Is Producing a Private Label Counterproductive for a Branded Manufacturer?

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Abstract

Private labels (or store brands) have clearly changed the relationships between manufacturers and retailers since the latter have gained bargaining power because of this new product competing with branded goods. However, looking into details show that some branded manufacturers also produce retailers' brands. These manufacturers argue that it is for using excess production capacities (idle otherwise).

We study the distributor's private label strategy for production within a framework featuring endogeneous store brand quality, bargaining power, possible differences in production technology and potential capacity constraint for the manufacturer. We first show that the retailer entrusts his store brand to an independent firm when the quality of the national brand is intermediate. If the production cost of the manufacturer is quite attractive compared to the one of the competitive fringe, the retailer asks the branded manufacturer to produce his private label on the ground of efficiency reasons.

We then extend our model by integrating a potential capacity constraint for the branded manufacturer. We show that if the capacity constraint affects both products, then the retailer prefers to choose an independent firm whereas he was electing the branded manufacturer when unconstrained. If capacity constraint applies only to store brand production, there exists intermediate values of the independent firm's cost disadvantage for which the retailer may change his strategy for store brand production by turning to an independent firm instead of remaining with the branded manufacturer.

The conclusions of our article thus partially confirm branded manufacturers' statement: they may produce store brand when they are not capacity constrained.

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Introduction

The increasing development of private labels (PL), products managed and sold by retailers, is unquestionably the most successful distributors' strategy on the last 30 years. These products represent in 2006 up to 25 % of goods sold in the US, 43% in the United Kingdom, 30% in France and 16% in Italy according to the Private Label Manufacturers' Association (PLMA). Even if these figures conceal a strong heterogeneity across product categories, PLs have become an inescapable issue for retailers (store image, quality, advertising) as well as for manufacturers (production stake). According Moati, Mazars and Ranvier (2007), the number of agrofood firms that produces PL in France has increased in time and represented 27% of the total number of firms in this sector in 2005. They generated 11.4% of the total French agrofood industry's revenue. The production of PL is mainly manufactured in small and medium firms with a market share of 82% in French large food stores in 2006; letting 12% for National Brand (NB) manufacturers. However, the share of small and medium firms in the production of PL tends to decrease to the benefit of NB manufacturers.

The economic literature has mostly studied the impact of PLs on the 'manufacturer-retailer' vertical relationships with a focus on downstream decisions (see Bergès-Sennou, Bontems and Réquillart, 2004). One of the main conclusion is that PLs have strengthened the retailer's position vis-à-vis manufacturers because these store brands constitute a credible alternative to branded goods, and therefore enhance retailers' reservation profits. The competition between PLs and branded goods on the retailer's shelf allows indeed distributors to get tariff concessions from manufacturers (see Mills 1995, 1998). Such a conclusion is robust to the type of contract signed between retailers and manufacturers (linear price, two-part tariff, see Caprice, 2000) and to the retailer's strategies scope (choice of PL quality, see Bontems et al., 1999). Another consequence of the PL development is about retailers' competition. In absence of PLs, and especially for food products, retailers used to sell the same products (named national brands - NB) and were therefore competing on an intrabrand basis for consumers' patronage. However, the apparition of PLs deeply modified this framework. By commercializing their own brands, retailers not only increase interbrand competition in-store (as seen) but also lessened competition with their rival. Characterized by the fact that a store brand can only be purchased in a given store (or chain store), consumers cannot any longer compare store brands between them on a price basis only. PLs therefore increase retailers' differentiation in the product range proposed and consequently lessened retailing competition. PLs introduction can thus be seen as a double success (vertically and horizontally) for retailers, at the detriment of the NB manufacturers.[1]

[1]For empirical consequences of PL development (NB retail price increase) see Ward et al. (2002) for the US and Bontemps, Orozco and Réquillart (2008) for France.

When retailers sell PL, they have to choose who is going to produce it. There are two possibilities for a retailer when he decides his store brand production strategy. First, he can entrust his own brand to an independent firm that only manufacture PLs. This solution is often chosen as stated above and is often used when there is a new PL to launch as mentioned in Hughes (1997). Second, the retailer can entrust the production of his store brand to a NB manufacturer. This second solution is less common and might be surprising. Producer choice for the production of the PL has been less studied in the literature. In a recent article, Bergès-Sennou (2006) finds that the distributor will entrust his store brand production to the NB manufacturer when the retailer's bargaining power or consumers' store loyalty are high enough. However, the demand specification is quite restrictive and quality of goods (PL and NB) are exogenous. Besides, demand is completely inelastic which discards any capacity constraint.

This analysis from only the "downstream point-of-view" (retailers) may not give the whole scene of what is really happening with PLs. PL production is also an important issue for manufacturers (upstream).[2] Important agrofood firms in terms of manufacturers' brand portfolio, like Kraft or Unilever in the United States, confess to produce PL for retailers. What should push the NB manufacturer to accept to produce a competing good? One answer is: if the manufacturer refuses, someone else will do it and get these additional revenues. Another answer is that PL may be a way for NB manufacturers to improve their contract conditions for the NB products by selling also the PL. As argued by NB manufacturers (Gomez-Arias and Bello-Acebron, 2008), another possible explanation may be that when they produce PLs, they use excess capacity production that would be costly otherwise. PL production can be a way for them to cover costs. However, if the manufacturer accepts to manufacture the PL there is a possibility for him to be capacity constrained and thus to have to adapt his NB production.

The goal of our article is to investigate precisely both retailer and NB manufacturer's decisions for the PL production. In other terms, does a capacity constrained manufacturer has an interest to produce a PL, and in this case, will the retailer ask him to do so? We propose a framework where a retailer negotiates with a NB manufacturer or with a firm for the store brand production, taking into account endogenous quality for the PL, firms' bargaining power, the degree of attractiveness and possible capacity constraint of the branded manufacturer.

We first find that when the production of the NB manufacturer is not capacity constrained, the retailer may not be selected by the retailer. Actually, the retailer entrusts his store brand to a specific firm when the NB quality is not too high. Otherwise, the NB manufacturer may be selected if the competing firm attractiveness is not so good. Second, when the total production(NB and PL) of the NB manufacturer is capacity constrained, the paper shows that the

[2]Competition authorities (like the European Commission) have a particular analysis of the production sector for mergers when private labels are present, see the merger between Kimberly-Clark and Scott (Case No IV/M.623, 1996).

retailer may not have any interest in entrusting the PL to the brand manufacturer (even if the PL quality would be higher). When capacity constraint only applies to PL (excess production facilities), the retailer may jeopardize his decision for intermediate value of the competitive fringe's attractiveness, that is when cost disadvantage is not too high. The conclusion of our article is thus that NB manufacturer may produce PLs when there are not capacity constrained or if the excess production facilities are only devoted to store brands. Otherwise, the necessary readjustment of the NB strategy makes the retailer reluctant to entrust the PL to the NB producer.

The paper is organized as follows. The next section presents the economic framework and firms' strategies. Section 2 analyzes the retailer's choice of product range and PL quality as well as the PL production decision. Section 3 introduces the possibility for the NB manufacturer to be capacity constrained, distinguishing whether the constraint applies to total production (NB and PL) or to the PL quantities only. A general discussion with conclusions then follows.

1 The framework and timing of the game

A downstream monopolist retailer R can sell two differentiated goods in quality. One product is a branded good (national brand) of an exogenous quality q_{NB} produced by an upstream manufacturer M at a unit cost $c(q_{NB}) = \frac{q_{NB}^2}{2}$. The second additional product is a private label (store brand) of endogenous quality q_{PL}. It is assumed that the quality of the PL is lower than the one of the NB: $q_{PL} < q_{NB}$.[3] There can be many explanations but the most relevant one being that NB products are heavily advertised by branded manufacturers, whereas store brands are not. This creates for consumers a difference of perception in the products' characteristics (on top of packaging or ingredients) that generates a higher willingness-to-pay for National Brands than for Private Labels (see Bell, 2000). This is empirically tested through structural econometric models based on consumers' panel scanner data like in Baltas (1997), Bergès et al. (2007) or Bonfrer and Chintagunta (2004).

For producing the private label, the retailer has two options: either he asks to an independent firm from a competitive fringe, either he turns to the national brand manufacturer and try to set with him a production contract for his own good. We suppose that the retailer negotiates tariff conditions in a Nash axiomatic framework with the national brand manufacturer. The bargaining power of the national brand manufacturer will be denoted α while the retailer's one will thus be $(1-\alpha)$. It is important to note that these alternatives for the PL production do not have the same implications for both parties. In the first case, since the upstream

[3]Empirical analysis (Dodds et al., 1991) supports that brand names have a positive effect on perception of quality and willingness to pay. This paper focus on low price private labels that are designed for consumers with low willingness to pay or that mimic NB products but often sold at a lower price. It does not apply for high-quality private labels that have been recently developed in order to increase consumer loyalty or to attract new consumers.

independent manufacturer is assumed to be part of a competitive sector, he will capture no margin (classic Bertrand competition) and all profits made on the PL are captured by the retailer. However, like in Bontems et al. (1999), we classically suppose that for the same PL quality to produce, the independent firm incurs a unit-cost disadvantage relative to the branded manufacturer: $c(q_{PL}) = \frac{q_{PL}^2}{2}$ whereas $c_I(q_{PL}) = \frac{c \cdot q_{PL}^2}{2}$ and $c \geq 1$. This can be because of technology difference coming from an experimented manufacturer (the NB one) or because of the difference in services the NB manufacturer may take in charge relatively to the independent manufacturer when producing a PL. More arguments are given in Comanor and Rey (2000) or Galizzi et al.(1997).

The retailer faces a demand constituted by a continuum of consumers whose utility is given by Mussa-Rosen (1978): $U(\theta, q, p) = \theta \cdot q - p$ where θ is the consumer's willingness-to-pay for quality and q is the quality of the product bought at price p. The parameter θ is uniformly distributed across $[0, 1]$.

The timing of the game is the following:

- *Step 1*: The retailer chooses his product range. He can either sell a National Brand, a Private Label or both products. If the retailer did choose to introduce his own Private Label, he simultaneously select the product quality (q_{PL}) and who will produce it. He can either entrust the Private Label to the National Brand manufacturer, or to an independent firm. The retailer negotiates a wholesale price w_{PL} and a franchise fee F with the selected firm. If the retailer also decided to sell a National Brand, then he also negotiates the wholesale price of the NB product w_{NB} with the branded manufacturer. In this situation, one franchise fee F is negotiated to share the total gain from the sales of PL and NB.

  Another option could be to have private label quality negotiated in a preceding step of the game as quality seems to be more irreversible than wholesale prices and franchises. However, the paper focus on the choice of the private label manufacturer. This choice impacts on the technology used and may thus result in a different private label quality. To evacuate a complicated scheme where private label quality could be changed according to the private label manufacturer choice, which in turns results also in a change in wholesale prices and franchises, the model considers that the retailer decides (and proposes) it all at once at step 2.[4]

- *Step 2*: In the relevant case of PL production, as far as the NB manufacturer is concerned, he accepts or refuses to produce the PL at the proposed tariff conditions by the retailer. If he refuses, the PL is produced by the independent firm from the competitive fringe.

[4] A precise analysis about retailer's commitment on his store brand quality and its impact on vertical surplus sharing can be found in Caprice (2000). Moreover, a UK report from the Competition Commission (2000) on groceries supply emphasizes how difficult it is for a retailer to change of PL supplier once the product has been defined.

- *Step 3*: The retailer decides the final prices of the private label (p_{PL}) and/or the national brand good (p_{NB}).

The game proposed here encompasses the following features. First, the product range choice by the retailer happens in stage 1 while PL production decision is the outcome of stage 2. This translates the fact that, for the retailer, committing on the PL commercialization (by in-store advertising or promotional campaigns) is more irreversible than selecting the private label manufacturer (who is unknown to consumers). Second, once the retailer decided to introduce a PL, if the NB manufacturer refuses to produce it, then it is in the interest of the retailer to ask an independent firm to do it, since the additional product can only generate positive profits for the retailer. Last, the negotiated contract includes one franchise fee for both products with the NB manufacturer instead of two. It thus takes into account that the two brands strategically interact in the negotiation. This assumption reinforces the bargaining position of the NB manufacturer and allow him to have better product positioning for his branded product (Galizzi et al., 1997). Bundling the NB and the PL when they are produced by the same manufacturer allows us to take into account the risk for the retailer of making his profits depend fully on one manufacturer (i.e. zero profit if the negotiation over the NB tariff fails). This argument is often evoked in competition policy cases, especially in the merger of Kimberly-Clark/Scott (Case IV/M.623,138-c). On the contrary, when the PL product is produced by a different firm, the retailer has a positive disagreement pay off (reservation profit) because the PL supply is independent of the NB negotiation issue. Bergès-Sennou (2006, p. 322) give more economic arguments on this issue, as well as Caprice (2000).

2 Benchmark case: no capacity constraint

We can summarize the choice of the retailer as being twofold: which goods to propose in his store (NB and/or PL) and who should produce the PL if the need arises (NB manufacturer or an independent firm). The quality of the PL is also a strategic choice for the retailer, and the store brand manufacturer's identity (and thus cost) will be of importance. We classically solve the game with backward induction.

2.1 Selling only the NB

If the retailer decides to introduce only a NB of quality q_{NB} at a price p_{NB}, consumers buy the good as long as $\theta \cdot q_{NB} - p_{NB} > 0 \Leftrightarrow \theta > \frac{p_{NB}}{q_{NB}}$. The market is not covered and the consumers' demand for NB good is given by:

$$D_{NB}(p_{NB}) = 1 - \frac{p_{NB}}{q_{NB}}.$$

Since we assume a Nash framework for tariff negotiations, the manufacturer and the retailer jointly maximizes the vertical profits by setting the wholesale price to the marginal cost while

the fix part F, paid by the retailer to the manufacturer, will leave the manufacturer a share of the vertical profit proportional to his bargaining power (no reserve profit here).[5] The program of the retailer is thus:

$$\max_{p_{NB}} \pi^R_{NB} = (p_{NB} - w^*_{NB}) \cdot \left(1 - \frac{p_{NB}}{q_{NB}}\right) - F \text{ where } w^*_{NB} = c(q_{NB}) = \frac{q^2_{NB}}{2} \tag{1}$$

Solving (1) gives the subgame equilibrium price of the NB and the corresponding profits for the retailer (π^{R*}_{NB}) and the NB manufacturer (π^{R*}_{NB}):

$$p^*_{NB} = \frac{1}{4} q_{NB}(2 + q_{NB}) \; ; \; \pi^{R*}_{NB} = \frac{1-\alpha}{16}\left((2 - q_{NB})^2 q_{NB}\right) \text{ and } \pi^{M*}_{NB} = \frac{\alpha}{16}\left((2 - q_{NB})^2 q_{NB}\right) = F^*.$$

2.2 Selling only the PL

The retailer may sell his own product only of quality q_{PL} at price p_{PL} to consumers rather than selling a NB. In such a case, the demand for the store brand product is defined by:

$$D_{PL}(p_{PL}, q_{PL}) = 1 - \frac{p_{PL}}{q_{PL}}.$$

If the retailer entrusts the PL production of quality q_{PL} to an independent firm (case denoted cf1 hereafter), because of the competitive pressure in the industry, the wholesale price is set to the unit cost of production and the franchise fee to zero so that the retailer captures all the gain from the sales of the PL. The program of the distributor is therefore:

$$\max_{p^{cf1}_{PL}} \pi^{R(cf1)} = (p^{cf1}_{PL} - w^{cf1*}_{PL}) \cdot \left(1 - \frac{p^{cf1}_{PL}}{q^{cf1}_{PL}}\right) - F^{cf1} \text{ where } w^{cf1*}_{PL} = \frac{c(q^{cf1}_{PL})^2}{2}. \tag{2}$$

The outcome of this maximization is $p^{cf1*}_{PL} = \frac{1}{4} q^{cf1}_{PL}(2 + c q^{cf1}_{PL})$ which leads to $\pi^{R(cf1)*}(q^{cf1}_{PL}) = \frac{(2 - c q^{cf1}_{PL})^2 q^{cf1}_{PL}}{16}$. Maximizing $\pi^{R(cf1)*}(q^{cf1}_{PL})$ with respect to q^{cf1}_{PL} gives the optimal PL quality, $q^{cf1*}_{PL} = \frac{2}{3c}$ and an ex-post retailer profit equal to $\pi^{R(cf1)*} = \frac{2}{27c}$.

A second option for the retailer is to entrust the PL production to the branded manufacturer (option denoted nb1 hereafter). This strategy implies two consequences for the retailer. On one hand, he benefits from lower unit cost for the PL product because of the manufacturer's efficiency in the production process. On the other hand, the retailer does not have anymore all the bargaining power as it was the case with an independent firm. He must now share the profit made on the private label, his own good, according to his negotiation strength. The wholesale price still set to unit cost, but the franchise fee will then reflect manufacturer's position within the vertical structure. In other words, the retailer maximizes:

$$\max_{p^{nb1}_{PL}} \pi^{R(nb1)} = (p^{nb1}_{PL} - w^{nb1*}_{PL}) \cdot \left(1 - \frac{p^{nb1}_{PL}}{q^{nb1}_{PL}}\right) - F^{nb1} \text{ where } w^{nb1*}_{PL} = \frac{(q^{nb1}_{PL})^2}{2}. \tag{3}$$

[5] The detailed analytical framework and its fundations are desribed in Osborne and Rubinstein (1990).

From (3), the optimal price p_{PL}^{nb1*} for the PL if the retailer contracts with the NB manufacturer is derived, $p_{PL}^{nb1*} = \frac{1}{4}q_{PL}^{nb1}(2 + q_{PL}^{nb1})$. Replacing p_{PL}^{nb1} by this expression in the corresponding profit functions gives the optimal profit for the retailer and the NB manufacturer:

$$\pi^{R(nb1)}(q_{PL}^{nb1}) = \frac{(1-\alpha)(2-q_{PL}^{nb1})^2 q_{PL}^{nb1}}{16} \text{ and } \pi^{M(nb1)*} = \frac{\alpha(2-q_{PL}^{nb1})^2 q_{PL}^{nb1}}{16} = F^{nb1*}.$$

The retailer and the NB manufacturer share the total gains from the sales of the private label. We assume that the retailer has no outside option at this stage of the game. This assumption relies on commitment the retailer faces concerning the choice of the producer for its private label. In other words, it is assumed that the threat of turning out to the competitive fringe when the retailer has already opted for the NB manufacturer is not credible.[6]
Maximizing the ex-post profit according to the PL quality leads to the optimal quality for the PL when it is produced by the NB manufacturer:

$$q_{PL}^{nb1*} = \frac{2}{3} \text{ and } \pi^{R(nb1)*} = \frac{2(1-\alpha)}{27}.$$

Comparing the subgame equilibrium profits for the retailer when it turns to an independent firm or to the NB manufacturer for the production of his PL shows the crucial role played by the trade-off for the retailer. When he decides his strategy about who should produce his private label, he balances the gain he can get from the efficient technology proposed by the NB manufacturer (translated by a cost advantage) with the fact that he is not almighty in the negotiation. This comes from the fact that the manufacturer's bargaining power applies to PL tariff conditions. As a consequence, he trades-off higher quality for his PL at a lower cost and rents to leave to the upstream manufacturer. Actually, the NB manufacturer is able to offer a wide range of product characteristics such that $q_{PL}^{cf1*} < q_{PL} < q_{NB}$. In other words, the NB manufacturer may always do better than an independent firm because of its technological advantage, but the PL product remains of lower quality than its own branded product.

2.3 Selling both NB and PL

We now turn to the case where the retailer decided to sell both competing products of unequal quality: NB and PL. For a NB of quality q_{NB} sold at a price p_{NB} and PL of quality $q_{PL} < q_{NB}$ and sold at a price p_{PL}, demand is the following:

$$D_{NB}(p_{NB}, p_{PL}, q_{PL}) = 1 - \frac{p_{NB} - p_{PL}}{q_{NB} - q_{PL}} \text{ while } D_{PL}(p_{NB}, p_{PL}, q_{PL}) = \frac{p_{NB} - p_{PL}}{q_{NB} - q_{PL}} - \frac{p_{PL}}{q_{PL}}.$$

Indeed, consumers buying the NB are characterized by the fact that they get a higher utility when purchasing the branded product rather than the PL: $\theta q_{NB} - p_{NB} > \theta q_{PL} - p_{PL} \Leftrightarrow \theta >$

[6] As discussed in Comanor and Rey (2000), if the independent firm is a potential entrant or a less established firm, the retailer may face coordination and communication problems (less information available on capacities and characteristics of the firms) that might generate additional transaction costs. Assuming no outside option at this stage of the game can then be justified by the existence of too high transaction in the short run so that the retailer's threat at this stage is marginal.

$\frac{p_{NB}-p_{PL}}{q_{NB}-q_{PL}}$. Besides, consumers trading-off between buying a PL or nothing are characterized by $\frac{p_{NB}-p_{PL}}{q_{NB}-q_{PL}} > \theta > \frac{p_{PL}}{q_{PL}}$.

The first possibility, like in the previous case, is to entrust the PL to an independent firm (cf2). Since the negotiation takes place in a Nash bargaining framework and the retailer contracts in this case with the independent firm, the outside option of the retailer if no agreement is reached with the NB manufacturer is positive. If the retailer refuses an agreement on the NB with the branded manufacturer, he still can sell his PL and put one instead of two products on the shelves. In such a case, since quality choice was made at stage 1, he cannot change it (commitment on the definition of products' characteristics). However, he can change the PL price to take into account that he becomes a single-product monopolist. The profit he will generate this way will constitute his outside option when he negotiates on NB tariffs with the manufacturer.

If an agreement is found, in order not to distort quantities and to maximize the vertical surplus, the negotiated wholesale price on the NB negotiated with the manufacturer will be set to marginal cost, that is: $w_{NB}^{cf2} = \frac{q_{NB}^2}{2}$. Regarding the PL, since the production comes from the competitive sector, it is also set to marginal cost: $w_{PL}^{cf2*} = \frac{c(q_{PL}^{cf2})^2}{2}$. Therefore, the retailer's program is to maximize:

$$\max_{\{p_{NB}^{cf2},p_{PL}^{cf2},q_{PL}^{cf2}\}} \pi^{R(cf2)} = \left(p_{NB}^{cf2} - \frac{q_{NB}^2}{2}\right) \cdot \left(1 - \frac{p_{NB}^{cf2} - p_{PL}^{cf2}}{q_{NB} - q_{PL}^{cf2}}\right) \tag{4}$$

$$+ \left(p_{PL}^{cf2} - \frac{c(q_{PL}^{cf2})^2}{2}\right) \left(\frac{p_{NB}^{cf2} - p_{PL}^{cf2}}{q_{NB} - q_{PL}^{cf2}} - \frac{p_{PL}^{cf2}}{q_{PL}^{cf2}}\right) - F^{cf2}.$$

From (4), when the PL production is entrusted by an independent firm, the equilibrium quality of the PL and the equilibrium prices of the NB and PL can be derived:

$$p_{NB}^{cf2*} = \frac{1}{4} q_{NB}(2 + q_{NB}) \; ; \; q_{PL}^{cf2*} = \frac{1}{4} q_{NB} \left(3 - \frac{\sqrt{9c-8}}{\sqrt{c}}\right)$$

$$p_{PL}^{cf2*} = \frac{q_{NB}\left[\sqrt{c}(12 + (9c-4)q_{NB}) - \sqrt{9c-8}(3cq_{NB}+4)\right]}{32\sqrt{c}}.$$

Replacing q_{PL}^{cf2}, p_{PL}^{cf2} and p_{NB}^{cf2} by q_{PL}^{cf2*}, p_{PL}^{cf2*} and p_{NB}^{cf2*} leads to the following vertical profit to be shared between the retailer and the manufacturer:

$$\Pi^{cf2*} = \frac{q_{NB}\left(32 + q_{NB}(\sqrt{c}(9c-8)^{\frac{3}{2}} q_{NB} - 32 - 9c(3c-4)q_{NB}\right)}{128}.$$

In case of disagreement, the retailer's reservation profit is given by:

$$\max_{p_{PL}} \widetilde{\pi}^R = \left(p_{PL} - \frac{c(q_{PL}^{cf2*})^2}{2}\right) \cdot \left(1 - \frac{p_{PL}}{q_{PL}^{cf2*}}\right) \tag{5}$$

leading to:

$$\widetilde{p}_{PL} = \frac{1}{4} q_{PL}^{cf2*}(2 + c q_{PL}^{cf2*}) \text{ and } \widetilde{\pi}^{R*} = \frac{\left(3\sqrt{c} - \sqrt{9c-8}\right) q_{NB}(8 - 3c q_{NB} + \sqrt{c(9c-8)} q_{NB}\right)^2}{1024c}.$$

The retailer's profit from the sales of the NB when he also sells a PL that is produced by the competitive fringe will then depend on his relative bargaining power with respect to the NB manufacturer as well as his outside option: $\pi^{R(cf2)*} = (1-\alpha) \cdot (\Pi^{cf2*} - \widetilde{\pi}^{R*}) + \widetilde{\pi}^{R*}$. The retailer will pay the NB manufacturer a franchise fee $F^{cf2*} = \alpha \cdot (\Pi^{cf2*} - \widetilde{\pi}^{R*})$ that will also depend on his relative bargaining power and on the disagreement payoff of the retailer.

The second possibility is to entrust the private label production to the NB manufacturer (nb2). In this case, the retailer makes its profits coming from both good depending on the same agent. To model this particular choice, as in Bergès-Sennou (2006), we suppose that the franchise negotiated with the NB manufacturer concerns both PL and NB. In other words, the negotiation between the retailer and the manufacturer is over both goods, even if the PL is exclusively managed by the retailer. Therefore, one consequence will be that profits coming from the PL have to be part of the negotiation, and thus shared according to each agent's bargaining power. Besides, in case of a disagreement in the negotiation process over the NB tariffs, the retailer has no more a reserve profit since both goods are negotiated jointly. One could think to the possibility for the retailer to change of PL producer, but we rule this out arguing that establishing a new partnership takes time, as well as defining new product characteristics.

The efficient Nash bargaining framework leads to wholesale price set to marginal cost and the retailer objective is to maximize:

$$\begin{aligned} \max_{\{p_{NB}^{nb2}, p_{PL}^{nb2}, q_{PL}^{nb2}\}} \pi^{R(nb2)} &= \left(p_{NB}^{nb2} - \frac{q_{NB}^2}{2}\right) \cdot \left(1 - \frac{p_{NB}^{nb2} - p_{PL}^{nb2}}{q_{NB} - q_{PL}^{nb2}}\right) \\ &+ \left(p_{PL}^{nb2} - \frac{(q_{PL}^{nb2})^2}{2}\right) \left(\frac{p_{NB}^{nb2} - p_{PL}^{nb2}}{q_{NB} - q_{PL}^{nb2}} - \frac{p_{PL}^{nb2}}{q_{PL}^{nb2}}\right) - F^{nb2}. \end{aligned} \tag{6}$$

This results in:

$$p_{NB}^{nb2*} = \frac{1}{4} q_{NB}(2 + q_{NB}) \; ; \; q_{PL}^{nb2*} = \frac{q_{NB}}{2} \; ; \; p_{PL}^{nb2*} = \frac{1}{4} q_{NB}(2 + q_{NB})$$

$$\text{and } \pi^{R(nb2)*} = \frac{(1-\alpha) \cdot (q_{NB}(5 q_{NB} - 16) + 16) q_{NB}}{64}$$

for $q_{NB} < \frac{4}{3}$. This condition insures that $D_{NB}^{nb2*}(p_{NB}^{nb2*}, p_{PL}^{nb2*}, q_{PL}^{nb2*}) > 0$.

2.4 The retailer's product range choice

All the subgame being solved, we thus need to compare retailer's profit to know which choice is the best one between introducing one product or not, and making the PL produced by the NB manufacturer or the independent firm if the need arises. Figure 1 depicts the case when $\alpha = \frac{1}{2}$.

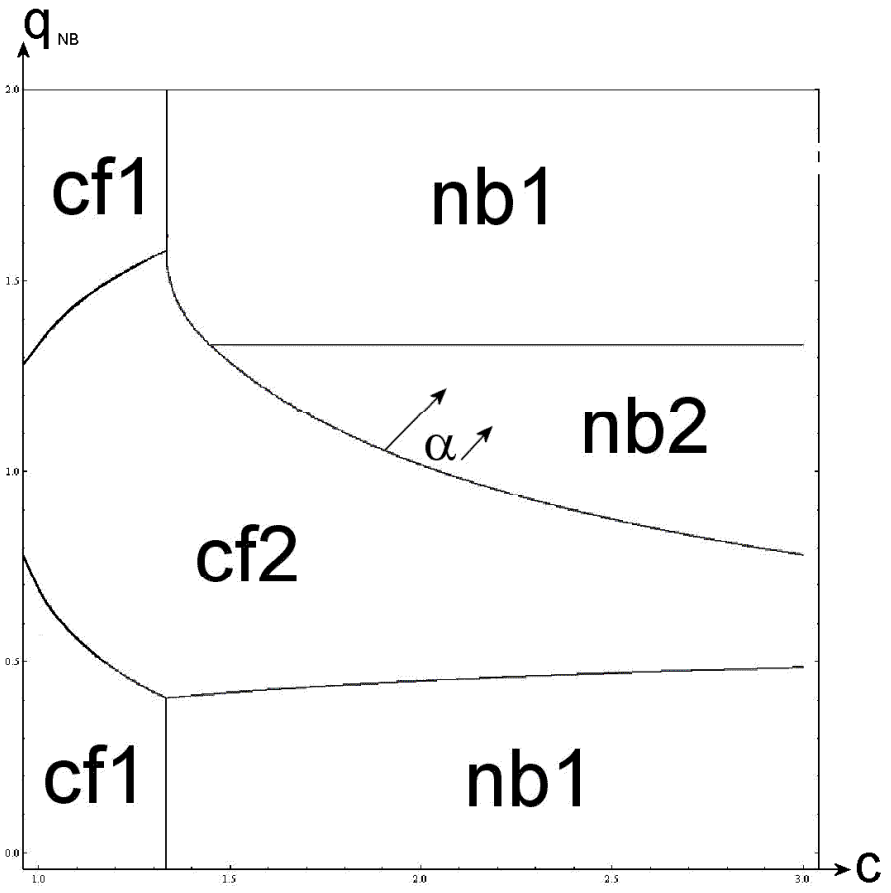

Figure 1: Equilibrium for retailer's products when $\alpha = \frac{1}{4}$.

When the quality of the NB is relatively low, the retailer does not have any incentive to sell it since the private label is more competitive compared to the branded product: he therefore chooses to sell exclusively the private label good. The choice for the PL producer is still relevant. For low levels of the unit cost (c) incurred by the independent firm, the retailer entrusts his PL production to one firm of the competitive fringe. Indeed, the revenues of the PL then goes entirely to the retailer. However, if such cost increases, it then becomes profitable for the distributor to make his PL produced by the national brand manufacturer. An independent firm is in this case turns out to be too costly compared to the rents the retailer has to leave to the NB manufacturer (bargaining process). Note that, for a given national brand quality q_{NB}, it becomes profitable for the retailer to also sell the branded product when the cost c increases. This is the consequence of discrimination gains that tend to decrease the PL quality and thus to improve the PL-NB quality gap.

When the quality of the national brand is higher, the retailer sells both products but must decide who will produce his store brand. The trade-off for the PL manufacturing depends on the cost disadvantage of the independent firm as well as the gain he can get from the NB negotiation outcome (resulting from the retailer's bargaining power when $\alpha < \widetilde{\alpha} = \frac{43-\sqrt{57}}{64}$).

The PL production is entrusted to the NB manufacturer when the cost disadvantage of the independent firm is too prejudicial and jeopardizes the PL profitability. Moreover, there exists in this situation a condition ($q_{NB} < \frac{4}{3}$) for the NB demand to be positive (NB price needs to be lower than consumers' willingness to pay) when the PL is produced by the NB manufacturer (NB2).

Finally, for high values of the NB quality, consumers do not buy anymore the branded product (too high price) but they still buy the PL product. The trade-off for its production fully depends on the unit cost (c) as in the first situation when q_{NB} was low.

It turns out that the situation where the NB manufacturer does produce both goods (NB2) is less likely than the one where the PL is entrusted to an independent firm (CF2). This outcome seems to fit with stylized facts where only 12 % of PL goods are produced by branded manufacturers. Besides, when the retailer bargaining power increases, then he is more likely to introduce a PL produced by the branded manufacturer since the residual profit he keeps from the store brand is correlated with his bargaining power, that is $(1 - \alpha)$.

One interesting remark relies on the PL quality level with respect to the introduction of the NB product. For instance, when $q_{NB} = \frac{3}{2}$, PL quality is higher under CF1 and NB1 (without NB sold) than under CF2. This emphasizes the role of the PL as a discriminating product to serve low willingness-to-pay consumers when the NB is also distributed.

Such a benchmark situation gives us some light on the retailer's decision determinants concerning his production choices (labels to be produced, identity of the producers). It also explains the NB manufacturer strategy related to the production of the PL. When his production capacity is not limited, he never refuses to produce the PL because he always find it more profitable to accept (getting higher profits on an additional good) rather than leaving the production to an independent firm and only suffering competition on his branded good (even if quality of PL was lower).

This result confirms the idea that NB manufacturers do produce PL when they have excess capacity. However, they may also find it profitable to produce PL when they have limited capacities. In this case, the argument of costly unused capacity as a justification of PL production will not be fully verified.

In the next section, we suppose that the manufacturer has a maximum capacity of production. He may therefore have to choose his production scheme if asked by the retailer to produce the PL.

3 When the NB manufacturer is capacity constrained

Capacity constraint arises for the manufacturer when the total quantity he should produce exceeds the maximal quantity he can produce (denoted K). If the production process makes it possible to substitute one production line affected to the NB to another affected to the PL with negligible cost, then the constraint should apply to total production. Since qualities of PL and NB are different by structure ($q_{NB} > q_{PL}$), because of ingredients or recipe, a capacity constraint applying to total production means that recipe between PL and NB is not so different and so it is easy for the manufacturer to switch some production installations from NB to PL if needed. On the contrary, when this is not evident, then capacity constraint should apply only to the PL production quantities. Implicitly, this supposes that the manufacturer has an excess production capacity that he chooses to devote exclusively and irreversibly to the PL production.

One could argue that there is an important fix cost to pay by the firm based on the production capacity limit. We could indeed have formalized this by an amount $F(K)$ where $F(.)$ is an increasing function of the upper limit production of the manufacturer. However, this would not alter the manufacturer trade-off in the sense that such a fix cost would have to be paid irrespectively of the choice to produce or not the PL. Indeed, by definition, such a cost would be linked to capacity constraint, whether this capacity is used or not. The only implicit assumption we make is to assume that the minimal profit the manufacturer receives covers the capacity constraint fix cost. Since we are more interested in the manufacturer's strategy about producing or not the PL, such formalization of the capacity cost did not appear to be relevant in our analysis.

The next section analyzes the case where K applies to total production while section 4.2 tackles the issue when capacity constraint only applies to PL quantities.

3.1 Capacity constraint applies to both NB and PL production

Assuming that capacity constraint applies to the total production is characterized by:

$$D_{NB}^{nb2*} + D_{PL}^{nb2*} = \frac{1}{8}(4 - 3q_{NB}) + \frac{1}{4}q_{NB} \geq K \Leftrightarrow q_{NB} \leq 4 - 8K < \frac{4}{3}. \tag{7}$$

The precedent inequality boils down to $K > \frac{1}{3}$. For the total demand to be constrained, the NB quality has to be low enough. Substitution pattern between products results in an increased PL demand when the NB quality decreases. Due to Mussa-Rosen specifications, total demand increases and becomes constrained since there are more consumers buying the PL good. Moreover, for a potential manufacturer's trade-off to arise in (nb2), the bargaining power α must satisfy:

$$\alpha < \widetilde{\alpha}^K = \frac{\left(969 + 613\sqrt{57}\right)(1 - 2K)^2}{4\left(K\left(802\sqrt{57}K - 741\sqrt{57} + 171\right) + 185\sqrt{57} + 19\right)} < \widetilde{\alpha}.$$

Indeed, if the manufacturer has a high bargaining power, the retailer may not be likely to entrust its PL to him and therefore, the case where the manufacturer is capacity constrained may not show-up.[7]

The retailer's program when wholesale price are set to marginal cost is thus (superscript K will denote variables in this setting):

$$\max_{\{p_{NB}^K, p_{PL}^K, q_{PL}^K\}} \Pi^K = \left(p_{NB}^K - \frac{q_{NB}^2}{2}\right) \cdot \left(1 - \frac{p_{NB}^K - p_{PL}^K}{q_{NB} - q_{PL}^K}\right)$$

$$+ \left(p_{PL}^K - \frac{(q_{PL}^K)^2}{2}\right)\left(K - 1 + \frac{p_{NB}^K - p_{PL}^K}{q_{NB} - q_{PL}^K}\right) - F^K.$$

This implicitly assumes an 'efficient rationing rule' for consumers between PL and NB, as described in Tirole (1988, p. 213). Once NB consumers are served, PL quantity will clear the market according to the remaining production capacity. Indeed, since the quality of the NB is higher than the one of the PL, and costs are quadratic, the net value of the national brand is greater than the one provided by the PL from a vertical industry point-of-view.

The maximizing profit price for the PL is: $p_{PL}^{K*}(p_{NB}^K, q_{PL}^K) = \frac{4p_{NB}^K - (q_{NB} - q_{PL}^K)\left(2 - 2K + q_{NB} + q_{PL}^K\right)}{4}$. This generates a quantity demand for each product equal to:

$$D_{NB}^{K*}(p_{NB}^K, q_{PL}^K) = \frac{1}{4}(2(1+K) - q_{NB} - q_{PL}^K)$$

$$\text{and } D_{PL}^{K*}(p_{NB}^K, q_{PL}^K) = \frac{-4p_{NB}^K + q_{NB}\left(2 - 2K + q_{NB} + q_{PL}^K\right)}{4q_{PL}^K}.$$

The capacity constraint is binding when $D_{NB}^{K*}(p_{NB}^K, q_{PL}^K) + D_{PL}^{K*}(p_{NB}^K, q_{PL}^K) = K$ which translates into the following NB equilibrium price:

$$p_{NB}^{K*}(q_{PL}^K) = \frac{\left(2(1-K) + q_{NB} - q_{PL}^K\right)\left(q_{NB} + q_{PL}^K\right)}{4}.$$

Incorporating these final prices and maximizing the resulting retailer's profit leads to the optimal PL quality:

$$q_{PL}^{K*}(K) = \frac{1}{3}\left(4 - 8K - q_{NB} + 2\sqrt{7K2 + 4K(q_{NB} - 1) + (q_{NB} - 1)^2}\right)$$

The resulting ex-post profit for the industry at the equilibrium is thus:

$$\Pi^{K*} = \frac{1}{54}\Big[2 - 12K + 6K^2 + 20K^3 - 2(\left(7K^2 + 4K\left(q_{NB} - 1\right) + \left(q_{NB} - 1\right)^2\right)^{\frac{3}{2}} \tag{8}$$

$$-6q_{NB} - 30Kq_{NB} + 48K^2q_{NB} + 6q_{NB}^2 + 15Kq_{NB}^2 - 2q_{NB}^3\Big]$$

[7] This condition is the solution of the limit NB quality ($\widetilde{q}_{NB}$) defined by $\pi^{R(cf2)}(\widetilde{q}_{NB}) = \pi^{R(nb2)}(\widetilde{q}_{NB})$ when $c = 3$ and then $\widetilde{q}_{NB} < 4 - 8K$.

and where $\pi^{R(K*)} = (1-\alpha) \cdot \Pi^{K*}$; $\pi^{M(K*)} = (1-\alpha) \cdot \Pi^{K*}$.

One consequence when the manufacturer is capacity constrained on total production is that the quantities of its own national brand product have to been adjusted. The optimal quality of the PL product is indeed higher than in the unconstrained framework in order to enjoy of market restriction, this generates a higher PL final price and thus more NB product sold than in the benchmark case.

Bergès-Sennou (2006) emphasized in a restrictive model (inelastic demand and exogenous quality) the importance of the trade-off between efficiency and bargaining power in the retailer's choice for the private label manufacturer. In the framework developed here, PL quality is endogenized and the price of goods does influence quantities sold. The PL quality decision by the retailer constitutes an additional strategy to its introduction in order to exploit market power on its own product. This strategic effect is reinforced in presence of production capacity constraint. In this case, the retailer would choose to ask the NB manufacturer for a higher PL quality resulting in an increased competition with the NB. Indeed, this leads to lower revenues from the NB product and makes the choice of an independent firm (cf2) more attractive for the PL production. Moreover, the benefits from efficiency linked to lower production cost in situation (nb2K) are always overridden by the gains from bargaining power (since all benefits from the PL are taken by the retailer when negotiating with an independent firm). Therefore, when the NB manufacturer is capacity constrained on total production, the retailer always turns to an independent firm for its store brand production whatever the cost disadvantage.

Then, when capacity constraint is binding, the NB manufacturer does no more produce the PL for the retailer while he was doing so without constraint. His revenues from the PL production vanishes when the retailer turns to the independent firm leading to a reduction in the NB manufacturer's profit.

Simulations made for $\alpha = \frac{1}{4}$ and $K = 0.37$ (since $4 - 8K > 0.8$ and $4 - 8K < \frac{4}{3}$) leads to equilibrium depicted in Figure 2 (with $q_{NB} \in [\frac{3}{4}, \frac{4}{3}]$).

When there is a capacity constraint for the NB manufacturer that applies to both products, the retailer prefers to entrust its store brand good to an independent firm. Potential efficiency gains on the PL if produced by the manufacturer are offset by the loss incurred on the NB product because of its price decrease and by the gain in bargaining revenues the retailer captures when negotiating with the independent firm.

3.2 Capacity constraint only applies to the PL production

Contrary to the previous section, we could also assume that the production process is such that the manufacturer may find it costly to affect production line from one good to another.

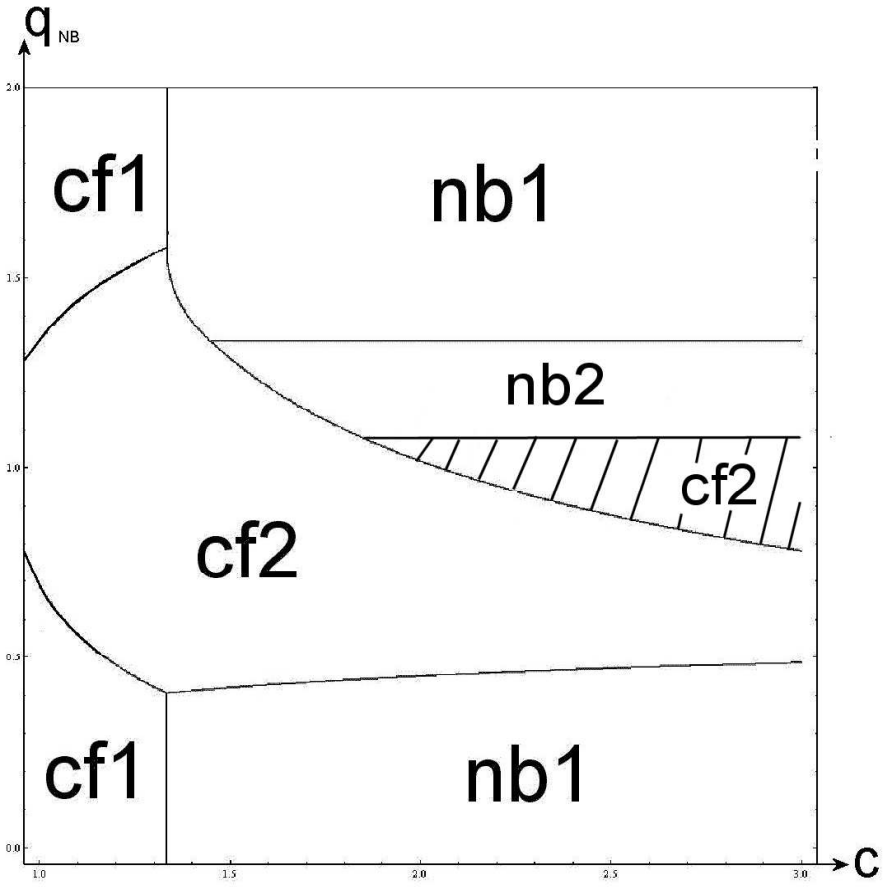

Figure 2: Equilibrium for retailer's products when $\alpha = \frac{1}{4}$ and capacity constraint on NB+PL.

This could result from specific tasks (or steps) in the production line that are connected intrinsically with the nature of the NB product. Therefore, manufacturer's decision will be about producing PL with specific extra-capacity that are not used at the detriment of the NB product.

The situation where capacity constraint (k) applies to PL production only is thus characterized by (superscript k will denote such setting):

$$D_{PL}^{nb2} = \frac{1}{4}q_{NB} \geq k \Leftrightarrow 4k \leq q_{NB} \leq \frac{4}{3} \text{ implying } k \leq \frac{1}{3}. \tag{9}$$

Note that when capacity constraint was applying to total production instead of PL production only, the characterization was reversed: national brand product needed to be of low-enough quality. When the capacity constraint applies to the sole PL production, an increase in the NB quality directly implies an increase in the PL quality and thus generates a higher PL demand which is now potentially constrained.

The limit price the retailer may set in order to sell no more than the total PL quantity is given by:

$$D_{PL}^{k*}(\widetilde{p}_{PL}) < k \Leftrightarrow \widetilde{p}_{PL} > \frac{q_{PL}^k(p_{NB}^k + k(q_{PL}^k - q_{NB}))}{q_{NB}}.$$

The retailer's program when wholesale price are set to marginal cost is thus:

$$\max_{\{p_{NB}^k, q_{PL}^k\}} \Pi^k = \left(p_{NB}^k - \frac{q_{NB}^2}{2}\right) \cdot \left(1 - \frac{p_{NB}^k - \widetilde{p}_{PL}}{q_{NB} - q_{PL}^k}\right) + \left(\widetilde{p}_{PL} - \frac{(q_{PL}^k)^2}{2}\right) k - F^k.$$

This leads to the following equilibrium under capacity constraint for the store brand product:

$$p_{NB}^{k*} = \frac{1}{4}q_{NB}(2 + q_{NB}) \ ; \ p_{PL}^{k*} = \frac{1}{8}q_{NB}(2 - 2k + q_{NB}) \ ; \ q_{PL}^{k*} = \frac{q_{NB}}{2}.$$

Total quantities produced at the equilibrium are:

$$D_{PL}^{k*} = k \text{ and } D_{NB}^{k*} = \frac{1}{4}q_{NB}(2 - 2k + q_{NB}).$$

The respective profits of the retailer and the manufacturer resulting from the equilibrium are therefore:

$$\pi^{R(k*)} = (1 - \alpha)\frac{q_{NB}}{16} \cdot (2kq_{NB} + (q_{NB} - 2)^2 - 4k^2)$$
$$\text{and } \pi^{m(k*)} = \alpha\frac{q_{NB}}{16} \cdot (2kq_{NB} + (q_{NB} - 2)^2 - 4k^2).$$

We provide a Figure 3 computed with $\alpha = \frac{1}{4}$ and $k = 0.235$. Such values where k is not too far from one-third make the trade-off for the retailer to arise by letting the branded manufacturer attractive enough for the PL production. Otherwise, when the constraint on k is too strong then the price for the PL would be too high in order to contain the demand.

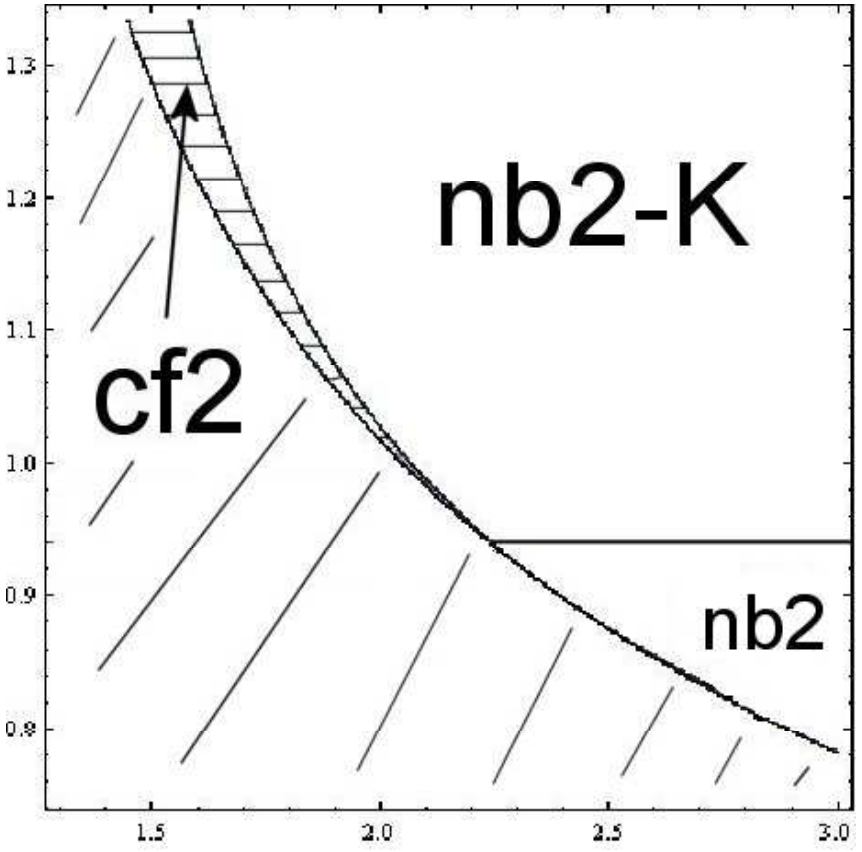

Figure 3: Equilibrium for retailer's products (capacity constraint on PL only) when $\alpha = \frac{1}{4}$ and $k = 0.235$ (depicted zone restricted to $q_{NB} \in [\frac{3}{4}, \frac{4}{3}]$ and $c \in [1.3, 3]$).

When capacity constraint only applies to the PL production, there now exists a situation where the national brand manufacturer is still elected for the PL production, even if quantities for PL good are bounded. However, if the cost-advantage of the branded manufacturer is low relatively to an independent firm, the retailer finds it more profitable to entrust his store brand production to the competitive fringe.

For a given NB quality, when maximal PL production is k, if the distributor elects the branded manufacturer, then he chooses a higher PL quality compared to (cf2). It results in a higher PL quantity (set to k) as well as a higher final PL price. The NB manufacturer has no other choice than to adapt his production by reducing NB quantity without changing its price.[8] One direct consequence is to reduce NB revenues while increasing PL ones. The retailer may thus find profitable to entrust his PL to the NB manufacturer as long as his cost-advantage is high enough to compensate the rents on the PL he leaves to the manufacturer. At the end, the capacity constraint hurts mainly the NB manufacturer while benefiting to the retailer.

[8]The property $p_{NB}(cf2) = p_{NB}(nb2-k)$ results from the additive form of the Mussa-Rosen utility combined with the invariance property described in De Meza(1997).

Conclusion

Private label production is a main issue for the upstream industry in terms of prospects. A NB manufacturer that is in competition with a competitive fringe for the production a private label always find it profitable to produce it rather than letting the private label be produced by an independent firm when the retailer chooses him.

The decision of the retailer for the choice between the two alternative potential producers (the NB manufacturer and an independent firm from a competitive fringe) is not straightforward and its trade-off deserved some economic analysis. When the NB manufacturer's production capacity is not limited, retailer's choice will mainly result from the trade-off between production efficiency and profitability. Indeed, for a given level of PL quality, the retailer will benefit from a cost advantage when dealing with the NB producer, resulting in a higher quality for his store brand whereas dealing with the competitive fringe would lead to a lower quality PL. However, because the distributor has less bargaining power with the NB manufacturer than with an independent firm (full bargaining power), he will capture less rents from his negotiation with the NB manufacturer. The lower his bargaining power, the lower the share of the net profits he will have.

We show that capacity constraint may also matter in such a trade-off. Assuming that the NB manufacturer may not be able to produce the total quantity required by the retailer when accepting to manufacture the PL, we find that the retailer will turn to the independent firm for the store brand rather than accepting the production reorganization proposed by the NB manufacturer. This reorganization consists in higher private label quality and thus results in lower quantities sold, which limits the gain he can get compared to those he can have when dealing with the competitive fringe. However, if the capacity constraint only applies to the private label product due to specificity of the production process, the retailer may accept to entrust his own brand to the NB manufacturer. Indeed, the private label benefits then from a higher quality and a higher price in order to limit store brand quantities such that capacity constraint is fulfilled. Sustaining a true competition with the NB product is indeed an appealing strategy for the retailer. Such a decision is jeopardized when the competing firm is not so inefficient in terms of production costs because the rent effect from keeping all revenues from the sales of the private label overrides the cost disadvantage of the independent firm.

The conclusions of our article partially confirm branded manufacturers' statement: they may produce store brand when they are not capacity constrained on total production. However, once production process is specific to the product by requiring for instance additional steps in production utilities (for achieving the recipe), then the manufacturers' statement is partially true. The retailer may indeed entrust the PL to the NB manufacturer even if capacity constrained.

A limit of our model is that it does not take into account the upstream competition between

different national brands. In this context, the branded manufacturer can choose to produce the private label as a counter-strategy and ask the retailer to remove rival brands from the shelves as a compensation in the negotiation. First, it should be noted that such 'agreement' is illicit from a competition policy point of view. Foreclosing rival brands would indeed result in lower variety offered to consumers without any efficiency increase in the vertical relationship. Second, the retailer may be reluctant to accept such a hazardous deal since there is a trade-off between a PL produced at a lower cost (in our framework) and a decrease in intrabrand competition in store (not modeled). On the long-run, the drawback of such a strategy may override the efficient PL production gains.

Regarding to competition between retailers, some further research may consist in introducing competition at the downstream level with more retailers, or going into details into production allocation of goods between NB and PL and intertemporal investment over time.

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