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Juin 2007

Cahier n° 2007-12

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Buyer Power through Producer's Differentiation[1]

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Résumé: Cet article montre que des distributeurs peuvent décider d'offrir des produits différenciés, non pas pour relâcher la concurrence horizontale, mais pour accroître leur pouvoir d'achat vis-à-vis de leur fournisseur. Nous analysons un modèle simple où deux producteurs offrent des produits différenciés en qualité à deux distributeurs en activité sur des marches séparés qui ne peuvent offrir qu'un seul produit aux consommateurs. A la première étape du jeu, les distributeurs choisissent quel produit mettre en rayon, puis chaque distributeur et son fournisseur négocient sur un contrat de tarif binôme. Enfin, les distributeurs choisissent leur quantités. Lorsque les coûts de production sont convexes, la part des profits joint revenant au distributeur est plus élevée lorsque les distributeurs choisissent de se différencier. L'origine de la différenciation peut donc être uniquement liée au désir des distributeurs d'accroître leur pouvoir d'achat: via la différenciation des fournisseurs, le distributeur obtient une plus large part de profits joints plus faibles. Ce résultat est robuste lorsque l'on introduit de la concurrence en aval. Nous mettons en évidence les conséquences de cette stratégie de différenciation sur le surplus des consommateurs.

Abstract: This paper shows that retailers may choose to offer products differentiated in quality, not to relax downstream competition, but to improve their buyer power in the negotiation with their supplier. We consider a simple vertical industry where two producers sell products differentiated in quality to two retailers who operate in separated markets. In the game, first retailers choose which product to carry, then each retailer and her chosen producer bargain over the terms of a two-part tariff contract and retailers finally choose the quantities. When upstream production costs are convex, the share of the total profits going to the retailer would be higher if they choose to differentiate. We thus isolate the wish to differentiate as "only" due to increasing buyer power: via producer's differentiation, the retailer gets a larger share of smaller total profits. This result also holds when retailers compete downstream. We derive the consequences of a differentiation induced by buyer power motives for consumer surplus.

Mots clés : Puissance d'achat, Gamme de produit, Différenciation des produits

Key Words : Buyer Power, Product line, Differentiation

Classification JEL: L13, L42

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1 Introduction

The retail sector underwent major changes in Europe and in the United States in the last thirty years. In particular, successive merger waves have led to the constitution of large international retail groups: in 2002 nearly 30% of the 200 top world retailers' sales turnover was realized by the top first ten retailers, among which were the American Wal-Mart and the French Carrefour.[1]

The issue of the potential and current increase in the buyer power of large retailers was raised simultaneously by industry participants, the media,[2], and by the Competition authorities in general.[3] Competition authorities took into account the retailers' buyer power in their analysis, either as an element of countervailing power in the cases of mergers between producers, or as a potential threat to competition. For instance, some merger proposals between the retailers Rewe/Meinl and Carrefour/Promodes, were authorized by the European Commission, only after the merging parties had committed themselves to maintain their relationships with a group of particularly exposed suppliers. Recent reports of the OECD[4], the OFT[5] or consulting groups[6] document the degree of and state of buyer power in the retail sector across countries and the issues that arise.

Retailers' buyer power has been the subject of a recent Industrial Organization literature, both empirical and theoretical, which raises in particular the question of its measurement, its origins and its consequences for social welfare (Inderst and Mazzarotto (2006)).

Among the consequences of buyer power, most articles have focused on the

[1] Deloitte, 2004 Global Powers of Retailing.

[2] Lynn, B. C., 2006. "Breaking the Chain: The Antitrust Case Against Wal-mart", www.Harpers.org, July 31, 2006.

[3] Schelings, R. and Wright J., "'Sui Generis'?: An Antitrust Analysis of Buyer Power in the Unites States and European Union", Law and Economics Working Paper series, Georges Mason University School of Law; EC, 1999;

"Buyer power and its impact on competition in the food retail distribution sector of the European Union". DG IV. Brussels.

[4] OCDE, (1999), "Buying Power and Multiproduct Retailers", series of round tables on Competition Policy DAFFE/CLP, 21.

[5] "The Welfare Consequences of the Exercise of Buyer Power", Dobson and al. OFT Report, 1998.

[6] "Buyer Power in Post-Merger Markets, The Efficiency Defense and Merger Simulation", PWC Economics Competition, Spring 2005.

countervailing power effect, a concept introduced by Galbraith in 1952. Galbraith argued that the increasing buyer power of concentrated retailers could allow then to obtain better conditions from their suppliers and thus to lower their costs. A large literature has been devoted to determining the framework under which a countervailing power effect may indeed be relevant.

Another important issue is that of the "non-price" effects of buyer power. Our paper fits directly in these recent developments by raising the question of the implications of the retailers' buyer power on the assortment of products which they offer to the consumers. In other words, our main issue is to understand the consequences of retailers' buyer power on the variety, or on the quality, of the products which they put in their shelves.

The main argument of this paper is developed in a simple framework where two symmetric non-competing retailers, being each a monopolist on downstream separated markets, have to choose in a first stage, which product to carry in their shelves. There are two products differentiated in quality and offered by different manufacturers and the retailers are capacity (shelf) constrained, and do indeed offer only one product. In a second stage, each retailer and her chosen producer simultaneously bargain over a two-part tariff contract and finally retailers choose the quantity of products to sell on the final market. In this context, we show that the retailers may choose to offer products differentiated in quality to the consumers. The differentiation does not aim at relaxing downstream competition between them - since we have assumed that retailers were not competing - but at improving their buyer power in their negotiation with their supplier.[7] Indeed, when production cost are convex the greater the number of retailers he deals with the greater the share of joint profits the producer is able to capture. A direct consequence is that retailers' buyer power may be raised thanks to the supplier's differentiation. Moreover, we show that there are cases that, by choosing the low quality product, the total joint profits to be shared are lower than if the retailer stuck to the high quality product the other retailer lists, but he is

[7]The IO literature devoted to the analysis of producer and retailer relationships traditionally refers to the principal-agent paradigm. The producer (principal) offers a take-it or leave-it contract to the retailer (agent). In this framework, the buyer power is limited to the retailer's ability to refuse the contract. Recent works on buyer power rather use the bargaining theory and assume that producer and retailer bargain over their contract (see for example Iyer and Villas-Boas (2003)). The balance of power between producer and retailer depends on the respective status-quo profits of the parties, i.e their outside option profits.

still able to extract a bigger share of those smaller profits. In doing so, we are able to isolate a wish to differentiate as "only" due to increasing buyer power (increasing the share of the "pie"). When differentiation occurs it harms not only the consumers surplus of those who buy the product of lower quality, but can also prove to be harmful for social welfare overall.

Several articles are devoted to the consequences of the balance of power between producers and retailers on retailers' listing strategy and thus are directly related to our work. Avenel and Caprice (2006) show how a high quality producer may have an incentive to offer different contracts to symmetric competing retailers in order that the latter specialize their offer: one of the retailers offers the high quality product while her competitor offers a low quality good supplied by a competitive fringe. This listing choice specialization is imposed by the producer, when his market power is high enough, to improve his profits thanks to the downstream competition relaxation effect. Shaffer (2005) highlights the adverse effect of slotting allowances competition between producers on retailer's listing choice. A producer may offer slotting allowances to secure his patronage in retailers' shelves when the latter are capacity constrained (each retailer can only store one product while two products are available in the market) to the detriment of another product offered by a competitive fringe. This strategy may thus harm consumer surplus. The paper by Inderst and Shaffer (2005) is also closely related to our work. They identify a new mechanism through which a horizontal merger between retailers can increase retailer's buyer power. Before the merger, retailers are on separated markets and buy from two different manufacturers. After the merger, the new consolidated retailer may commit to a single sourcing strategy in order to increase her buyer power. Finally, Chen (2006) shows that when a retailer may choose the number of products' variety she puts in her shelves (without capacity constraint) and bears a constant retail cost, her countervailing power lowers consumer prices but reduces product diversity. On the one hand, the monopoly distortion in price is reduced but on the other hand, the distortion in terms of variety of products is increased and consumers are always worse off.

This paper also sheds light into the theory of product differentiation (Anderson, De Palma and Thisse (1992)) showing that buyer power can be a source of differentiation. This idea has to our knowledge not been previously explored and researched in the literature. Differentiation itself is not unambiguously welfare improving or welfare reducing. Consumers may benefit from the availability of a wide variety of product offerings to serve their

differing preferences. Yet differentiation can also facilitate the exercise of market power. The producer (or retailer) who offers a differentiated product often enjoys a localized monopoly and may be able to charge a higher price than it otherwise could. While our theoretical argument is developed initially in a context where the retailers are not directly competing in the downstream markets, we show that it also holds when the retailers compete in the same market. Within this context, supplier's differentiation may be an optimal strategy for the retailers to improve their buyer power but also, as an indirect effect, relax downstream competition. The welfare effects are thus more complex, and in particular, we show that when competition is strong enough, the total welfare effect may be positive.
The paper proceeds as follows. The next section presents the model, section 3 sets up the situation for separate retail markets and section 4 extends the results to imperfectly competing retail markets. Section 5 concludes and discusses implications of the results.

2 The model

We assume that there are two manufacturers offering vertically differentiated products $K = \{H, L\}$, where H is of quality h and L is of quality l, and we assume that the quality l is strictly less than h. For simplicity, let assume that both manufacturers have exactly the same cost function $C(q)$[8]. Thus, if producer H is able to produce a higher quality good it may be explained for example by a higher reputation collected in the past (thanks to sunk cost). One can consider here, for instance, that H is the first national brand producer while L would be the second national brand producer. We simply assume that $C'(q) > 0$ and we'll derive our results according to different shapes of this cost function.

Manufacturers cannot sell their product directly to consumers but can do it through retailers. There are two retailers and we will analyze successively the case where each retailer is a monopolist on her market, and the case where the two retailers compete in the same market. As shelf space is limited, we assume that each retailer can carry only one product while there are two

[8]We can assume that the production cost of the low quality product is less than the production cost of the high quality good without changing qualitatively our results.

products available.[9] Let the subscript $i = 1, 2$ denote the retailer and the superscript $K = \{H, L\}$ denote the product sold.

Consumer's demand for good K at retailer i increases with the level of quality k and decreases in its price denoted p_i^K. We use the original vertical differentiation model of Mussa and Rosen (1978) where consumers have a marginal willingness to pay for quality θ, and we assume that this parameter is distributed according to a density $f(\theta)$ on an interval $[0, \overline{\theta}]$. The size of the market is normalized to 1 without loss of generality. We also assume that each consumer buys at most one unit of the good. The surplus a θ-type consumer withdraws from its consumption at the price p_i^K is $S(\theta) = \theta k - p_i^K$. Consumers buy the good as long as $S(\theta) \geq 0$.

In this setting, we consider the following simple game :

Stage 1: Each retailer chooses which product K to carry on his shelf;

Stage 2 : Each retailer bargains with his chosen manufacturer on a two-part tariff contract (w_i^K, T_i^K) where w_i^K is the price paid per unit of good and T_i^K is a fixed tariff independent of the quantity of the good.

Stage 3: Retailers choose their final quantity q_i^K [10].

The main assumption of this game is the ability of retailers to commit in the first stage on their listing choice. This hypothesis is close to Scott-Morton and Zettelmeyer (2004) and differs from other works such as Avenel and Caprice (2006) or Shaffer (2005). The latter papers consider that all potential producers rather compete ex-ante for the limited shelf space by offering slotting allowances to the retailers, so all producers and retailers

[9] For example, consider the case of a product with a certain facing width, and the shelf space only allows one facing of a product to be visible in the shelf, while additional units of the same product can be stored behind the facing. The restriction that retailers only carry one product is a simplifying assumption. The results would also hold for the case when retailers can carry a fixed number M of products in the shelf, where there are $N > M$ products available at the manufacturer level.

[10] The alternative assumption where retailers set their price p_i^K in the last stage wouldn't change the results when retailers are in separated markets. We discuss the role of this assumption in the section devoted to retail competition.

are relevant. Our assumption allows only a certain set of retailers to be relevant for certain producers, because retailers already commit to carry certain products ex-ante. We thus implicitly assume that their is a sunk fixed cost per negotiation for retailers sufficiently high to deter retailers to enter in a bargaining process with all suppliers whereas they finally only sell one product.

The bargaining in the second stage follows the Nash (1950) bargaining process and in the case where both retailers carry the same product in their shelves, we use the contract equilibrium concept developed by O'Brien and Shaffer (1992). Contracts are negotiated secretly between each pair (K, i) and while negotiating, K and i have passive conjectures: they take the other pair's terms of the negotiation $\left(w_j^K, T_j^K\right)$ as given. The contracts resulting from these assumptions are thus resistant to any pairwise deviation. Multilateral deviations are excluded.[11]. We determine in section 3 equilibria of the game when each retailer is a monopoly on her downstream market and then introduce retail competition in section 4.

3 Each retailer is a monopoly in her downstream market

In this section, each retailer is a downstream monopolist in his market. Retailer i's inverse demand function is $P_i^K(q_i^K)$ if he carries the good K of quality k where q_i^K is the quantity offered. We denote the vertical bilateral joint profits for the sales by retailer i of a quantity q_i^K of good K as $\Upsilon_i^K\left(q_i^K\right) = P_i^K(q_i^K)q_i^K - C(q_i^K)$. We assume that $\Upsilon_i^L\left(q_i^L\right)$ strictly increases in l.[12] We solve the game backwards.

3.1 The quantity choice

As each retailer is a monopolist in her market, her demand is as follows. Consumers buy the good as long as $S(\theta) \geq 0$ and thus the total demand for

[11]However, multilateral deviations would only occur in a price setting (See Rey and Vergé (2002))

[12]This assumption is verified by a wide class of distribution functions $F(\theta)$.

good K is $q_i^K = \int_{\frac{p_i^K}{k}}^{\overline{\theta}} f(\theta)d\theta$. Let $P_i^K\left(q_i^K\right)$ denote the corresponding inverse demand function for good K at retailer i.
In the last stage of the game, retailer i, who carries the good K, chooses the quantity q_i^K that maximizes her profit taking as given her own two-part tariff (w_i^K, T_i^K) negotiated in stage 2. Retailer i's profit is:

$$\pi_i^K = (P_i^K\left(q_i^K\right) - w_i^K)q_i^K - T_i^K \tag{1}$$

We assume that π_i^K is concave in q_i^K. Retailer i's optimal quantity choice is denoted $q_i^{K*}(.)$.
As both retailers are in separated markets, the optimal quantity choice of a retailer in the last stage is independent of the quantity chosen by the other retailer. In the second stage, the bargaining takes place and there are two cases to consider according to retailers' listing choices in the first stage. The two listing structures are denoted $\{K, K\}$ and $\{K, -K\}$.

3.2 The bargaining game

3.2.1 Case $\{K, -K\}$

In this case, retailers supply from different manufacturers, and since they are in separated markets, the two negotiations are completely independent from one another.
K and i bargain over a two-part tariff contract (w_i^K, T_i^K). We denote Π_i^K the profit realized by the manufacturer K who supplies the retailer i through a contract (w_i^K, T_i^K): $\Pi_i^K = w_i^K q_i^K + T_i^K - C(q_i^K)$. The equilibrium two-part tariff $(\widehat{w}_i^K, \widehat{T}_i^K)$ is the solution of the following Nash program:

$$\underset{w_i^K, T_i^K}{Max} (\Pi_i^K)^{1-\alpha}(\pi_i^K)^{\alpha} \tag{2}$$

where $\alpha \in]0, 1[$ is a parameter describing the exogenous buyer power of retailers. Results being independent of the value of α within the interval $]0, 1[$, we henceforth assume that parties have equal exogenous bargaining power: $\alpha = \frac{1}{2}$. Solving the FOCs, we find that the optimal wholesale price is equal to the marginal cost of production and thus maximize bilateral joint profits. Thus the equilibrium wholesale price is defined by the following implicit function: $\widehat{w}_i^K = \left.\frac{\partial C(q_i^K)}{q_i^K}\right|_{q_i^K = q_i^{K*}(\widehat{w}_i^K)}$.

The equilibrium transfer is such that the retailer and the manufacturer captures exactly an equal share of the joint profits :

$$\widehat{T}_i^K = \frac{1}{2}P(q_i^{K*})q_i^{K*} - \widehat{w}_i^K q_i^{K*} + \frac{1}{2}C(q_i^{K*}) \tag{3}$$

Lemma 1 *Whatever the cost function, when retailers carry differentiated products, each retailer (resp. the manufacturer) captures a share $\frac{1}{2}$ of the bilateral joint profits.*

Proof. Straightforward from (3). ■
The Nash program insures that first, the size of the pie is maximum, it is here equal to the monopoly profit, and second, that the pie is shared according to the exogenous bargaining power, here $\frac{1}{2}$.

3.2.2 Case $\{K, K\}$

The two retailers bargain with the same supplier. Negotiations are no longer independent from one another since the producer K now has a status-quo in his bargaining towards each retailer: in case of a breach in the bargaining between K and i, K realizes a positive profit with the other retailer j. However, we have assumed that contracts are negotiated simultaneously and secretly. While a pair (K, i) negotiates, she considers the terms $(\overline{w_j^K}, \overline{T_j^K})$ of the other pair's negotiation as given. Moreover, if the bargaining of the pair (K, i) fails, the other pair (K, j) would not be aware of it before her own bargaining is over[13].
The Nash program of the negotiation between K and i may thus be written as follows:

$$\underset{w_i^K, T_i^K}{Max} (\Pi_{i+j}^K - \overline{\Pi_j^K})^{\frac{1}{2}} (\pi_i^K)^{\frac{1}{2}} \tag{4}$$

where $\Pi_{i+j}^K = w_i^K q_i^K + T_i^K + \overline{w_j^K} q_j^K + \overline{T_j^K} - C(q_i^K + q_j^K)$ and $\overline{\Pi_j^K} = \overline{w_j^K} q_j^K + \overline{T_j^K} - C(q_j^K)$.
From the FOCs and from the symmetry between markets, the optimal input prices w_i^{K*} are equal to the marginal costs of production which maximize

[13]Thus everything happens as if the producer K had simultaneously sent two agents to bargain with each of the retailers and if those agents couldn't communicate while they bargain.

bilateral joints profits. Thus, w_i^{K*} is defined in equilibrium by $w_i^{K*} = w_j^{K*}$ and the following implicit function:

$$w_i^{K*} = \left.\frac{\partial C(q_i^K + q_j^K)}{\partial q_i^K}\right|_{(q_i^{K*}(w_i^{K*}), q_j^{K*}(w_j^{K*}))} \tag{5}$$

Here, the optimal tariff now shares the joint profits depending on the producer's status-quo. The lower the incremental profit the producer obtains thanks to his relationships with i, the higher the tariff paid by the retailer to the producer.

The equilibrium tariff is:

$$T_i^{K*} = \frac{1}{2}P(q_i^{K*})q_i^{K*} - w_i^{K*}q_i^{K*} + \frac{1}{2}(C(q_i^{K*} + q_j^{K*}) - C(q_j^{K*})) \tag{6}$$

We thus analyze three sub-cases:

(1) When the cost function is linear ($C''(q) = 0$), since $q_j^{K*} = q_i^{K*}$, the equilibrium tariff is:

$$T_i^{K1*} = \frac{1}{2}P(q_i^{K*})q_i^{K*} - w_i^{K*}q_i^{K*} + \frac{1}{2}C(q_i^{K*}) \tag{7}$$

Here, the retailer and the producer captures a half of their joint profits. The equilibrium expression T_i^{K1*} is indeed exactly equivalent to $\widehat{T}_i^K$.

(2) When the cost function is concave ($C''(q) < 0$), the equilibrium tariff T_i^{K2*} is strictly lower than in the linear cost case: $T_i^{K2*} < T_i^{K1*}$. Here, the retailer captures a share of his joint profits $\delta > \frac{1}{2}$.

(3) When the cost function is convex ($C''(q) > 0$), the equilibrium tariff T_i^{K3*} is always higher than in the linear cost case: $T_i^{K3*} > T_i^{K1*}$. In that case, the retailer captures a share of his joint profits with the manufacturer $\gamma < \frac{1}{2}$.

We thus obtain our first proposition:

Proposition 2 *If the upstream cost functions are convex, and if retailers can commit on which product they carry before the negotiation takes place, a retailer increases her buyer power in carrying a differentiated product.*

Proof. Straightforward from (6) ■

The insight for this result is as follows. Each retailer bargains with the producer at the margin. Thus, if the producer has a convex cost function, the quantity bought by each of the two retailers induces a higher marginal production cost than the marginal cost a single retailer's order would induce. The convexity of costs here insures that the greater the number of retailers he bargains with, the greater the producer's bargaining power. Conversely, when cost are convex, retailers have a greater buyer power when they supply towards differentiated producers. Inderst and Wey (2003) have previously shown that, in another context, the convexity of cost may also explain why a larger buyer has a greater bargaining power towards a producer than a smaller buyer. A larger buyer who buys a greater quantity of good, induces on average a smaller incremental production cost than the smaller quantity bought by a smaller size buyer. Chemla (2003) has also shown how an upstream monopoly, who can choose and commit on the number of retailers he supplies, could have a greater seller power in dealing with multiple retailers. His result relies on the same mechanism: the producer incurs a fix cost per retailer that is strictly increasing with the number of retailers. The latter cost convexity is due to agency costs in an incomplete contract environment rather than to the production function, but the basic insight is the same.

3.3 Optimal listing choice

First of all, note that since both manufacturers have the same cost function and since retailers can, in our simple demand framework, always extract a higher surplus from consumers by selling the high quality product, it is straightforward that there is no equilibrium where the two retailers would choose to carry L. It is always optimal, at least for one of the two retailers, to sell H. Then, the question is whether or not it is a best response for the other retailer to also carry H or to carry L.[14]

[14] Alternatively, we could consider that the manufacturer L can enter the market without cost and does not enter the market unless he is listed by a retailer (unless he has an order).

In this section, and for simplicity, we consider that the retailer 1 has chosen to carry H, and we analyze the best reply of retailer 2. Let Υ_2^{H*} denote the optimal joint profits between the retailer 2 and the producer H and, $\widehat{\Upsilon}_2^L$, the joint profits between L and 2.

We analyze successively the case where the cost function is linear, concave and convex.

1−Linear cost function

In this case we know, from the previous section, that retailer 2 captures half of her joint profits with the producer whatever her listing choice. Finally, her choice only depends on the comparison of joint profits the retailer can realize with each of the producer. Since the cost functions are identical and linear, we have $\Upsilon_2^{H*} > \widehat{\Upsilon}_2^L$. Thus, the retailer 2 always chooses to carry H.

2−Concave cost function

In this case, and from the previous section, the retailer 2 obtains a share $\delta > \frac{1}{2}$ of her joint profits with the producer when she carries also the product H and a share $\frac{1}{2}$ when she carries the differentiated product L. Moreover, since the cost function is concave the marginal cost of production of the producer H is lowered when the two retailers carry his product rather than when 2 carries L : $\widehat{\Upsilon}_2^L < \Upsilon_2^{H*}$. Thus, the retailer 2 realizes strictly higher joint profits carrying H than L. As $\widehat{\pi}_2^L = \frac{\widehat{\Upsilon}_2^L}{2} < \pi_2^{H*} = \delta\Upsilon_2^{H*}$, the retailer 2 always chooses to carry H.

3−Convex cost function

If the cost function is convex, the retailer captures a share $\gamma < \frac{1}{2}$ of her joint profits when she also carries H, $\widehat{\pi}_2^L = \frac{\widehat{\Upsilon}_2^L}{2}$, and a share $\frac{1}{2}$ if she carries L, $\pi_2^{H*} = \gamma\Upsilon_2^{H*}$. We also know that, since the cost function is convex, the joint profits realized with L can now be higher than the joint profits realized with H.

To compare those profits, we first compare the two joint profits. More precisely, in the extreme case where $l = 0$, $\widehat{\Upsilon}_2^L = 0$ and at the other extreme,

if $l = h$, $\widehat{\Upsilon}_2^L > \Upsilon_2^{H*}$.[15] By definition $\widehat{\Upsilon}_2^L$ strictly increases with the quality of the product l, thus, there exists a unique threshold $\bar{l} \in]0,1[$ such that if $l \in \left]\bar{l},1\right]$, the joint profits when the retailer carries L is strictly higher than joint profits if the retailer carries H also.
We now focus on the interval of qualities where $l \in [0,\bar{l}]$ where $\widehat{\Upsilon}_2^L \leq \Upsilon_2^{H*}$. In $l = \bar{l}$, by definition $\widehat{\Upsilon}_2^L\left(\bar{l}\right) = \Upsilon_2^{H*}$ and since the retailer has a lower share of the joint profits when she carries H, we have: $\pi_2^{H*} < \widehat{\pi}_2^L\left(\bar{l}\right)$. Since $\widehat{\Upsilon}_2^L(0) = 0$ and $\widehat{\Upsilon}_2^L(l)$ is by assumption strictly increasing in l, there exists a unique threshold $\widetilde{l} \in \left]0,\bar{l}\right[$ such that retailer 2 realizes a better profit choosing to carry L when $l > \widetilde{l}$ and to carry H when $l \leq \widetilde{l}$.
The above discussion leads us to the following lemma:

Lemma 3 *When $C''(q) \leq 0$, the only Nash equilibrium of the game is $\{H,H\}$. When $C''(q) > 0$, there is a threshold $\widetilde{l}$ such that when $l\epsilon[\widetilde{l},1]$, the unique Nash equilibrium of the game is $\{H,L\}$.*

Proof. See appendix 6.1.1. ■

A retailer renounces to carry the high quality product to the benefit of a second brand only if the quality of the latter is high enough. This result translates well that, when a first national brand has a very strong brand, it is less likely that the retailer renounces to carry it in her shelves.
In the interval of qualities $[\bar{l},1]$, the retailer 2 sells L rather than H and two reasons explain her choice: (1) to raise her buyer power and (2) to increase her joint profits with the producer thanks to the reduction of her marginal cost. Both effects are derived from the convexity of costs. Thus $\{H,L\}$ is the unique Nash equilibrium of the game when $l > \bar{l}$.
In the interval of qualities $[\widetilde{l},\bar{l}]$, joint profits are smaller and the only motivation for 2 to carry L on her shelves rather than H is that, in supplying from a producer who has no alternative outlet on equilibrium, she has a greater buyer power. This result is interesting and allows us to highlight another source of product differentiation that relies on buyer power: the producer's differentiation. Here, retailers do not carry differentiated products in their shelves to relax retail competition since each retailer is a monopolist in her downstream market.
We thus obtain the following proposition:

[15] See detailed proof in appendix 6.1.1.

Proposition 4 *Non competing retailers may choose producer's differentiation only with the purpose to increase their buyer power.*

Proof. Straightforward since $\widehat{\Upsilon}_2^L \leq \Upsilon_2^{H*}$ when $l\epsilon[\widetilde{l}, \bar{l}]$. ■

As we previously announced the above result holds for any value of the retailer's exogenous bargaining power $\alpha \in]0,1[$. However, results would be changed in the extreme case where one of the parties has all the power. If $\alpha = 0$, since producers capture the entire surplus of their relationships with the retailers, retailers are indifferent in their listing choice and both $\{H, L\}$ and $\{H, H\}$ are equilibria of the game. If $\alpha = 1$, retailers capture the entire surplus of their relationships with the producer, the listing choice is realized only through the comparison of the retailer 2 joint profits selling either H or L and only the threshold $\bar{l}$ is relevant.

If we now look at the consumer surplus, the choice by 2 to carry the product L on her shelves has different consequences according to the market considered. For consumers located in retailer 1's market, the effect is strictly fruitful: because of cost convexity, H's marginal cost of production is lowered when 2 renounces to carry also the product H, which allows 1 to sell a greater quantity of good H at a lower price. For the retailer 2's consumers, the effects are more complex. On the one hand, the lowering in marginal cost also has a positive effect for consumers since it tends to lower prices, but on the other hand, the downgrading in quality is clearly harmful. The total effect depends on the definition of both $f(\theta)$ and $C(q)$. Therefore, we briefly derive in the next subsection an illustrative example with a quadratic cost function and a uniform distribution function of consumers' tastes, and analyze more closely the consequences of our results in terms of consumer surplus and welfare.

3.4 Illustrative example

Let the high quality parameter be normalized to $h = 1$ while the low quality l varies in the interval $[0, 1]$. The parameter θ is assumed to be uniformly distributed on the interval $[0, 1]$. Therefore, the inverse demand for the good K of quality k is: $P_i^K = k\left(1 - q_i^K\right)$
To focus on the most interesting case, let the cost function be convex and defined by the following equation: $C(q) = \frac{cq^2}{2}$,where $c > 0$. The parameter c is degree of cost's convexity. In this example, we always have π_i^K concave and Υ_i^K strictly increases in k. Solving the game, we obtain the following equilibrium and corresponding profits.

3.4.1 The two retailers carry H

To find the solution of the game, we apply previous general approach. The equilibrium contract is $w_i^{K*} = \frac{c}{1+c}$ and $T_i^{K*} = \frac{2-c}{16(1+c)^2}$ for $i = 1, 2$. The wholesale price increases with c while the tariff decreases in c. This is straightforward as total cost and marginal cost strictly increase with c. Final prices and quantities, $p_i^{K*} = \frac{1+2c}{2(1+c)}$ and $q_i^{K*}\left(w_i^{K*}\right) = \frac{1}{2(1+c)}$ for $i = 1, 2$, are respectively increasing and decreasing in c. Corresponding retailers' profits are
$\pi_i^{K*} = \frac{2+c}{16(1+c)^2}$ for $i = 1, 2$ and strictly decrease with the level of cost c.
The profit of the producer K and consumer surplus in that case are naturally both decreasing in c: $\Pi^{K*} = \frac{2+3c}{8(1+c)^2}$ and $S^* = \frac{1+2c}{4(1+c)^2}$.
The share of the joint profits with the producer the retailer captures $\gamma = \frac{2+c}{4(1+c)} < \frac{1}{2}$ and (γ) strictly decreases with c. As we proved in the previous section, the source of the producer's power in his bargaining with each retailer is linked to the difference between his profit and his status-quo profit. This difference decreases when the difference of costs $C\left(2q_i^K\right) - C\left(q_i^K\right)$ increases, i.e as the convexity of cost rises. As c increases, it lowers the difference of profit a producer can realize with and without a retailer, and thus increases his bargaining power within the relationship towards i. On the contrary, the share of joint profits the retailer captures decreases with the level of cost c.

3.4.2 One retailer carries L

The equilibrium contract is $\widehat{w}_1^H = \frac{c}{2+c}$ and $\widehat{T}_1^H = \frac{2-c}{4(2+c)^2}$ between H and 1 and $\widehat{w}_2^L = \frac{cl}{2l+c}$ and $\widehat{T}_{12}^L = \frac{(2l-c)l^2}{4(2l+c)^2}$ between 2 and L. Retail prices and quantities are $\widehat{p}_1^H = \frac{1+c}{2+c}$ and $\widehat{p}_2^L = \frac{l(c+l)}{2l+c}$, $q_1^{H*}\left(\widehat{w}_1^H\right) = \frac{1}{2+c}$ and $q_2^{L*}\left(\widehat{w}_2^L\right) = \frac{l}{2l+c}$. Corresponding retailers profits are $\widehat{\pi}_1^H = \frac{1}{4(2+c)}$and $\widehat{\pi}_2^L = \frac{l^2}{4(c+2l)}$. In this example, our main assumption is always true: $\widehat{\Upsilon}_2^L(l)$ strictly increases in l.
Finally, the profit of the two producers and consumer surplus in this case are : $\widehat{\Pi}^H = \frac{1}{4(2+c)}$ and $\widehat{\Pi}^L = \frac{l^2}{4(c+2l)}$, $\widehat{S} = \frac{1}{2}\left(\frac{1+c}{(2+c)^2} + \frac{l^2(c+l)}{(c+2l)^2}\right)$. The latter equilibrium outcome values are all strictly increasing in l. Here, and as we proved in the general case, a retailer simply captures a half of her joint profits with the producer.

3.4.3 Comparison

In this illustrative example, we assume, as in the general case, that the retailer 1 has chosen to carry H in her shelves and we analyze the best response strategy for the retailer 2.

We represent in Figure 1 the different thresholds $\bar{l}$ and $\widetilde{l}$ defined in the general case. In this example the corresponding thresholds are functions of the parameter c. We also represent a threshold l^s (resp. l^{s2} such that if $l > l^s$ (resp. $l > l^{s2}$, the producers' differentiation increases the sum of consumers' surplus in both markets (resp. retailer 2's market consumers' surplus).

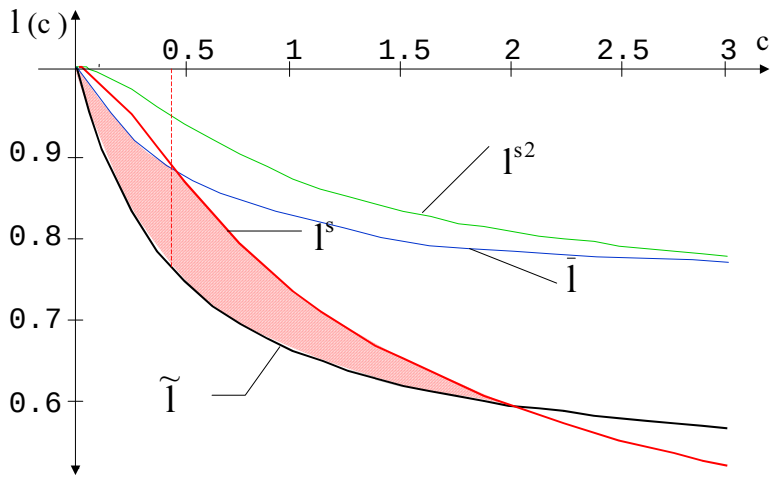

Figure 1: Thresholds

Note first that all the thresholds strictly decrease with c since the benefit of a producers' differentiation increases with the cost convexity, either for retailers, the vertical industry or the consumers[16]. In the shaded area, the retailer chooses to supply from the low quality producer only in order to

[16]The exact formula for all the quality thresholds are provided in appendix 6.1.2.

improve her buyer power since $l \in [\widetilde{l}, \bar{l}]$. Moreover, in the same area, this strategy is always damaging for consumer surplus since $l < l^s$. When c is low enough, i.e at the left of the vertical dotted line, a differentiation induced by a buyer power concern can only have negative effects on consumer surplus regardless of l. We thus obtain the following remark.

Corollary 5 *The producer's differentiation may damage consumer surplus for low degree of convexity in the cost function.*

Proof. see appendix 6.1.2. ■
For sufficiently low values of the parameter c, the damages for consumers on market 2 surpass the benefits for consumers on market 1. It is clear that, at a given level of quality l, the negative effect of 2 carrying L for the market 2 consumers is reduced as the convexity of cost is raised. On the other hand, the benefits of 2 carrying L for the consumers in market 1 strictly increases with cost convexity. The total effect on surplus will thus be negative if the convexity of costs is not too strong.

4 Retail competition

In this section we assume that the two retailers compete in the same market of size 1. In this new framework, retailers also have the usual motivation for product differentiation to relax downstream competition. It is straightforward that the only Nash equilibrium of the game in a perfect competition setting would be for retailers to offer differentiated products. We thus adopt an imperfect competition setting assuming that retailers compete à la Cournot. We keep the general notations adopted in section 3 except that for simplicity, we assume from the start that if the two retailers list different products, 1 offers H and 2 offers L. The game is solved backwards.

4.1 The quantity choice

Consumers' demand differs according to the listing structure $\{H, L\}$ or $\{H, H\}$. The superscript $S = \{HH, HL\}$ henceforth refers to the listing structure considered.

4.1.1 Case $\{H, H\}$

Consumers buy the good H as long as $S(\theta) \geq 0$ and thus the total demand for good H is $Q^{HH} = \int_{\frac{p_i^K}{k}}^{\overline{\theta}} f(\theta)d\theta$. Let $P^{HH}\left(Q^{HH}\right)$ denote the corresponding inverse demand function for good H on the market. In equilibrium, the total supply equals demand such that, $Q^{HH} = \sum_i q_i^{HH}$.

In the last stage of the game, retailer i chooses her quantity q_i^{HH} that maximizes her profit given the tariff she has negotiated in stage 2 and considering her rival's quantity as given. Optimal Cournot quantities are denoted by $q_1^{HH*}(.)$ and $q_2^{HH*}(.)$.

4.1.2 Case $\{H, L\}$

The consumer θ now compares his surplus if he buys the product H, $S^H(\theta) = \theta h - P_1^H$, or the product L, $S^L(\theta) = \theta l - P_2^L$. The indifferent consumer between buying H or L has a type $\widetilde{\theta} = \frac{P_1^H - P_2^L}{h-l}$. The total demand for good H at retailer 1 is thus $q_1^H = \int_{\widetilde{\theta}}^{\overline{\theta}} f(\theta)d\theta$ and the total demand for good L at retailer 2 is thus $q_2^L = \int_{\frac{P_2^L}{l}}^{\widetilde{\theta}} f(\theta)d\theta$. Let $P_1^H\left(q_1^H, q_2^L\right)$ and $P_2^L\left(q_1^H, q_2^L\right)$ denote the corresponding inverse demand functions.

In stage 3, each retailer chooses the quantity that maximizes her profit given the tariff she has negotiated in stage 2 and taking as given the quantity sold by her rival. Optimal Cournot quantities are denoted $\widehat{q}_1^{HL}(.)$ and $\widehat{q}_2^{HL}(.)$.

4.2 The bargaining game

In a competition framework, secret contracts may give rise to secret discounting which raises a commitment inefficiency (see Hart and Tirole (1990), O'Brien and Shaffer (1992), McAfee and Schwartz (1994)). The latter inefficiency is discussed further when solving the subgame when H serves both retailers. In addition to the general assumption on secrecy of contracts we assume here that contracts are not observable ex-post.[17] It means that the

[17] Choosing the alternative assumption of ex-post observability, would raise a new coordination problem in the vertical chain. A retailer and her supplier would have an incentive to bargain over a contract with a marginal part undercutting the contract bargained by her rival to give her an advantage over her rival in the competition stage: The equilibrium wholesale prices would then be set below the marginal cost. Bonnano and Vickers (1987)

contract terms between H and 1 are not observed by 2 before the latter chooses his quantity in stage 3. Technically, a pair (K, i) bargains taking into account the quantity chosen by the other retailer j in stage 3 as given. This assumption was pointless in section 3 since retailers were not competing and thus had no incentive to change their quantity choice in the last stage according to the contract bargained by the other retailer.

4.2.1 Case $\{H, L\}$

In that case, retailers supply towards different manufacturers, but since they now compete, the two negotiations could be related through the quantity choice. However, due to our assumptions on secrecy of contracts, negotiations remain independent from one another.
Solving the Nash program, we find that the optimal input price is chosen in order to maximize joint profits and thus equal to the marginal cost of production.

Lemma 6 *Whatever the cost function, when retailers carry differentiated products, the manufacturer (resp. each retailer) captures a share $\frac{1}{2}$ of the bilateral joint profits.*

Proof. See appendix 6.2.1 ■
With retail competition, as in the separated markets case, when they supply towards different producers, retailers get half of their joint profit with the supplier.

4.2.2 Case $\{H, H\}$

In case of a breach in the bargaining between H and 1, H realizes a positive profit with the other retailer 2. However, we have assumed that contracts are negotiated simultaneously and secretly without ex-post observability of contracts. While a pair $(H, 1)$ negotiates, she considers the contract (w_2^{HH}, T_2^{HH}) of the other pair's negotiation and the quantity q_2^{HH} chosen by the retailer 2 in stage 3 as given. Thus, the quantity outcome will be the Cournot equilibrium outcome and the upstream monopolist can not, through the contracting

have highlighted this vertical coordination problem in a price competition setting.

stage, extends his monopoly power at the downstream level: this is the commitment inefficiency raised in a secret contract setting.[18]
Solving the Nash program and from the symmetry between markets, in equilibrium, wholesale prices are equal to the marginal cost of production. The solution leads to the following result:

Lemma 7 *When retailers compete in the same market and costs are convex, retailers have a strictly higher share of their joint profits with their supplier when they carry differentiated products.*

Proof. See appendix 6.2.2 ■
Again, we obtain the same result in an imperfect competition framework than in the separated markets case.

4.3 Optimal listing choice

We now analyze the retailer 2 listing choice in the first stage of the game.

4.3.1 General result

The general solution of this stage is the same as in section 3 unless there is a new reason to explain why 2 may carry L rather than H: Retailer 2 has here the classical incentive to differentiate from 1 in order to relax downstream competition. Let Υ_2^{HH} (resp. Υ_2^{HL}) denote the joint profits realized by the retailer 2 and the producer H (resp.L). The superscript "c" stands for competition.

Lemma 8 *When $C''(q) > 0$, there exists a quality level $\bar{l}^c < 1$ such that if $l = \bar{l}^c$, $\Upsilon_2^{HL} = \Upsilon_2^{HH}$. There is a threshold $\widetilde{l^c} < \bar{l}^c$ such that when $l \epsilon [\widetilde{l^c}, 1]$, the unique Nash equilibrium of the game is $\{H, L\}$.*

[18] On the contrary, in a public contract setting, the producer could bargain with each retailer over a two-part tariff contract such that they would share according to the exogenous bargaining in two equal parts half of the monopoly profit. A retailer wouldn't have any incentive to deviate in setting a higher quantity in stage 3 since it would earn a strictly negative profit.

Proof. see appendix 6.2. 3 ■

From lemma 7 we obtain the following proposition:

Proposition 9 *Competing retailers may choose producer's differentiation only with the purpose to increase their buyer power.*

Proof. From lemma 7, the proof is analogous to section 3. ■

All our results thus holds in a competition framework. In the interval of quality level $\left[\overline{l}^c, 1\right]$ the retailer now chooses to differentiate to reduce her production cost, to improve her buyer power and to relax downstream competition. In the interval $[\widetilde{l}^c, \overline{l}^c]$ it is only the increase in buyer power through producer's differentiation that leads the retailer to carry the good L.
If we now turn to the effect on consumer surplus, the effects are much more complex than in the separated markets case. Even if the two retailers carry different products in order to increase their buyer power, it also reduces downstream competition and thus may raise prices. Whereas market 1's consumers were always better off when 2 had chosen to carry L in the separated markets case, it is now possible for retailer 1's consumers to be worse off because of the price rise. On the other hand, thanks to the competition, a reduction in cost is more likely to be passed through to consumers than in the case where markets were separated. Therefore, the effect on consumer surplus could, on the contrary, be positive. We develop again an illustrative example to further analyze the effects on consumer surplus.

4.3.2 Illustrative example

The illustrative example is the same as in the previous case. All details of the calculations are provided in the appendix. We obtain the following result:

Corollary 10 *When retail competition is strong enough, the producer's differentiation has strictly positive effects on consumer surplus.*

Proof. see appendix 6.2.4. ■
When retailers compete à la Cournot, product differentiation has a strictly fruitful influence on consumer surplus. Indeed, the pass through of a reduction in the production cost is higher when retailers compete than when they

had a monopoly position in separated markets. Thus, if cost are convex, differentiation lowers the cost which benefits to consumers to a larger extent than in the separated markets case. This shows that with convex cost, despite of the reduction in competition they can expect, retailers are reluctant to carry differentiated products when it would be profitable for consumers. The intuition for this is twofold: (1) the retailer doesn't capture all the benefits induced by her choice to carry L since both her rival and the consumers take a part of it; (2) this strategy allows the retailer to lower her cost, but also provides the same competitive advantage to her rival which reduces directly her profitability.

5 Conclusion

This article first highlights a new source of buyer power. Indeed, convexity of costs (or capacity constraints) at the production level explains why larger retailers have a greater buyer power towards producers (see Inderst and Wey (2005)), but we prove here that it also guarantees that producer's market power increases with the number of his outlets. We thus show that producer's differentiation may be a source of buyer power for retailers. Second, in a framework where manufacturers offer products differentiated in quality, this paper shows that retailers may choose to differentiate their product lines with the only purpose to raise their buyer power. Indeed, a retailer may have an incentive to supply towards a lower quality good manufacturer because the latter will have in equilibrium a lower market power than the high quality good manufacturer, due to a smaller number of outlets. This article thus stems that a capacity constrained retailer may not always carry the "best product" for consumers. However, when production costs are convex, producers' differentiation allows a retailer to lower the marginal cost and the latter economies are partly passed through to consumers. When retail competition is strong enough, consumers may rather benefit from producer's differentiation. These results would also hold, at least, when retailers are in separated markets, if we had considered that the two manufacturers were offering different varieties of a product rather than different qualities.[19]

[19]The insight is in a framework where consumers are uniformly distributed along a linear city of length 1. One manufacturer offers a product whose characteristic is 1/2 while the other offers, for instance a good whose characteristic is 3/4. In this framework it is straightforward that one of the retailers could have an interest to carry the 3/4 variety

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6 Appendices

6.1 Separated retail markets

6.1.1 Proof of Lemma 3

By definition, when $l = 0$, $\widehat{\Upsilon}_2^L = 0$. We then prove that if $l = h$, $\widehat{\Upsilon}_2^L > \Upsilon_2^{H*}$ in two steps as two changes are induced when 2 carries L rather than H.
(i) Assume that the marginal cost w_2^{H*} and optimal quantities q_2^{H*} are unchanged, then, if $l = h$, the choice of L has a strictly beneficial effect through the cost convexity. The cost reduction would simply be: $-C(q_2^{H*}) + C(2q_2^{H*})/2 > 0$. Thus, $\widehat{\Upsilon}_2^L\left(q_2^{H*}\left(w_2^{H*}\right)\right) > \Upsilon_2^{H*}\left(q_2^{H*}\left(w_2^{H*}\right)\right)$.
(ii) When 2 carries L, the marginal cost is reduced from w_2^{H*} to $\widehat{w}_2^L$ and corresponding optimal quantities increase from q_2^{H*} to $\widehat{q}_2^L$ and we know that

$\widehat{\Upsilon}_2^L\left(\widehat{q}_2^L\left(\widehat{w}_2^L\right)\right) > \widehat{\Upsilon}_2^L\left(q_2^{H*}\left(w_2^{H*}\right)\right)$ since $\widehat{w}_2^L$ maximizes the vertically integrated profits.
From (i) and (ii) we have proved that when $l = h$, $\Upsilon_2^{H*}\left(q_2^{H*}\left(w_2^{H*}\right)\right) < \widehat{\Upsilon}_2^L\left(\widehat{q}_2^L\left(\widehat{w}_2^L\right)\right)$.

6.1.2 Illustrative example

The formulae of the different thresholds are:

$$\widetilde{l} = \frac{2 + c + \sqrt{4 + 12c + 21c^2 + 16c^3 + 4c^4}}{4(1+c)^2}$$

and

$$\bar{l} = \frac{1 + \sqrt{1 + 2c + 2c^2}}{2(1+c)}$$

We do not give the explicit value of thresholds l^s and l^{s2} since their expressions are complex and not instructive. However, we easily prove that $l^{s2} - \widetilde{l}$ strictly increases with c and that when $c \to \infty$, $l^{s2} - \widetilde{l} \to \frac{\sqrt{2}-1}{2}$The difference $\bar{l} - \widetilde{l}$ also strictly increases with c and that when $c \to \infty$, $\bar{l} - \widetilde{l} \to \frac{\sqrt{2}-1}{2}$. Both $\widetilde{l}$ and l^s strictly decrease in c. As $c \to \infty$, $l^s \to 0$ while $\widetilde{l} \to \frac{1}{2}$. The difference $l^{s2} - \bar{l}$ strictly decreases in c and $l^{s2} - \bar{l} \to 0$ as $c \to \infty$.

6.2 Retail Competition

6.2.1 Case {H,L}

Best response quantities are denoted $q_1^{HLbr}(.)$ and $q_2^{HLbr}(.)$.
We denote Π_i^{HL} the manufacturer's profit realized with the retailer i through a contract (w_i^{HL}, T_i^{HL}) who anticipates that the quantity q_j^{HL} set by her rival j is given, where $\Pi_i^{HL} = w_i^{HL} q_i^{HLbr} + T_i^{HL} - C(q_i^{HLbr})$. Moreover, the retailer i's profit is denoted $\pi_i^{HL} = \left(P(q_i^{HLbr}, q_j^{HL}) - w_i^{HL}\right) q_i^{HLbr} - T_i^{HL}$. The equilibrium two-part tariff contract (w_i^{HL}, T_i^{HL}) is the solution of the following Nash program

$$\underset{w_i^{HL}, T_i^{HL}}{Max} (\Pi_i^{HL})^{\frac{1}{2}} (\pi_i^{HL})^{\frac{1}{2}} \tag{8}$$

.
The equilibrium wholesale price is defined by the following implicit function $\widehat{w}_i^{HL}$: $w_i^{HL} = \left.\frac{\partial C(q_i^{HL})}{q_i^{HL}}\right|_{q_i^{HL} = \widehat{q}_i^{HL}(.)}$

The equilibrium transfer is: $\widehat{T}_i^{HL} = \frac{1}{2}P(\widehat{q}_i^{HL})\widehat{q}_i^{HL} - \widehat{w}_i^{HL}\,\widehat{q}_i^{HL} + \frac{1}{2}C(\widehat{q}_i^{HL})$.

6.2.2 Case {H,H}

Best response quantities are denoted $q_1^{HHbr}(.)$ and $q_2^{HHbr}(.)$. The Nash program of the negotiation between H and i may be written as follows:

$$\underset{w_i^{HH},T_i^{HH}}{Max}(\Pi_{i+j}^{HH} - \overline{\Pi_i^{HH}})^{\frac{1}{2}}(\pi_i^{HH})^{\frac{1}{2}}$$

where $\Pi_{i+j}^K = w_i^{HH}q_i^{HHbr} + T_i^{HH} + w_j^{HH}q_j^{HH} + T_j^{HH} - C(q_i^{HHbr} + q_j^{HH})$, $\overline{\Pi_i^{HH}} = w_j^{HH}q_j^{HH} + T_j^{HH} - C(q_j^{HH})$ and $\pi_i^{HH} = \left(P^{HH}\left(q_i^{HHbr}, q_j^{HH}\right) - w_i^{HH}\right)q_i^{HHbr} - T_i^{HH}$.
Solving the Nash program and from the symmetry between markets, in equilibrium, $w_i^{HH*} = w_j^{HH*}$ and $q_j^{HH*} = q_i^{HH*}$ and the optimal input prices are defined by the following implicit function :$w_i^{HH} = \left.\frac{\partial C(q_i^{HH}+q_j^{HH})}{q_i^{HH}}\right|_{q_i^{HH}=q_i^{HH*}(.)}$

The equilibrium tariff is: $T_i^{HH*} = \frac{1}{2}P(q_i^{HH*})q_i^{HH*} - w_i^{HH*}q_i^{HH*} + \frac{1}{2}(C(q_i^{HH*} + q_j^{HH*}) - C(q_i^{HH*}))$.

6.2.3 Listing choice

As in the separated market case, when $l = h$, $\Upsilon_2^{HL} > \Upsilon_2^{HH}$ and when $l = 0, \Upsilon_2^{HL} = 0 < \Upsilon_2^{HH}$. The facts that Υ_2^{HL} increases in l and that Υ_2^{HH} is independent of l are thus sufficient to insure that there is a unique threshold $\bar{l}^c < 1$ such that $\Upsilon_2^{HL} = \Upsilon_2^{HH}$.
This insures that in the interval $[\widetilde{l^c}, \bar{l}^c]$ it is only the buyer power that explains the incentives for retailer 2 to differentiate.

6.2.4 Illustrative example

The equilibrium outcomes in the case {H,L} are
$\widehat{q}_1^{HL}(.) = \frac{2-l-2w_1^{HL}+w_2^{HL}}{4-l}$ and $\widehat{q}_2^{HL}(.) = \frac{l(1+w_1^{HL})-2w_2^{HL}}{(4-l)l}$;
$\widehat{w}_1^{HL} = \frac{c^2+cl(2-l)}{2c+c^2+4l+2cl-l^2}$ and $\widehat{w}_2^{HL} = \frac{cl(1+c)}{2c+c^2+4l+2cl-l^2}$;
$\widehat{T}_1^{HL} = \frac{(2-c)(c+(2-l)l)^2}{4(c^2+(4-l)l+2c(1+l))^2}$ and $\widehat{T}_2^{HL} = \frac{(1+c)^2l^2(2l-c)}{4(c^2+(4-l)l+2c(1+l))^2}$;
$\widehat{\pi}_1^{HL} = \frac{(2+c)(c+(2-l)l)^2}{4(c^2+(4-l)l+2c(1+l))^2}$ and $\widehat{\pi}_2^{HL} = \frac{(1+c)^2l^2(c+2l)}{4(c^2+(4-l)l+2c(1+l))^2}$;

$\widehat{S}_1^{HL} = \int_{\widetilde{\theta}}^{1} \left(\theta - \widehat{p}_1^{HL}\right) d\theta = \frac{(c+(2-l)l)(c+2cl^2+l(2+l))}{c^2+(4-l)l+2c(1+l)}$;
$\widehat{S}_2^{HL} = \int_{\frac{\widehat{p}_2^{HL}}{l}}^{\widetilde{\theta}} \left(\theta - \widehat{p}_2^{HL}\right) d\theta = \frac{(1+c)(c+2l)}{c^2+(4-l)l+2c(1+l)}$;
$\widehat{S}^{HL} = \widehat{S}_1^{HL} + \widehat{S}_2^{HL}$.
The equilibrium outcomes in the case {H,H} are
$q_1^{HH*}(.) = \frac{1-2w_1^{HH}+w_2^{HH}}{3}$; $q_2^{HH*}(.) = \frac{1-2w_2^{HH}+w_1^{HH}}{3}$;
$w_1^{HH*} = w_2^{HH*} = \frac{2c}{3+2c}$;
$T_1^{HH*} = T_2^{HH*} = \frac{2-c}{4(3+2c)^2}$;
$\pi_1^{HH*} = \pi_2^{HH*} = \frac{(2+c)}{4(3+2c)^2}$;
$S^{HH*} = \int_{p^{HH*}}^{1} \left(\theta - p^{HH*}\right) d\theta = \frac{2}{(3+2c)^2}$;
$S_1^{HH*} = S_2^{HH*} = \frac{S^{HH*}}{2}$.
All the thresholds derive immediately from the comparison between these outcomes values.
Their expressions are nonetheless very complex so we simply give here some basic results.[20] The two thresholds $l^{sc}/S^{HH*} = \widehat{S}^{HL}$ and $\widetilde{l}^c/\pi_2^{HH*} = \widehat{\pi}_2^{HL}$ are such that $l^{sc}(0) = \widetilde{l}^c(0) = 0$, and $\widetilde{l}^c(c) - l^{sc}(c)$ strictly increases in c, and goes to $\frac{1}{2}$ when c goes to infinity.

[20]The mathematica files are available from the authors by request.