}\right)q_R < 0$$

increases the gross profit of the small rival retailer, and thus its profit, since $\frac{q_L^{**}}{l} < q^*$ (from Proposition 2) and $P'(Q) < 0$ (by assumption). The *cost effect,*

$$\frac{\partial\left[A2\right]}{\partial\left(q_L + (m-l)Q_{h,\phi}\right)} = \left[\begin{array}{c} C'\left(q_L + (m-l)Q_{h,\phi} + l\left(n-1\right)q_R\right) - \\ C'\left(q_L + (m-l)Q_{h,\phi} + \left(l\left(n-1\right)-1\right)q_R\right) \end{array}\right] > 0,$$

decreases the costs of the small rival retailer's sales, and thus increases its profit, since $q_L^{**} + (m - l)Q_{h,\phi}^{**} < lq^* + \left(m-l\right)Q_h^*$ (from Proposition 2). Both the competition effect and the cost effect increase the profit of the small rival retailer after an inefficient merger. We thus conclude that $\pi_R^{**}(q_R) > \pi_R^*(q_R)$ for any $q_R > 0$ when $\mu > 0$.■

8.5 Proof of Proposition 4

Claim: More downstream competition in local markets makes profitable inefficient mergers less likely, i.e., $\partial_n \widetilde{\mu} < 0$.

To be completed.

Recall that $\widetilde{\mu}(n)$ is implicitly defined by

$$\begin{aligned} l\pi\left(q^*, Q_h^*, Q^*\right) &= \pi_L\left(\tilde{\mu}, q_L^{**}, Q_{h,L}^{**}, Q^{**}\right) \qquad i.e., \\ l\left[\left(P(Q_h^*) - c\right)q^* - \left(C(Q^*) - C(Q^* - q^*)\right)\right] &= \left(P(Q_{h,L}^{**}) - (c + \tilde{\mu})\right)q_L^{**} - \left(C(Q^{**}) - C(Q^{**} - q_L^{**})\right) \end{aligned}$$

where the equilibrium quantities before the merger (q^*, Q_h^*, Q^*) and the equilibrium quantities after the merger $(q_L^{**}, Q_{h,L}^{**}, Q^{**})$ are functions of n. Differentiating the above equality with respect to n gives

$$\partial_n\left[l\pi\left(q^*, Q_h^*, Q^*\right)\right] = \partial_{c_L}\pi_L^{**}\partial_n\widetilde{\mu} + \partial_n\pi_L\left(q_L^{**}, Q_{h,L}^{**}, Q^{**}\right)$$

i.e.

$$\partial_{c_L}\pi_L^{**}\partial_n\widetilde{\mu} = \partial_n\left[l\pi\left(q^*, Q_h^*, Q^*\right) - \pi_L\left(q_L^{**}, Q_{h,L}^{**}, Q^{**}\right)\right] \tag{5}$$

For linear demand and quadratic upstream cost function,

we have $\partial_n\left[l\pi\left(q^*, Q_h^*, Q^*\right) - \pi_L\left(q_L^{**}, Q_{h,L}^{**}, Q^{**}\right)\right] > 0$; moreover, using $\partial_{\widetilde{c}}\pi_L^{**} = -q_L^{**} < 0$, we conclude that $\partial_n\widetilde{\mu} < 0$.

The proof have to be done for the general case.■

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