Buyer Power through the Differentiation of Suppliers[1]

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Abstract

This paper argues that rival retailers may choose to differentiate their supplying producers, even at the expense of downgrading the quality of the product offered to consumers, to improve their buyer power. We show that, through the differentiation of suppliers, a retailer may obtain a larger slice of a smaller pie, i.e, smaller bilateral joint profits. Thus, the "only" purpose of differentiation is to gain increasing buyer power. This result may hold (i) when retailers compete in the final market or (ii) when retailers are active in separate markets. The differentiation of suppliers, which results from a buyer power motive, may be harmful for consumer surplus and social welfare.

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1 Introduction

In the last half century, the retail sector in western countries has undergone several major changes that have shifted power from manufacturers toward retailers. A rapid wave of consolidation has led to the creation of large retail groups.[1] In addition, retailers have allocated an increasing amount of shelf space to their private labels, resulting in an impressive increase in the market shares of these private labels, which has strengthened retailers vis-a-vis manufacturers.

Finally, manufacturers have been confronted with the rise of hard discounters. The German groups Lidl and Aldi have expanded throughout the EU[2], and more recently in the U.S., with Aldi's U.S. retail chain Trader Joe's or Aldi stores. In 2009, hard discounters represented more than 20% of grocery sales in Belgium, Austria and Denmark and more than 10% in France, Spain, Portugal and the Netherlands. In the U.S., other grocery discounters, such as Family Dollar and Dollar General, have also expanded quickly. Hard discounters typically offer a small assortment of grocery products, primarily consisting of generic and private label goods[3], and create a minimalist shopping environment that involves low distribution costs. As a result, hard discounters can offer prices up to 60% lower than those of leading national brands and 40% lower than large retailers' private labels (see Cleeren et al. (2009)).

In this paper, we provide a theoretical argument that helps explain why private labels often replace national brands on retailers' shelves and in particular the success of hard discounters in which private labels are the largest part of the assortment. Our paper argues that two retailers may choose to purchase from different suppliers, even if doing so entails offering a product of lower quality to consumers. The retailer may make this decision for the sole purpose of improving its buyer power in negotiations with its supplier, i.e., the retailer obtains a larger slice (increased buyer power) of a smaller pie (due to the sale of lower-quality and/or less-known goods).

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[1]Deloitte, (2004): Global Powers of Retailing. In 2002, nearly 30% of the sales turnover of the world's top retailers was generated by the top ten retailers.

[2]The two groups represented about 42% of German grocery sales in 2009; see "The Hard Discount Model in Retailing", IESE Business School, University of Navarra, 2010.

[3]In Aldi, private label product assortment exceeds 90% (see "Private Label Strategy," Harvard Business Review Press, 2007). Trader Joe's carries approximately 2,000 products, as opposed to the 30,000 products carried at a typical supermarket. The chain does not carry familiar mass-market brands such as Coca-Cola, Budweiser or Pampers (see "Trader Joe's Recipe for Success," BusinessWeek, 2008.)

The main argument of this paper is developed in a framework where two symmetric retailers are capacity (shelf) constrained and can offer only one product. Two products differentiated in quality are offered by different producers. We analyze a simple game where retailers first choose their assortment strategy, i.e., they commit to stocking one of the two goods, and then each retailer bargains sequentially with (and only with) its selected producer over a two-part tariff contract. Finally, the retailers sell to consumers. We show that one retailer may prefer to commit to negotiating with the low-quality producer to avoid a rivalry with the other retailer in purchasing from the high-quality producer. We highlight that the retailer finds it profitable to buy from the low-quality producer because it then extracts a larger slice of a "smaller pie" (smaller bilateral joint profits). We thus isolate a motivation for differentiating with the sole purpose of increasing buyer power (increasing the slice) of a smaller pie. Then, we develop two illustrations in standard industrial organization models, one where retailers also compete to sell to consumers, and another where retailers are active in separate markets. We show in the two cases that differentiation arises for a buyer power motive only and point out that this differentiation strategy may be harmful for consumer surplus and welfare.

Our paper is related, first, to the literature on private labels. The literature on this topic is abundant and mainly attempts to explain the emergence of private labels (cf. Bergès et al. (2004) for a survey).[4] One rationale often advanced for retailers to sell a private label is to gain buyer power vis-à-vis the national brand producers (Mills, 1995): the profit from the sale of their private label is used as an outside option in their bargaining with the national brand producer. In this paper, we contribute to explaining why private labels could not only coexist with national brands on retailers' shelves but could actually replace them, a trend that is particularly prevalent at hard discounters. The first insight is that, given the capacity constraint on the shelves, selling a private label instead of a national brand may simply be the most profitable option for a retailer: the retailer has to share the joint surplus with the national brand producer, whereas it can capture the whole surplus from the sale of a private label, which is often sold at marginal cost by a manufacturer dedicated to the retailer. However, we provide here an additional argument. Even if the retailer had *ex ante* the same bargaining power

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[4]Note that recent literature analyzes the consequences for producer's quality investments of the coexistence of private labels and national brands on the shelves, (e.g., Bergès and Bouamra (2005), Chambolle et al (2014) and Inderst et al (2015)).

vis-a-vis the national brand manufacturer and the private label manufacturer, a retailer could be better off by selling the private label instead of the national brand because it would enjoy greater buyer power *ex post*.

In addition, this paper follows a recent literature stream pertaining to the factors affecting the size of vertical channel profit and how that profit is shared among channel participants (Iyer and Villas-Boas (2005); Dukes et al.(2006)). Among the determinants of buyer power, the literature often puts forward that larger firms can obtain larger discounts from a negotiation partner (Chipty and Snyder (1999), Inderst and Wey (2006), Inderst and Shaffer (2007), Montez (2007), Misra and Mohanty (2008)). Our paper contributes to this literature by showing that differentiation of suppliers may be a new source of buyer power.

Further, our results contribute to the standard literature on product differentiation which shows the incentive of a duopoly to differentiate its offer in order to relax competition (e.g., Gabzsewicz and Thisse (1979) or Shaked and Sutton (1982)). In our paper, two competing retailers may also have an incentive to offer differentiated goods, not to relax downstream competition, but instead to avoid a rivalry in purchasing from the high-quality good producer.

Finally, our paper relates to a literature on the consequences of buyer power for social welfare (see Inderst and Mazzarotto (2008) for a survey). Most articles have focused on the price effects of buyer power: as retailers exert their buyer power to reduce their costs, these gains are partly passed on to consumers through lower retail prices.[5] Another important issue is that of the "non-price" effects of buyer power, in particular, its impact on innovation or on the variety of products offered by retailers. Our paper responds to these recent research developments by raising the question of the implications of buyer power on retailers' assortment. From this angle, several articles are directly related to our work. For instance, Avenel and Caprice (2006) have shown that the balance of power in the vertical chain affects competing retailers' equilibrium product lines. However, in their model, only the high-quality producer has market power towards retailers, and their result relies on a gap in the production costs of the two qualities of products. Unlike the situation in this paper, without a disadvantage in cost for the high-quality producer, the two retailers would always offer the same product

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[5]See Inderst and Shaffer (2008) for a survey.

line to consumers. Inderst and Shaffer (2007) identify a new mechanism through which a cross-border merger between retailers can increase buyer power. Before the merger, retailers are in separate markets and buy from two different producers. After the merger, the newly consolidated retailer may commit to a single sourcing strategy to increase its buyer power, which may be detrimental to consumers.

The paper proceeds as follows. Section 2 presents the general framework of the model, in which retailers single source and commit to their assortment strategy in a first stage. Section 3 characterizes an equilibrium in which one of the retailers buys from a low-quality supplier for the sole purpose of increasing its buyer power. Section 4 then derives the implications of our result for consumer surplus and welfare in the case of two illustrations, one with retail competition and linear costs in 4.1, and another where retailers are active in separate markets with convex production costs in 4.2. Section 5 shows that a similar result obtains when retailers imperfectly compete in prices and discusses the robustness of our main result to our bargaining assumptions. Section 6 concludes.

2 The model

Two producers offer vertically differentiated products $K = \{L, H\}$ of respective qualities $k = \{l, h\}$ with $0 < l \leq h$. Each producer offers only one good, and thus the producer of good H (resp. L) is also referred to as the supplier H (resp. L). For simplicity, assume both producers have exactly the same cost function $C(q)$ with $C'(q) \geq 0$.[6] Thus, if H produces a higher quality good, this may be explained for example by a better reputation established in the past (thanks to a sunk cost). One can consider here, for instance, that H is the producer of the first national brand and L the producer of a second national brand or a private label. We assume that the cost function is weakly convex $(C''(q) \geq 0)$ and will further discuss this assumption.

Producers cannot sell their product directly to consumers but instead must sell through retailers. We assume that there are two retailers $i = \{1, 2\}$ with limited shelf

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[6]Assuming instead that the low-quality good has a smaller production cost would not qualitatively change our results. Our goal here is to avoid any "trivial" assumptions that could explain why a retailer would prefer offering the low instead of the high-quality good; a difference in the production cost may be one of these assumptions.

space: each of the two retailers has a single slot for a product.[7]

Consumer demand for good K at retailer i increases with the quality level k and decreases according to the price, denoted P_i^K. As in the original vertical differentiation model of Mussa and Rosen (1978), each consumer purchases at most one unit of the good and has a marginal willingness to pay for quality θ, and this parameter is distributed according to the distribution function $F(\theta)$, continuously defined on the segment $[\underline{\theta}, \overline{\theta}]$. The corresponding probability density function is denoted $f(\theta)$. A consumer who buys product K at price P_i^K obtains a surplus $S(\theta, k) = \theta k - P_i^K$.

The timing of the game is as follows:

Stage 1: Each retailer commits to stocking a product K on its shelf;

Stage 2: Each retailer-producer pair negotiates sequentially on a tariff T_i^K, gathering a wholesale unit price w_i^K and a fixed tariff F_i^K;

Stage 3: Retailers choose their final quantities q_i^K.

The main assumption of this simple game is the ability of retailers to commit to their assortment strategy in the first stage. This timing highlights that the assortment strategy is a long-term decision of the retailer that conveys its brand image to consumers.[8] This assumption implies that we allow only a subset of suppliers to be relevant for certain retailers in the bargaining stage because retailers have already committed to carrying certain products in stage 1. It also represents well the choice of retail format, e.g., a hard discount *vs* supermarket.

We use the sequential non-cooperative bargaining game defined by Stole and Zwiebel (1996).[9] According to their framework, a sequence of pairs is set, and we solve the bargaining game following the sequence. Each pair $K - i$ thus takes a turn negotiating secretly over a contract (w_i^K, F_i^K). If K and i reach an agreement, then bargaining moves to the next pair. If there is a breakdown in the negotiation for a given pair of

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[7]For example, consider the case of a product with a certain facing width: the available space only allows one facing of a product to be visible on the shelf, while additional units of the same product can be stored behind the facing. Marx and Shaffer (2010) show, for instance, that retailers may commit themselves to scarcity of shelf space in order to reinforce the competition between manufacturers.

[8]This hypothesis is also found in Scott-Morton and Zettelmeyer (2004).

[9]When $\alpha = \frac{1}{2}$, the outcome of such a negotiation process is equivalent to the standard cooperative-game solution concept of Shapley values for a corresponding cooperative game.

firms, this becomes common knowledge, and the sequence of negotiations begins again without that pair. We assume that each retailer's bargaining power in the negotiation is $\alpha \in [0,1]$ and each producer's bargaining power is $1 - \alpha$. Given that the contract terms themselves are not observable by third parties, we make assumptions on out-of-equilibrium beliefs. Following O'Brien and Shaffer (1992) and McAfee and Schwartz (1994), we assume that firms have passive beliefs: if i receives an unexpected offer from K, i does not revise its beliefs about any other outcome of the game. Thus, each pair takes the outcome of the negotiations between other pairs as given, and such a Nash bargaining game is bilaterally efficient.[10]

To solve this game, note first that, as both producers have exactly the same cost and H is producing a higher quality, it is always optimal in stage 1 for at least one of the two retailers, say 1, to sell H. The question remains as to whether retailer 2 prefers to purchase from a differentiated supplier, and we therefore focus the analysis on the two relevant market structures, henceforth denoted (H,L) and (H,H).[11]

3 Producers' differentiation as a source of buyer power

We first convey our main result without any specification on cost and demand functions. The inverse demand functions for goods H and L when retailer 1 offers a quantity q_1^H of good H, whereas retailer 2 offers a quantity q_2^L of good L, are respectively denoted $P_1^H(q_1^H, q_2^L)$ and $P_2^L(q_2^L, q_1^H)$. The inverse demand functions for good K when the two retailers offer a quantity q_i^K and q_{-i}^K of good K are denoted $P_i^K(q_i^K, q_{-i}^K)$ for each retailer $i = 1, 2$ and each good $K = H, L$. We also assume symmetry, which implies that, when $q_i^K = q_{-i}^K = q^K$, we have $P_i^K(q^K, q^K) = P^K(q^K, q^K)$ for $i = 1, 2$ and $K = H, L$.

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[10]Nash bargaining for each pair can also be modelled as an infinite horizon sequential strategic game à la Binmore, Rubinstein and Wolinsky (1986).

[11]We prove in Appendix 7.1.4 that there exists no equilibrium (L,L).

3.1 Quantity choices

Given our bargaining assumptions, i.e., secret negotiations on two-part tariffs and passive beliefs, wholesale prices are set to marginal cost in stage 2.[12] Therefore, in stage 3, each retailer chooses the quantity that maximizes its joint profit with the manufacturer selected in stage 1. Note that, in order to solve stage 3, we use the equilibrium wholesale prices of stage 2.[13] However, we will proceed in a classic backward induction to determine the equilibrium fixed fees of the stage -2 negotiation.

Case (H,L)

We denote the optimal quantity choices vector in this case by $(\hat{q}_1^H, \hat{q}_2^L)$. Given that the equilibrium wholesale prices are $\hat{w}_i^K = C'(\hat{q}_i^K)$, retailer 1 chooses its quantity $\hat{q}_1^H$ to maximize its joint profit with producer H:[14]

$$P_1^H(q_1^H, q_2^L)q_1^H - C(q_1^H),$$

and retailer 2 chooses its quantity $\hat{q}_2^L$ to maximize its joint profit with producer L:

$$P_2^L(q_2^L, q_1^H)q_2^L - C(q_2^L).$$

Assuming that there exists an interior solution[15], the optimal quantity choices $(\hat{q}_1^H, \hat{q}_2^L)$ are implicitly defined by the following FOCs:

$$\frac{\partial P_1^H(\hat{q}_1^H, \hat{q}_2^L)}{\partial q_1^H}\hat{q}_1^H + P_1^H(\hat{q}_1^H, \hat{q}_2^L) - C'(\hat{q}_1^H) \quad = 0. \tag{1}$$

$$\frac{\partial P_2^L(\hat{q}_2^L, \hat{q}_1^H)}{\partial q_2^L}\hat{q}_2^L + P_2^L(\hat{q}_2^L, \hat{q}_1^H) - C'(\hat{q}_2^L) \quad = 0. \tag{2}$$

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[12]See, for instance, McAfee and Schwartz (1994).

[13]Details are available in Appendix 7.1.1.

[14]A proof is available in Appendix 7.1.1.

[15]If the difference in quality is large enough and if competition among retailers is strong enough, there may be no demand for the low-quality good. However, we focus our analysis on cases where there is positive demand for the two goods.

Henceforth, we define:

$$\Upsilon^H \equiv P_1^H(\hat{q}_1^H, \hat{q}_2^L)\hat{q}_1^H - C(\hat{q}_1^H) \tag{3}$$

$$\Upsilon^L \equiv P_2^L(\hat{q}_2^L, \hat{q}_1^H)\hat{q}_2^L - C(\hat{q}_2^L) \tag{4}$$

Case (H,H)

Given the symmetry, we denote the optimal quantity choices vector in this case by (q^{H*}, q^{H*}). Because the equilibrium wholesale price $w^{H*} = C'(q^{H*} + q^{H*})$, each retailer i chooses its quantity q^{H*} to maximize its joint profit with producer H:

$$P_i^H(q_i^H, q_j^H)q_i^H - C(q_i^H + q_j^H),$$

and q^{H*} is thus implicitly defined by the following FOC:

$$\frac{\partial P^H(q^{H*}, q^{H*})}{\partial q_i^H}q^{H*} + P^H(q^{H*}, q^{H*}) - C'(q^{H*} + q^{H*}) = 0 \text{ for } i \neq j \tag{5}$$

Similarly, in the event that only one agreement is reached between H and i, the retailer maximizes its joint profit with H:

$$P_i^H(q_i^H, 0)q_i^H - C(q_i^H),$$

and the optimal quantity q^{H0} is implicitly defined by the following FOC:

$$\frac{\partial P_i^H(q^{H0}, 0)}{\partial q_i^{H0}}q^{H0} + P_i^H(q^{H0}, 0) - C'(q^{H0}) = 0 \text{ for } i \neq j \tag{6}$$

Henceforth, we define:

$$\Upsilon^{HH} \equiv 2P^H(q^{H*}, q^{H*})q^{H*} - C(2q^{H*}) \tag{7}$$

$$\Upsilon^{H0} \equiv P_i^H(q^{H0}, 0)q^{H0} - C(q^{H0}) \tag{8}$$

We obtain the following lemma:

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Lemma 1 *In case (H, L) retailer 1 sells $\hat{q}_1^H$ and retailer 2 sells $\hat{q}_2^L$, the profit generated by product H is Υ^H and the profit generated by product L is Υ^L. In case (H, H), both retailers choose q^{H*} and total industry profit is Υ^{HH}.*

We now solve the game backward to determine how the industry profit is shared between the producer and the retailers in the bargaining stage.

3.2 Stage 2- Bargaining over fixed fees

In this bargaining stage, the profit is shared according to the split-the-difference rule. Note that it is simpler to consider that firms bargain over total tariffs T_i^K which is strictly equivalent to bargaining over fixed fees F_i^K, because $T_i^K = w_i^K q_i^K + F_i^K$ and the equilibrium wholesale unit prices have already been determined. We again consider in turn cases (H,L) and (H,H).

Case (H,L)

Retailers purchase from different producers, and therefore the two negotiations are independent: firms have no outside option profit in their bargaining. According to the split-the-difference rule, the equilibrium tariff $\hat{T}_i^K$ (where $\hat{T}_i^K = \hat{w}_i^K \hat{q}_i^K + \hat{F}_i^K$) is defined as follows:

$$(1 - \alpha)[P_i(\hat{q}_i^K, \hat{q}_i^{-K})\hat{q}_i^K - \hat{T}_i^K] = \alpha[\hat{T}_i^K - C(\hat{q}_i^K)] \tag{9}$$

where the left-hand-side term in brackets is the profit captured by retailer i (i.e., the incremental gain from trade of retailer i) and the right-hand side term in brackets, is the profit of producer K (i.e., the incremental gain from trade of producer K). According to the the split-the-difference rule, if $\alpha = \frac{1}{2}$, retailer i and producer K set the tariff in order to split equally bilateral joint profits Υ^K. If $\alpha = 1$ (resp. $\alpha = 0$), the retailer (resp. the producer) has all the power and thus captures Υ^K. We thus obtain:

$$\hat{T}_i^K = (1 - \alpha)P_i(\hat{q}_i^K, \hat{q}_i^{-K}) + \alpha C(\hat{q}_i^K) \tag{10}$$

Using (3), the equilibrium transfer $\hat{T}_i^{K}$[16] is such that the retailer (resp. the producer)

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[16]Note that the equilibrium fixed fee is $\hat{F}_i^K = \hat{T}_i^K - \hat{w}_i^K \hat{q}_i^K$.

captures a slice α (resp. $1 - \alpha$) of Υ^K:

Lemma 2 *When retailers stock differentiated products, each retailer i (resp. producer K) captures a slice α (resp. $1 - \alpha$) of the optimal bilateral joint profits Υ^K.*

    Proof. It is clear using (3) and (10) because retailer i captures $\hat{\pi}_i^K = P_i(\hat{q}_i^K, \hat{q}_i^{-K})\hat{q}_i^K - \hat{T}_i^K = \alpha(P_i(\hat{q}_i^K, \hat{q}_i^{-K}) - C(\hat{q}_i^K)) = \alpha\Upsilon^K$. A detailed proof is available in Appendix 7.1.2. ∎

Case (H,H)

    In contrast to case (H,L), the producer H has an outside option in its bargaining with each retailer. If H and 1 fail to reach an agreement, then H bargains with only one firm (retailer 2) and the producer's status quo profit is therefore $(1 - \alpha)\Upsilon^{H0}$ (straightforward from Lemma 2). Still, retailers have no outside option in their negotiations because they have committed themselves in stage 1 to bargaining with one producer only. As in Stole and Zwiebel (1996) and de Fontenay and Gans (2005), the outcome of the negotiation is independent of the sequence of negotiations because the contract terms agreed upon by one pair are not observed by other pairs.[17] First, a sufficient condition for the bargaining with the two retailers to be successful is that total industry profit in that case exceeds the producer's outside option profit, i.e., $\Upsilon^{HH} > (1 - \alpha)\Upsilon^{H0}$. If this condition does not hold, H has no incentive to bargain with the two retailers, and there is a breakdown in one of the two negotiations. Now, if $\Upsilon^{HH} > (1 - \alpha)\Upsilon^{H0}$ holds, given the symmetry between retailers, bilateral joint profits to split between a retailer and producer H are $\frac{\Upsilon^{HH}}{2}$. According to the split-the-difference rule, the equilibrium tariff $T_j^{H*} = T_i^{H*} = T^{H*}$ is defined as follows:

$$(1 - \alpha)[P^H(q^{H*}, q^{H*}) - T^{H*}] = \alpha[2T^{H*} - C(q^{H*} + q^{H*}) - (1 - \alpha)\Upsilon^{H0}] \quad (11)$$

where the left-hand-side term in brackets is the profit captured by retailer i (i.e., the incremental gain from trade of retailer i) and the right-hand-side term in brackets is the

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[17]If in contrast contract terms were publicly observable, the order of negotiations could matter (e.g., Marx and Shaffer (2007)).

incremental gain from trade for producer H. We therefore obtain:

$$T^{H*} = \frac{(1-\alpha)P^H(q^{H*}, q^{H*})}{(1+\alpha)} + \frac{\alpha C(q^{H*} + q^{H*})}{(1+\alpha)} + \frac{\alpha(1-\alpha)\Upsilon^{H0}}{(1+\alpha)} \qquad (12)$$

Equilibrium retailers' profits are then obtained by replacing (12) into the left-hand-side term in brackets in (11). Using (7) and simplifying, we obtain:

$$\pi_1^{H*} = \pi_2^{H*} = \alpha\frac{\Upsilon^{HH}}{2} + \frac{\alpha(1-\alpha)}{1+\alpha}(\frac{\Upsilon^{HH}}{2} - \Upsilon^{H0}). \qquad (13)$$

We define $\gamma \equiv \frac{\pi_1^{H*}}{\frac{\Upsilon^{HH}}{2}}$. We now obtain the following lemma:

Lemma 3 *When $\Upsilon^{HH} > (1-\alpha)\Upsilon^{H0}$, if both retailers stock the high-quality good H, each retailer i (resp. producer H) captures a share $\gamma = \alpha + \frac{\alpha(1-\alpha)}{1+\alpha}(1 - \frac{2\Upsilon^{H0}}{\Upsilon^{HH}})$ of the optimal bilateral joint profits $\frac{\Upsilon^{HH}}{2}$. Therefore, suppliers' differentiation may increase a retailer's buyer power when $\frac{\Upsilon^{HH}}{2} < \Upsilon^{H0}$, because then $\gamma < \alpha$. In addition, when $\Upsilon^{HH} < (1-\alpha)\Upsilon^{H0}$, only one retailer can sell H in equilibrium.*

Proof. A complement of the proof is available in Appendix 7.1.3. ∎

Note also that, when selling L instead of H, the retailer nonetheless improves its buyer power (i.e., the slice of the pie it obtains) but also improves the buyer power of the other retailer by depriving producer H of its outside option in the negotiation. We now go backward, solving stage 1 of the game where retailers choose their assortment.

3.3 Optimal listing choice

To solve that stage, we now make the following restrictions on equilibrium profits:

- **Assumption A**: $\frac{\Upsilon^{HH}}{2} > \Upsilon^L$

- **Assumption B**: $\frac{\Upsilon^{HH}}{2} \leq \Upsilon^{H0}$

- **Assumption C**: $\Upsilon^{H0} < \frac{\Upsilon^{HH}}{(1-\alpha)}$

Under Assumption A, if retailers had all the bargaining power in their negotiation with the producer (i.e., if $\alpha = 1$), retailer 2 would always choose also to stock H; indeed,

retailer 2 captures Υ^L when stocking L and $\frac{\Upsilon^{HH}}{2}$ when stocking H. Assumption A is crucial to prevent any other source of differentiation from happening in our model. Assumption B derives from lemma 3 and implies that retailer 2 always obtains a smaller share $\gamma < \alpha$ of its bilateral profit when choosing also to stock H. Again this assumption is a necessary condition for our result: it ensures that producers' differentiation increases a retailer's slice of the pie, i.e., a retailer's buyer power.[18]

Finally, if Assumption C did not hold, the producer H would never have any incentive to bargain with the two retailers in case (H, H), and only one retailer would be active in equilibrium. This last assumption also enables us to rule out another potential motive for differentiation: producers' differentiation to avoid exclusion.[19].

We provide several illustrations in the next section showing that Assumptions A and B are reasonable for a large range of industrial organization models. We obtain the following proposition:

Proposition 4 *Under Assumptions A-C, there exists a unique equilibrium (H, H) when $\Upsilon^L \leq \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$ and a unique equilibrium (H, L) when $\Upsilon^L > \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$. When equilibrium (H, L) exists, the sole motive for a retailer to choose to offer good L is to increase its buyer power: it thus obtains a larger slice of smaller bilateral joint profits.*

Proof. First, as shown in Appendix 7.1.4, there is no equilibrium (L,L). We can therefore assume that retailer 1 chooses H in equilibrium. Under Assumption A, the pie to be shared by retailer 2 is always smaller when buying from L than H. Under Assumption B, the slice of profit obtained by retailer 2 when buying from L is always higher than the slice it obtains when buying from H. Comparing retailer 2's profit in the two cases, i.e., $\alpha\Upsilon^L$ in case (H, L) and the expression given by eq.(13) in case (H, H), it is clear that retailer 2 has an incentive to deviate toward L when $\Upsilon^L > \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$. Thus, equilibrium (H, H) only exists when $\Upsilon^L \leq \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$. When $\Upsilon^L > \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$, there is an equilibrium (H, L). Under Assumption B, $0 < \frac{\Upsilon^{HH}-(1-\alpha)\Upsilon^{H0}}{(1+\alpha)} < \frac{\Upsilon^{HH}}{2}$ and therefore intervals of existence for equilibria (H, H) and (H, L) are non-empty. ∎

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[18]In this paper, we clearly distinguish the exogenous bargaining power parameter α from the retailer's buyer power, which is the slice of bilateral joint profits that a retailer obtains. This slice is endogenously determined by the vertical market structure.

[19]We discuss such a motive in the illustration with retail competition in Section 4.1

This Proposition 4 establishes our main result that producers' differentiation may be a source of buyer power for a retailer. This result is in the same vein as the incentive of a duopoly to differentiate its product in order to relax competition, as highlighted in Gabzsewicz and Thisse (1979) or Shaked and Sutton (1982). In contrast, in this paper, the only motivation for a retailer to switch in favor of the low-quality good is to increase its buyer power. Assumption A ensures that no other motive of differentiation, such as to relax downstream competition, can arise in our model: fully powerful competing retailers ($\alpha = 1$) would always choose to offer the high-quality good.

We now derive several industrial organization models and the welfare implications of our main result.

4 Illustrations

We develop below two different illustrations in which retailers are either competitors in the same market or active in separate markets. We show that in both cases retailer 2 may choose to stock product L for a buyer power motive only, and we highlight that this may be harmful for consumers and welfare.

4.1 Retail Competition

Assume that retailers compete à la Cournot in the same market and that the cost function is linear $C(q) = c.q$.

Case (H,L)

In this case, each consumer θ now compares its surplus from purchasing H at retailer 1, $S^H(\theta) = \theta h - P_1^H$, to the surplus from purchasing L at retailer 2, $S^L(\theta) = \theta l - P_2^L$. The consumer who is exactly indifferent between purchasing H and L is of the type $\widetilde{\theta} = \frac{P_1^H - P_2^L}{h-l}$. Total demand for good H at retailer 1 is thus $q_1^H = \int_{\widetilde{\theta}}^{\overline{\theta}} f(\theta)d\theta$ and total demand for good L at retailer 2 is thus $q_2^L = \int_{\frac{P_2^L}{l}}^{\widetilde{\theta}} f(\theta)d\theta$. By inverting these demands, we obtain $P_1^H(q_1^H, q_2^L)$ and $P_2^L(q_1^H, q_2^L)$ the corresponding inverse demand functions.

Case (H,H)

Consumers purchase H as long as $S(\theta) \geq 0$ and thus total demand for H is $Q^H =$

$\int_{\frac{P^H}{k}}^{\overline{\theta}} f(\theta)d\theta$. In equilibrium, offer equals demand, and therefore $Q^H = \sum_{i=1,2} q_i^H$. We thus obtain an inverse demand function $P^H(q_1^H + q_2^H)$. Assumption B always holds in our example. Indeed, with Cournot competition and linear costs, a monopoly profit is higher than the industry profit in a Cournot duopoly, i.e., $\Upsilon^{HH} < \Upsilon^{H0}$. [20]

Proposition 5 *Under Assumptions A and C, when retailers compete à la Cournot in the same market and production costs are linear, there exists a unique equilibrium (H, L) when $\Upsilon^L > \frac{\Upsilon^{HH} - (1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$ and a unique equilibrium (H, H) when $\Upsilon^L < \frac{\Upsilon^{HH} - (1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$. When equilibrium (H, L) exists, the sole motive for a retailer to choose to offer good L is to increase its buyer power.*

Assumption A is key here. Under Assumption A, retailer 2 never has an incentive to stock product L to relax downstream competition with retailer 1 who sells H. The classic motive for product differentiation is excluded here thanks to Assumption A. We show further that, in the Cournot competition case, when consumers are uniformly distributed, Assumption A always holds.

Because $\Upsilon^{HH} < \Upsilon^{H0}$, Assumption C may not hold; in that case, producer H would have no incentive to bargain with the two retailers in case (H, H). Therefore, absent Assumption C, if both retailers chose to stock H, there would be a breakdown in one of the two negotiations in the bargaining stage, and only one monopolist retailer would offer product H in equilibrium. In that case, retailer 2 would choose to stock L in order to avoid being excluded. However, under Assumption C, the sole motive for differentiation remains to increase the retailer's buyer power.

For example, with a uniform distribution of $\theta \in [0, 1]$, and normalizing the cost to 0 and h to 1, we have $\Upsilon^L = \frac{l}{(4-l)^2}$ and $\frac{\Upsilon^{HH}}{2} = \frac{1}{9}$. We obtain that retailer 2 chooses to differentiate if $l \in [\widehat{l}, 1[$, defined as follows:[21]

$$\widehat{l} = \begin{cases} \frac{2+6(2+9\alpha - \sqrt{5(1+10\alpha+9\alpha^2)})}{(9\alpha-1)} & \text{if } \alpha \geq \frac{1}{9}, \\ 0 & \text{if } \alpha < \frac{1}{9}. \end{cases} \qquad (14)$$

---

[20]Indeed with Cournot and linear costs, eq (5) is rewritten as: $P^H(q_1^{H*} + q_2^{H*}) + \partial_{q_1^H} P^H(q_1^{H*} + q_2^{H*})q_1^{H*} - c = 0 > P^H(q_1^{H*} + q_2^{H*}) + \partial_{q_1^H} P^H(q_1^{H*} + q_2^{H*})(q_1^{H*} + q_2^{H*}) - c$, given that $\partial_{q_1^H} P^H(q_1^{H*} + q_2^{H*}) < 0$; Therefore, we have $q_1^{H*} + q_2^{H*} > q^{H0}$. It is straightforward then that if total Cournot quantity is always larger than the monopoly quantity, total industry Cournot profit is always lower than the monopoly profit.

[21]The example is derived in Appendix 7.2.

When $\alpha \geq \frac{1}{9}$ (i.e., under Assumption C), the threshold $\widehat{l}$ strictly increases in α. Indeed, the more buyer power the retailers have, the less they need to increase it through suppliers' differentiation. Figure 2 represents equilibria in this example, with the parameter α varying in the interval $[0,1]$ in abscissa and l varying in the interval $[0,1]$ in ordinate.
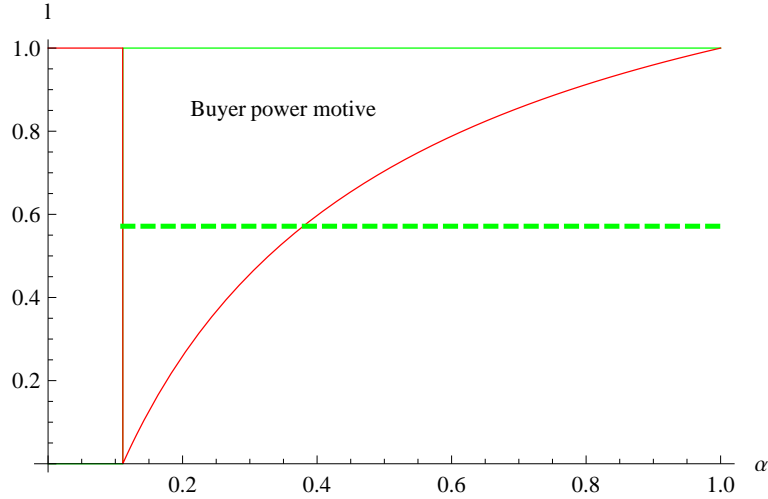

Figure 1: Representation for $h = 1$ and $c = 0$.

Regarding the analysis of consumer surplus, whenever $\alpha \geq \frac{1}{9}$, it is always damaging for consumer surplus and social welfare to have one retailer selling L. Indeed, when this happens, retail competition is relaxed, inducing a price increase that hurts consumers. Note, however, that, when $l > \frac{4}{7}$ (i.e., above the dashed green line on the graph), producers' differentiation is also damaging for industry profit.[22] In our example, the harm caused to consumers is always larger than the potential benefit for the industry, and thus social welfare always decreases. Note also that the damage caused to consumers strictly decreases in l but is independent of α. However, when $\alpha < \frac{1}{9}$ (when Assumption C does not hold), if the two retailers had selected H, only one would be active in equilibrium, thus leading to the monopoly outcome; thus, the differentiation of suppliers, by preventing the exclusion of one retailer, always increases consumer surplus, whereas it decreases industry profit.

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[22]In contrast, when vertical differentiation is strong enough, differentiation softens downstream competition and industry profit becomes closer to the monopoly profit.

4.2 Retailers are active in separate markets

Assume now that each retailer is a monopolist in its market and that market size is normalized to 1. Retailer i's inverse demand function is $P_i^K(q_i^K, 0) = P_i^K(q_i^K)$ if it stocks the good K where q_i^K is the quantity offered. We also assume that production costs are strictly convex, i.e., $C''(q) > 0$.

Consumers purchase the good as long as $S(\theta, k) \geq 0$ and total demand for K at retailer i is $q_i^K = \int_{\frac{P_i^K}{k}}^{\overline{\theta}} f(\theta) d\theta$. Inverting this expression gives the inverse demand function $P_i^K(q_i^K)$ in each market.

In this framework, Assumption B is always verified. On the one hand, we have $\Upsilon^{H0} = \Upsilon^H$. Indeed, as the two retailers are active in separate markets, there is no cross-effect of q_{-i} on $P_i(q_i)$, and the quantity sold by the retailer 1 in case (H, L) is the monopoly quantity, i.e., $\hat{q}_1^H = q^{H0}$. Moreover, the strict cost convexity implies that $\frac{\Upsilon^{HH}}{2} < \Upsilon^{H}$[23] and therefore we have $\frac{\Upsilon^{HH}}{2} < \Upsilon^H = \Upsilon^{H0}$.

In contrast, Assumptions A and C do not always hold. Indeed, the cost convexity assumption implies that $\frac{\Upsilon^{HH}}{2} < \Upsilon^H$; as $\Upsilon^L < \Upsilon^H$, Assumption A may either hold or not. Assumption A is key as it enables us to exclude the case where differentiation could arise for a cost efficiency motive. Assumption C implies an upper bound to the convexity of the cost function; otherwise, the producer H would have an incentive to exclude one of the retailers. By definition, when $l = 0$, $\Upsilon^L = 0$ because consumers derive no utility from the consumption of a 0-quality good. As Υ^L strictly increases in l and tends toward Υ^H when l goes to h, if $\Upsilon^L \in (\frac{\Upsilon^{HH}}{2}, \Upsilon^H)$, it could be profitable for retailer 2 to stock L just because it then bargains over a larger pie, i.e., larger bilateral joint profit. Such a cost efficiency motive could then also explain the equilibrium (H,L). However, under Assumption A, i.e., $\Upsilon^L < \frac{\Upsilon^{HH}}{2}$, and, when $\Upsilon^L \in (\frac{\Upsilon^{HH} - (1-\alpha)\Upsilon^{H0}}{(1+\alpha)}, \frac{\Upsilon^{HH}}{2})$, retailer 2 stocks L with the sole purpose of increasing its buyer power. We thus obtain the following proposition:

Proposition 6 *Under Assumption A and C, when retailers are active in separate markets and production costs are strictly convex, there exists a unique equilibrium (H, L)*

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[23]If costs are linear, eq (1) and eq (5) become similar because retailers operate in separate markets. Therefore $\hat{q}_1^H = q^{H*} = q^{H0}$ and $\frac{\Upsilon^{HH}}{2} = \Upsilon^H = \Upsilon^{H0}$.

when $\Upsilon^L > \frac{\Upsilon^{HH} - (1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$ and a unique equilibrium (H, H) when $\Upsilon^L \leq \frac{\Upsilon^{HH} - (1-\alpha)\Upsilon^{H0}}{(1+\alpha)}$. When equilibrium (H, L) exists, the sole motive for a retailer to choose to offer good L is to increase its buyer power.

The insight for this result is as follows. If the producer has a convex cost function, the marginal cost of H is reduced in the case where it deals with only one retailer. This effect tends to reinforce its status quo profit in the bargaining with one retailer, in that the producer then obtains a larger slice of the industry profit when dealing with the two retailers. Conversely, when costs are convex, each retailer has stronger buyer power, i.e., obtains a larger slice of the industry profit, when each one sources from a different producer. Chipty and Snyder (1999) and Inderst and Wey (2007) have previously shown that the convexity of producers' costs may also explain why a larger buyer has stronger bargaining power than a smaller buyer. This is because each buyer regards itself as marginal in its negotiation with the producer. Therefore, the incremental value of the relationship with an inframarginal retailer is always higher than the incremental value of the relationship with the marginal retailer. Then, the profit that the producer extracts from the large retailer (composed, for instance, of the marginal retailer and the inframarginal retailer) is strictly lower than the profit it extracts from two small retailers (each being a marginal retailer).[24]

Concerning industry profits, we know it is optimal for a fully merged industry to have one of the retailers selling product L if $\Upsilon^L \geq \Upsilon^{HH} - \Upsilon^H$. Equilibrium (H,L) exists when $\Upsilon^L > \frac{(\Upsilon^{HH} - \Upsilon^H(1-\alpha))}{(1+\alpha)}$ and this threshold reaches its lowest value for $\alpha = 0$ and is then equal to $\Upsilon^{HH} - \Upsilon^H$. Therefore, when an equilibrium (H,L) exists, it is always optimal for the industry.

Regarding consumer surplus, the choice by retailer 2 to stock L has the following consequences. For consumers located in 1's market, the effect is strictly beneficial; because of cost convexity, the marginal cost of good H is reduced when retailer 2 refuses to also stock H, which allows retailer 1 to sell a larger quantity of H at a lower price. For consumers located in 2's market, the decrease in marginal cost also has a positive effect, but the downgrading in quality is harmful. The total effect on consumer surplus

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[24]Chemla (2003) has also shown that an upstream monopoly could obtain greater seller power by committing itself to dealing with multiple retailers, when the producer incurs a fixed cost per retailer that strictly increases with the number of retailers. The cost convexity is then due to agency costs in an incomplete contract environment rather than to the production cost.

and welfare depends on the definitions of both $f(\theta)$ and $C(q)$.

We derive an illustrative example with uniform distribution of θ, a quadratic cost function $C(q) = cq^2/2$, where we normalize $h = 1$.[25] Equilibrium values are $\Upsilon^{HH} = \frac{1}{(2+2c)}$, $\Upsilon^L = \frac{l^2}{(2c+4l)}$, and $\Upsilon^H = \frac{1}{(4+2c)}$. In this example, Assumption C is always verified as $\Upsilon^{HH} > \Upsilon^H$.

Figure 2 represents equilibria settings when $h = 1$ and $c = 0.5$, with the parameter α varying in the interval $[0,1]$ in abscissa and l varying in the interval $[0.5,1]$ in ordinate. The area where (H, L) is in equilibrium appears above the plain red curve. Below the
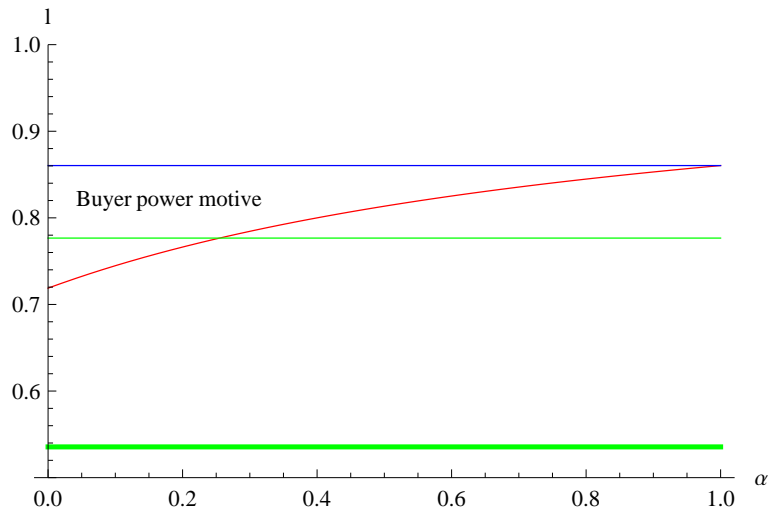

Figure 2: Representation for $h = 1$ and $c = 0.5$.

red curve, the equilibrium (H, H) arises. Above the blue line, bilateral joint profits are increased through the differentiation of suppliers. Therefore, in the area within the blue and red frontiers, the differentiation of suppliers arises from a buyer power motive only. The plain green line indicates the limit above which it is beneficial for consumers located in the second market to buy the low-quality good. The thick green line indicates the frontier above which differentiation of suppliers benefits consumers on average.

It is interesting to discuss the main assumption of this illustration, i.e., the strict cost convexity. Note, first, that in case of concave or linear costs, retailer 2 would always choose to also stock H because (i) its bilateral joint profits with H would be higher and (ii) it would receive a slice of its bilateral joint profits with H that is higher than (with

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[25]This example is developed in detail in Appendix 7.3.

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concave costs) or equal to (with linear costs) the slice it would obtain in negotiating with L. This assumption of strict cost convexity is key for the result when retailers are active in separate markets.

5 Robustness

In this section, we discuss the robustness of our results when considering imperfect price competition and changing the bargaining framework.

5.1 An example with imperfect price competition

Our results readily extend to an imperfect price competition setting.[26] To see this, we use a linear demand specification where β is the degree of horizontal differentiation among retailers.[27]

- In case (H, L)

$$\begin{cases} p_1^H = h - q_1^H - \beta q_2^L, \\ p_2^L = l - q_2^L - \beta q_1^H \end{cases}$$

- In case (H, H), for $j \neq i$ and $i = 1, 2$:

$$p_i^H = h - q_i^H - \beta q_{-i}^H.$$

Although passive beliefs are sufficient to ensure that wholesale prices are set to marginal cost in the Cournot case, with price competition we need to use the contract equilibrium concept introduced by Crémer and Riordan (1987), which implies both passive beliefs and schizophrenia of the negotiator, which prevent multilateral deviations by H when it bargains with the two retailers. In this framework of assumptions, wholesale prices are set to marginal cost when the retailers compete in prices (see O'Brien and Shaffer (1992), Rey and Vergé (2010)). To simplify the expressions below, we also normalize the marginal cost to 0.

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[26]The complete resolution of the following example is provided in Appendix 7.4.

[27]Here, we drop the Mussa and Rosen (1978) utility specification in favor of a simpler representative consumer quadratic utility function. Indeed, we need to introduce another imperfect competition parameter β to avoid Bertrand competition in the case where both retailers offer quality H, i.e, in case (H, H).

We restrict our attention to cases where either competition intensity is not too high, or the low-quality is not too low, to ensure that there is a positive market share for each good in the case (H, L). We obtain the following condition when $h = 1$:

$$l > \underline{l} = \frac{\beta}{2 - \beta^2} \tag{15}$$

We show that proposition 5 extends to the case of imperfect price competition. When competition is sufficiently intense, there exists a positive threshold α' such that:

Proposition 7 *Under Assumptions A-C, there is a threshold $\tilde{l}$ such that, for all $l \in [Max(\tilde{l}, \underline{l}), h]$, retailer 2 chooses to purchase from L for the sole motive of improving its buyer power.*

Proof. See Appendix 7.4. ∎

Regarding consumer surplus, results are similar to those obtained in the Cournot competition case.

5.2   Robustness to the bargaining concept

In this section, we discuss the robustness of our results to our bargaining assumptions. In particular, we examine whether our results hold if the contracts negotiated are binding rather than non-binding. In our model, we have assumed, as in Stole and Zwiebel (1996), that, in the case of a breakdown in one pair's negotiation, this knowledge becomes public and the other pair can renegotiate accordingly. This assumption plays a role in our model only in case (H, H). Assume now that the negotiations between the two pairs are simultaneous and that, in the case of a breakdown in one pair's negotiation, the contract reached by the other pair is binding, or that this breakdown is no longer observed by the other pair, which would have the same effect. Our results would still be valid as long as the production cost is strictly convex. In a new set-up with binding contracts, even if there is a breakdown in the negotiation between, say, H and 1, H and 2 would keep the same contract with the same marginal cost and tariff. Therefore, in case of a breakdown between H and 1, the quantity sold by 2 remains q^{H*}, defined by (5). We

thus need to define the corresponding joint profits:

$$\Upsilon^{H\prime} \equiv P_i(q^{H*})q^{H*} - C(q^{H*}) \tag{16}$$

with $\Upsilon^{H\prime} \leq \Upsilon^H$ when $C''(q) \geq 0$. The split-the-difference-rule for the negotiation $H-i$ now gives the following:

$$(1-\alpha)[P_i(q^{H*})q^{H*} - T_i] = \alpha[T_i - C(q^{H*} + q^{H*}) + C(q^{H*})] \tag{17}$$

where the left-hand term in brackets is the profit of retailer i and the right-hand term in brackets is the incremental profit of H from trade with i. The right-hand term derives from the following difference:

$$T_i + T_{-i} - C(q^{H*} + q^{H*}) - (T_{-i} - C(q^{H*})) \tag{18}$$

As both retailers are symmetric, $T_i = T_{-i}$ and using eq (16), we obtain:

$$\pi_i^{**} = \alpha(\Upsilon^{HH} - \Upsilon^{H\prime})$$

Absent cost convexity, i.e., when $\Upsilon^{H\prime} = \Upsilon^H = \frac{\Upsilon^{HH}}{2}$, each retailer would obtain a slice α of bilateral joint profits $\frac{\Upsilon^{HH}}{2}$. In contrast, if costs are strictly convex, this slice is strictly lower than α and therefore Assumption B holds.

Finally, our results hold in the illustration with separate retailers and strictly convex production costs, whereas our results no longer hold in the illustration with retail competition and linear costs. Note, however, that our results would remain valid with retail competition and strictly convex production costs.

6   Conclusion

The main result obtained in this paper, that the differentiation of suppliers can be a source of buyer power, is novel. We have shown that, in some cases, retailers who seek to increase their buyer power by producers' differentiation may turn to a lower-quality good supplier. Our findings then also imply that a retailer may not always offer the "best

product"to consumers. We prove that, in the case of retail competition, differentiation for buyer power motives could be harmful both for consumers and industry profit. To motivate the assortment choice of our stage 1, we have introduced the example of hard discounters who specialize in selling non-branded goods to consumers. More specifically, this may also represent the choice of a retailer to offer private labels for a given product category. Of course, a retailer may experience other benefits as a result of specializing in the discounter format or in private labels. For instance, producers offering low-quality goods may also have lower production costs or lower bargaining power with respect to the retailer. While these may be additional explanations for the rise of hard discounters or private labels, they only add to our argument. Our model sets aside these forces to show that, all other things being equal (product cost, bargaining power), a retailer may have an incentive to switch to a low-quality good assortment in order to increase its buyer power. In terms of policy implications, our result argues for a retail regulation that would limit the switch of classic supermarkets with branded goods into hard discounters or limit the development of private labels. Note that our argument is only valid for a fixed retail market structure. If developing a hard discount format enables a new retailer to enter and compete in the market, then our analysis is reversed. A promising avenue for further research would be the study of suppliers' incentives to invest either in cost reduction technologies, affecting the convexity of the cost function (cf. Inderst and Wey (2007)), or in quality, in order to create more (or instead limit) differentiation of retailers.

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7 Appendices

7.1 General case

7.1.1 Complement of proof for stage 3

Case (H,L)

Retailer i's profit is:

$$\pi_i^K = P_i(q_i^K, q_{-i}^{-K})q_i^K - \hat{w}_i^K q_i^K - F_i^K. \tag{19}$$

Each retailer i maximizes its profit and $\hat{q}_i^K$ is then the solution of the following FOC:

$$\frac{\partial P_i(\hat{q}_i^K, q_{-i}^{-K})}{\partial q_i^K}\hat{q}_i^K + P_i(\hat{q}_i^K, \hat{q}_{-i}^{-K}) - \hat{w}_i^K = 0 \tag{20}$$

Given that $\hat{w}_i^K = C'(\hat{q}_i^K)$ for $K = H, L$, we obtain eq (1) and (2).

Case (H,H)

Retailer i's profit is:

$$\pi_i^H = P_i(q_i^H, q_{-i}^H)q_i^H - w_i^{H*}q_i^H - F_i^H. \tag{21}$$

Each retailer i maximizes its profit and, given symmetry, q^{H*} is then the solution of the following FOC:

$$\frac{\partial P^H(q^{H*}, q^{H*})}{\partial q_i^H}q^{H*} + P^H(q^{H*}, q^{H*}) - w_i^{H*} = 0 \tag{22}$$

Using $w_i^{H*} = C'(q^{H*} + q^{H*})$, we obtain eq (5).

7.1.2 Complement of Proof for lemma 2

Case (H,L)

Each producer-retailer pair bargains to split its bilaterally efficient joint profit. The Nash programme between K and i therefore is rewritten:

$$\underset{T_i^K}{Max}[P_i(\hat{q}_i^K, \hat{q}_{-i}^{-K})\hat{q}_i^K - T_i^K]^\alpha [T_i^K - C(\hat{q}_i^K)]^{(1-\alpha)}$$

Deriving the log of the above programme with respect to T_i^K gives the following FOC:

$$-\alpha[T_i^K - C(\hat{q}_i^K)] + (1-\alpha)[P_i(\hat{q}_i^K, \hat{q}_{-i}^{-K})\hat{q}_i^K - T_i^K] = 0$$

which gives the split-the-difference-rule presented in eq (9).

7.1.3 Complement of Proof for lemma 3

Case (H,H)

Each producer-retailer pair bargains to share its bilaterally efficient profit. The Nash programme between H and i therefore is rewritten:

$$\underset{T_i^H}{Max}[P^H(q^{H*}, q^{H*}) - T_i^H]^\alpha [T_i^H + T_{-i}^H - C(q^{H*} + q^{H*}) - (1-\alpha)\Upsilon^{H0}]^{(1-\alpha)}$$

Deriving the log of the above programme with respect to T_i^H and using $T_{-i}^{H*} = T_i^{H*} = T^{H*}$, we obtain the following FOC:

$$-\alpha[2T^{H*} - C(q^{H*} + q^{H*}) - (1-\alpha)\Upsilon^{H0}] + (1-\alpha)[P^H(q^{H*}, q^{H*}) - T^{H*}] = 0$$

which gives the split-the-difference-rule presented in eq (11).

7.1.4 Non-existence of equilibrium (L,L)

We now prove that indeed there is no equilibrium (L,L). Each retailer i chooses its quantity q_i^L to maximize its joint profit with producer L:

$$P_i^L(q_i^L, q_{-i}^L)q_i^L - C(q_i^L + q_{-i}^L),$$

Given symmetry, both retailers choose the same optimal quantity $q_1^{L*} = q_2^{L*} = q^{L*}$, implicitly defined by the following FOC:

$$\frac{\partial P^L(q^{L*}, q^{L*})}{\partial q_i^L}q^{L*} + P^L(q^{L*}, q^{L*}) - C'(q^{L*} + q^{L*}) = 0 \text{ for } i \neq j$$

In case only one agreement is reached between L and i, the retailer maximizes its joint profit with L:

$$P_i^L(q^L, 0)q^L - C(q^L),$$

and the optimal quantity q^{L0} is implicitly defined by the following FOC:

$$\frac{\partial P_i^L(q^{L0}, 0)}{\partial q^{L0}} q^{L0} + P_i^L(q^{L0}, 0) - C'(q^{L0}) = 0 \quad \text{for } i \neq j$$

Henceforth, we define:

$$\Upsilon^{LL} \equiv 2P^L(q^{L*}, q^{L*})q^{L*} - C(2q^{L*}) \tag{23}$$

$$\Upsilon^{L0} \equiv P_i^L(q^{L0}, 0)q^{L0} - C(q^{L0}) \tag{24}$$

and by symmetry with eq(13), each retailer obtains a profit :

$$\pi_1^{L*} = \pi_2^{L*} = \alpha \frac{\Upsilon^{LL}}{2} + \frac{\alpha(1-\alpha)}{1+\alpha}\left(\frac{\Upsilon^{LL}}{2} - \Upsilon^{L0}\right). \tag{25}$$

The profit that retailer 1, say, would obtain by deviating toward (H,L) is $\alpha\Upsilon^H$ according to lemma (2). Note that we have $\Upsilon^{LL} < \Upsilon^{HH}$. Moreover, under Assumption B and symmetry between producers, we have $\frac{\Upsilon^{LL}}{2} < \Upsilon^{L0}$.

$$\pi_1^{L*} < \alpha \frac{\Upsilon^{HH}}{2} \leq \alpha\Upsilon^H$$

The last inequality comes from our assumption $C'' \geq 0$ and implies that there is always a profitable deviation toward (H, L).

7.2 Retail Competition

This illustrative example is derived for θ uniformly distributed over $[0, 1]$ and for a linear cost function with a unit cost $c = 0$.

- When the two retailers stock H

The equilibrium contract is $q^{H*} = \frac{1}{3}$. The equilibrium total joint profit is $\Upsilon^{HH} = \frac{2}{9}$ and bilateral joint profits are $\frac{\Upsilon^{HH}}{2}$. The equilibrium tariff $T^{H*} = \frac{(12+\alpha(5-9\alpha))}{36(1+\alpha)}$ and retailers' equilibrium profit is: $\pi_i^{H*} = \frac{\alpha(9\alpha-1)}{36(1+\alpha)}$ for $i = 1, 2$.

Consumer surplus is $S^* = \frac{2}{9}$. Welfare is $W^* = \frac{4}{9}$.

- If one retailer stocks L

The equilibrium contract is $\hat{q}_1^H = \frac{2-l}{4-l}$ and $\hat{T}_1^H = \frac{(2-l)^2(1-\alpha)}{(4-l)^2}$ between H and 1, $\hat{q}_2^L = \frac{1}{(4-l)}$, and $\hat{T}_2^L = \frac{l(1-\alpha)}{(4-l)^2}$ between 2 and L. Note that there is a positive demand for the low-quality good for any $l > 0$. Equilibrium joint profits are: $\Upsilon^L = \frac{1}{(4-l)^2}$ and $\Upsilon^H = \frac{(2-l)^2}{(4-l)^2}$. Consumer surplus is $\hat{S} = \frac{4+l(1-l)}{2(4-l)^2}$.

Welfare is $\hat{W} = \frac{l+(2-l)(2+l)}{2(4-l)^2} + \frac{1}{(4-l)^2} + \frac{(2-l)^2}{(4-l)^2}$.

By comparing π_2^{H*} with $\hat{\pi}_2^L = \alpha\Upsilon^L$, we obtain a threshold α^* such that, whenever $l > l^* = \frac{14+54\alpha-6\sqrt{5(1+10\alpha+9\alpha^2)}}{9\alpha-1}$, the retailer chooses the differentiation of suppliers for a buyer power motive only. Whenever $\alpha \geq \frac{1}{9}$, it is always damaging for consumer surplus and social welfare to have one retailer selecting the low-quality good as $\hat{W} < W^*$ for any $s \in [0,1]$. However, when $\alpha < \frac{1}{9}$, Assumption C would be violated and, if both retailers had selected H, only one would be active in equilibrium, thus leading to the monopoly outcome. Thus, the differentiation of suppliers, by preventing exclusion, always increases consumers' surplus and always decreases industry profit.

7.3 Retailers active in separated markets

This illustrative example is derived for θ uniformly distributed over $[0,1]$ and for a convex cost function with a unit cost $\frac{cq^2}{2}$. The inverse demand function in each market is $P_i^K(q_i^K) = k(1-q_i^K)$.

- When the two retailers stock H

Each retailer maximizes bilateral joint profit with the producer, i.e., $P_i^K(q_i^H)q_i^H - \frac{c(q_i^H+q_{-i}^H)^2}{2}$. The equilibrium contract is $q_i^{H*} = \frac{1}{2(1+c)}$. The equilibrium total joint profit is $\Upsilon^{HH} = \frac{1}{2(1+c)}$ and bilateral joint profits are $\frac{\Upsilon^{HH}}{2}$. If there is a monopolist retailer for product H, it maximizes $P_i^K(q_i^H)q_i^H - \frac{c(q_i^H)^2}{2}$ and therefore $q^{H0} = \frac{1}{2+c}$. The corresponding joint profit $\Upsilon^{H0} = \frac{1}{4+2c}$ and consumer surplus is $\frac{1}{8(1+c)}$. When $c = 0.5$, retailers' equilibrium profit is: $\pi_i^{H*} = \frac{4+6\alpha+\sqrt{(2+3\alpha)(23+27\alpha)}}{15(1+\alpha)}$ for $i = 1, 2$.

Consumer surplus is $S^* = \frac{1}{12}$. Welfare is $W^* = \frac{5}{12}$.

- If one retailer stocks L

The equilibrium quantities are $\hat{q}_1^H = \frac{1}{2+c}$ and $\hat{q}_2^L = \frac{l}{2l+c}$. Note that there is a positive demand for the low-quality good for any $l > 0$. The corresponding joint profits are

$\Upsilon^H = \Upsilon^{H0} = \frac{1}{4+2c}$ and $\Upsilon^L = \frac{l^2}{4l+2c}$. Consumer surplus is $\hat{S} = \frac{1}{2}\left(\frac{1}{(c+2)^2} + \frac{l^3}{(c+2l)^2}\right)$. For $c = 0.5$, retailer 2's profit is $\hat{\pi}_2^L = \frac{l^2\alpha}{1+4l}$ and $\hat{S} = \frac{2}{25} + \frac{2l^3}{(1+4l)^2}$. By comparing π_2^{H*} with $\hat{\pi}_2^L$, we obtain a threshold l^* such that, whenever $l > l^* = \frac{4+6\alpha+\sqrt{(2+3\alpha)(23+27\alpha)}}{15(1+\alpha)}$, the retailer chooses the differentiation of suppliers for the buyer power motive only.

7.4   Example with imperfect price competition

To show that our results hold in a price competition model, we use a demand specification following Häckner (2000). The representative consumer utility function is:

$$U(q_h, q_l) = hq_h + lq_l - \frac{(q_h^2 + q_l^2)}{2} - \beta q_l q_h + m \tag{26}$$

where $\beta \in [0, 1]$ is a degree of horizontal differentiation among the retailers, $h > l > 0$ represents respectively the maximum valuation for a high (resp. low) quality good; q_h and q_l respectively denote the quantity of high and low-quality goods purchased by the representative consumer and m is the respective quantity of the "composite good". The representative consumer maximizes $U(q_h, q_l) - p_h q_h - p_l q_l$, where (p_h, p_l) is the price vector. When one of the two competing retailers offers the high-quality good and the other retailer offers the low-quality good, demand for each type of good is rewritten as follows:

$$q_h = \frac{h - p_h - l\beta + p_l\beta}{1 - \beta^2}$$
$$q_l = \frac{l - p_l - h\beta + p_h\beta}{1 - \beta^2}$$

When the two competing retailers offer the high-quality good, demand at each retailer is rewritten:

$$q_1 = \frac{h - p_1 - h\beta + p_2\beta}{1 - \beta^2}$$
$$q_2 = \frac{h - p_2 - h\beta + p_1\beta}{1 - \beta^2}$$

Using the contract equilibrium concept a la Crémer and Riordan (1987), in equilibrium wholesale prices are equal to the marginal production cost c and the fixed fee enables the sharing of profits within the vertical chain. In case (H, L), bilateral joint profits are respectively denoted Γ^H and Γ^L

$$
\begin{align}
\Gamma^H &= \frac{(h-c)^2(1-\beta)}{(2-\beta)^2(1+\beta)} \tag{27} \\
\Gamma^L &= \frac{\left(h\beta + l\left(2-\beta^2\right) - c\left(2-\beta-\beta^2\right)\right)^2}{\left(4-\beta^2\right)^2\left(1-\beta^2\right)} \tag{28}
\end{align}
$$

We normalize $h = 1$ and $c = 0$. We restrict our attention to cases where either competition intensity is not too high, or the low-quality is not too low, to ensure that there is a positive market share for each good. We obtain the following condition:

$$
l > \underline{l} = \frac{\beta}{2 - \beta^2} \tag{29}
$$

Whenever this condition is verified, $\Gamma^H > \Gamma^L$.

When the two retailers now offer the high-quality good, the status quo joint profit is $\Gamma^{H0} = \frac{(1-c)^2}{4}$. Therefore depending on the product it offers, retailer 2 has the following profits:

$$
\begin{align}
\pi_2^h &= \frac{\alpha\left(4 - 8\beta + 3\beta^2 - \beta^3 + \alpha(-2+\beta)^2(1+\beta)\right)}{4(1+\alpha)(-2+\beta)^2(1+\beta)} \tag{30} \\
\pi_2^l &= \alpha\frac{\left(h\beta + l\left(2-\beta^2\right) - c\left(2-\beta-\beta^2\right)\right)^2}{\left(4-\beta^2\right)^2\left(1-\beta^2\right)} \tag{31}
\end{align}
$$

We obtain a threshold: if $l > \tilde{l} = \frac{\beta}{2-\beta^2} + \frac{1}{2}\sqrt{\frac{16 + 16\alpha - 32\beta - 24\alpha\beta^2 + 16\beta^3 - \beta^4 + 9\alpha\beta^4 + \beta^6 - \alpha\beta^6}{(1+\alpha)\left(-2+\beta^2\right)^2}}$, retailer 2 always chooses to source from a differentiated supplier for a buyer power motive only. Consumer surplus when the two retailers sell H is $C^* = \frac{(h-c)^2}{(2-\beta)^2(1+\beta)}$ and when the two retailers sell different products, $\hat{C} = \frac{-2hl\beta^3 + 2c^2(1-\beta)(2+\beta)^2 - 2c(h+l)(1-\beta)(2+\beta)^2 + h^2\left(4-3\beta^2\right) + l^2\left(4-3\beta^2\right)}{2\left(4-\beta^2\right)^2\left(1-\beta^2\right)}$. For all $l > \underline{l}$ and $\beta \in [0, 1]$, we have $\hat{C} < C^*$.