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FABIAN BERGÈS AND ZOHRA BOUAMRA-MECHEMACHE

Ecole d'économie de Toulouse (TSE) - Manufacture des Tabacs
Aile Jean-Jacques Laffont - 21, allée de Brienne - 31000 TOULOUSE
Tél : +33 (0) 5 61 12 85 89 - Fax : +33 (0) 5 61 12 86 37 - **www.TSE-fr.eu** - contact@TSE-fr.eu

Is Producing a Private Label Counterproductive for a Branded Manufacturer?*

Fabian Bergès† and Zohra Bouamra-Mechemache‡

Abstract

Branded food manufacturers vindicate the use of excess production capacities (idle otherwise) to justify their production of retailers' brands.

We study the distributor and food manufacturer's private label strategy for production within a framework featuring endogenous store brand quality, bargaining power, possible differences in production technology and potential capacity constraint for the branded manufacturer.

According to the structure of capacity constraint (applying to both products or private label only), the retailer may prefer to choose an independent firm whereas he selected the branded manufacturer when unconstrained. The conclusions of our article thus partially confirm branded manufacturers' thinking: they may produce store brands when they are not capacity constrained.

JEL Classifications: L11, L13, Q13.

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†Toulouse School of Economics (INRA-GREMAQ & IDEI); mail: Fabian.Berges@toulouse.inra.fr

‡Toulouse School of Economics (INRA-GREMAQ); mail: Zohra.Bouamra@toulouse.inra.fr

Introduction

The increasing development of private labels (PL), products managed and sold by retailers, is unquestionably the most successful distributors' strategy of the last 30 years. These products represented 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, 2009). Even though 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). Studies about PL producers' characteristics are rare, and figures to make comparisons across countries do not exist. According Moati, Mazars and Ranvier (2007), the number of agrofood firms that produce PL in France has increased in time and represented 27% of the total number of firms in this sector in 2005.[1] They generated 11.4% of total French agrofood industry revenue. The production of PL is mainly manufactured in small and medium-sized firms with a market share of 82% in French large food stores in 2006; leaving 12% for National Brand (NB) manufacturers. However, the share of small and medium-sized firms in the production of PL has tended to decrease to the benefit of large 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 conclusions 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 indeed allows distributors to get tariff concessions from manufacturers (see Mills 1995, 1998). Such a conclusion is robust to the type of contract

[1] To illustrate the diverse situations, in sub-sectors like milk, oil, desserts, ham, frozen food and pasta, leading brand manufacturers do produce store brands. However, for some other products, exclusive national brand production is the rule (chocolate, water, soda, ...).

signed between retailers and manufacturers (linear price, two-part tariff, see Caprice, 2000) and to the retailer's scope of strategies (choice of PL quality, see Bontems et al., 1999). Another consequence of PL development concerns retailers' competition. In the 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 increased interbrand competition in-store (as seen) but also lessened competition with their rivals. Characterized by the fact that a store brand can only be purchased in a given store (or chain store), consumers can no longer compare store brands to each other on a price basis only. PLs therefore increase retailers' differentiation in the product range proposed and consequently lessen retailing competition. The introduction of PLs can thus be seen as a twofold success (vertically and horizontally) for retailers, to the detriment of the NB manufacturers.[2]

When retailers sell PL, one important choice for them is to choose who is going to be the manufacturer. There are two possibilities for a retailer when he decides on his store brand production strategy. First, he can entrust his own brand to an independent firm that only manufactures PLs. This solution is often chosen, as shown by the statistics 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 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 the consumers' store loyalty are high enough. However, the demand specification used is quite restrictive and the quality of goods (PL and NB) is exogenous. Besides, demand is

[2]For empirical studies about private label development and its impact on national brand prices, see Bontemps et al. (2008) regarding France, or Ward et al. (2002) regarding the US. A theoretical model that supports empirical evidences on this particular topic is developed in Gabrielsen and Sørgard (2007).

completely inelastic, which discards any capacity constraint.

This analysis from just the "downstream point-of-view" (retailers) may not give the whole picture of what is really happening with PLs. PL production is also an important issue for manufacturers (upstream). Large agrofood firms in terms of manufacturers' brand portfolio, like Kraft or Unilever in the United States, confess that they produce PL for retailers. What could encourage the NB manufacturer to accept to produce a competing good? One answer is if the manufacturer refuses, someone else will do it and get this additional revenue. Another answer is that PL may be a way for NB manufacturers to improve their contract conditions for the NB products by also selling 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 that he will be capacity constrained and thus have to adapt his NB production.

The aim of our article is to investigate precisely both retailer's and NB manufacturer's decisions for PL production. In other words, does a capacity constrained manufacturer have an interest in producing 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 production of a store brand. The model developed takes 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's 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 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 values of the attractiveness of the competitive fringe, that is, when cost disadvantage is not too high. The conclusion of our article is thus that NB manufacturers may produce PLs when they 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 PL quantities only. The impact on quality and welfare are then analyzed. A general discussion with conclusions then follows.

1 The framework and timing of the game

A downstream monopolist retailer R can sell two goods, differentiated 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 $c_M(q_{NB}) = \frac{q_{NB}^2}{2}$. The second additional product is a private label (store brand) of endogenous quality q_{PL}. Quality is mainly the result of the combination of product characteristics such as ingredients and recipes, thus affecting marginal cost. However persuasive advertising effort by the manufacturer (not directly linked to quantities, fixed costs not considered here) may also influence consumers' decisions. It is assumed that the quality of the PL is lower than that of the NB: $q_{PL} < q_{NB}$.[3] There can be many explanations but the most

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

relevant one is that NB products are heavily advertised by branded manufacturers, whereas store brands are not. This creates for consumers a difference of perception regarding 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 consumer 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 an independent firm from a competitive fringe or he turns to the national brand manufacturer and tries to draw up 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 independent manufacturer is assumed to be part of a competitive sector, he will thus make 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 be produced, the independent firm incurs a unit-cost disadvantage relative to the branded manufacturer: $c_M(q_{PL}) = \frac{q_{PL}^2}{2}$ whereas $c_I(q_{PL}) = \frac{c \cdot q_{PL}^2}{2}$ and $c \geq 1$. This can be because of a technology difference coming from an experienced manufacturer (the NB one) or because of the difference in services the NB manufacturer may handle compared 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 as follows:

- *Step 1*: The retailer chooses his product range. He can either sell a National Brand, a Private Label or both products. If the retailer does choose to introduce his own Private Label, he simultaneously selects the product quality (q_{PL}) and who will produce it. He can entrust the Private Label either 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 article focuses 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 in a change in wholesale prices and franchises, the model considers that the retailer decides (and proposes) it all at once.[4]

- *Step 2*: 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 with the PL production decision. Second, the negotiated contract includes one franchise fee for both products with the NB manufacturer instead of two. It thus takes into account the fact 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

[4] A precise analysis of the 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 PL supplier once the product has been defined.

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) gives more economic arguments on this issue, as does 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} (case denoted *nb1*), 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 the 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 maximize the vertical profits by setting the wholesale price to the marginal cost while the fixed 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

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

of the retailer is thus:

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

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^{M*}_{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 only sell his own product 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), the wholesale price is set to the unit cost of production and the franchise fee to zero because of the competitive pressure in the industry. The retailer captures all the gain from the sales of the PL. The program of the distributor is therefore:

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

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 PL production to the branded manufacturer (option denoted *nb1* hereafter). This strategy implies two consequences for the retailer. On the 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 no longer has all the bargaining power as 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 is still set to unit cost, but the franchise fee will then reflect the manufacturer's position within the vertical structure. In other words, the retailer maximizes:

$$\max_{p_{PL}^{nb1}} \pi^{R(nb1)} = (p_{PL}^{nb1} - w_{PL}^{nb1*}) \cdot \left(1 - \frac{p_{PL}^{nb1}}{q_{PL}^{nb1}}\right) - F^{nb1} \text{ where } w_{PL}^{nb1*} = \frac{(q_{PL}^{nb1})^2}{2}. \tag{3}$$

The optimal price p_{PL}^{nb1*} for the PL if the retailer contracts with the NB manufacturer is derived from (3): $p_{PL}^{nb1*} = \frac{1}{4} q_{PL}^{nb1}(2 + q_{PL}^{nb1})$. 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 the commitment the retailer faces concerning the choice of the producer for his private label. In other words, it is assumed that the threat of turning 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 he 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 on 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 his weak position in the negotiation. This comes from the fact that the manufacturer's bargaining power applies to PL tariff conditions.

[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.

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 as follows:

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

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: $\theta q_{NB} - p_{NB} > \theta q_{PL} - p_{PL} \Leftrightarrow \theta > \frac{p_{NB} - p_{PL}}{q_{NB} - q_{PL}}$. 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 (situation *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 the quality choice was made at stage 1, he cannot change it (commitment on the definition of product characteristics). However, he can change the PL price to take into account the fact 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 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:

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

When the PL production is entrusted to an independent firm, the equilibrium quality of the PL and the equilibrium prices of the NB and PL can thus 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:

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

leading to:

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

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 (situation *nb2*). In this case, the retailer makes profits coming from both goods 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. Such a contractual restriction is in fact a shortcut that structurally modifies the game by depriving the retailer of using the PL as an outside option when negotiating the branded product. The resulting loss in retailer's bargaining power translates thus into a negotiation advantage for the branded manufacturer. 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. Additionally, 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 about the possibility for the retailer to change 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 the wholesale price set to marginal cost and the retailer's objective is to maximize:

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

This results in:

$$p_{NB}^{nb2*} = \frac{1}{4}q_{NB}(2 + q_{NB}) \; ; \; q_{PL}^{nb2*} = \frac{q_{NB}}{2} \; ; \; p_{PL}^{nb2*} = \frac{1}{16}q_{NB}(4 + q_{NB})$$

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

for $q_{NB} < \frac{4}{3}$. This condition ensures 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 the retailer's profit to know which choice is best between introducing one product or not, and having the PL produced by the NB manufacturer or the independent firm if the need arises. Figure 1 depicts the case when $\alpha = \frac{1}{4}$.

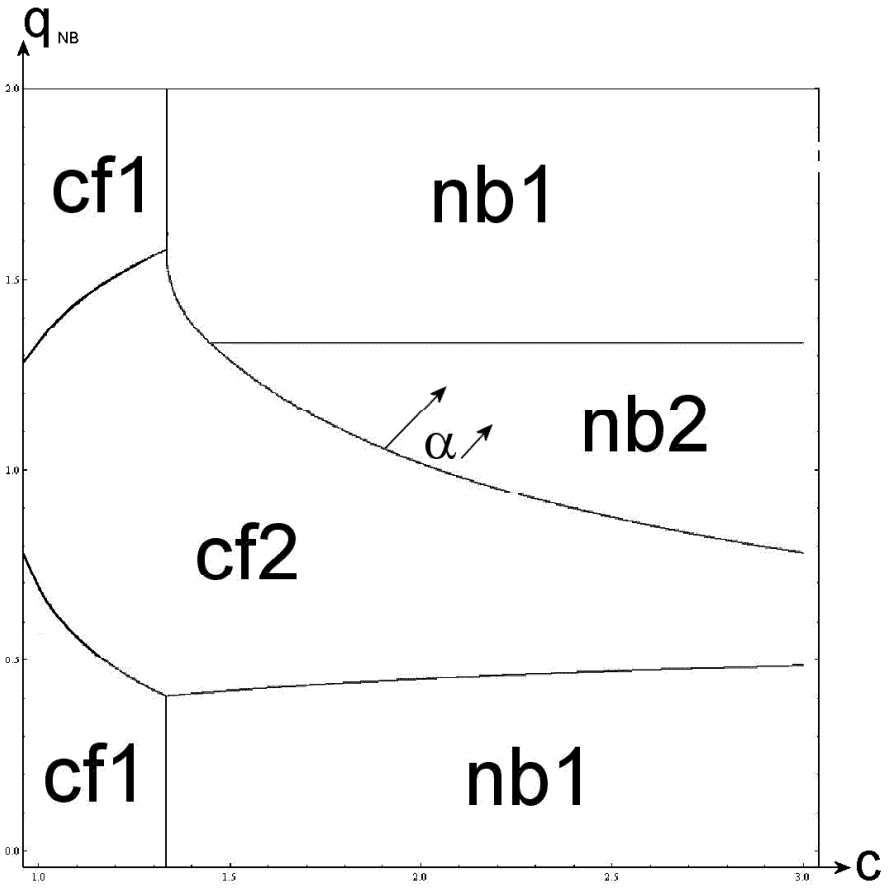

Figure 1: Equilibrium for retailer's products when $\alpha = \frac{1}{4}$.

Proposition 1 *For too low or too high values of the national brand quality, the retailer only sells its PL, whereas for intermediate values, the retailer has an interest to sell the NB product in addition to its own private label. Moreover, if the PL production cost-advantage of the branded manufacturer is high enough, the retailer entrusts its store good production to the latter.*

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 unit cost (c) incurred by the independent firm, the retailer entrusts his PL production to one firm from the competitive fringe. Indeed, the revenue of the PL then goes entirely to the retailer. However, if such cost increases, it becomes profitable for the distributor to have his PL produced by the national brand manufacturer. An independent firm in this case turns out to be too inefficient 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 cost c increases. This is the consequence of discrimination gains that tend to decrease the PL quality and thus to enlarge 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 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 $\alpha < \widetilde{\alpha} = \frac{43-\sqrt{57}}{64}$). PL production is entrusted to the NB manufacturer when the cost disadvantage of the independent firm is too prejudicial and jeopardizes 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 NB quality, consumers no longer buy the branded product (price too high) 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 is less likely than the one where the PL is entrusted to an independent firm. This outcome seems to fit with stylized facts where only 12 % of PL goods are produced by branded manufacturers.

Proposition 2 *When the bargaining power of the NB manufacturer increases, the retailer will be less inclined to entrust its PL to the branded manufacturer.*

Furthermore when the retailer bargaining power, that is $(1-\alpha)$, increases then he is more likely to introduce a PL produced by the branded manufacturer. The bargaining power of the retailer reflects the ability of the retailer to extract rents from the negotiation. It does not affect the joint profit made from the sale of both products on the market but the share of the profit each agent will capture. Then, when the retailer decides about PL production, he has to take into account its ability to retain a limited share of the vertical surplus. If such ability is low, retailer's own profit will be low despite the higher total profit generated when the branded manufacturer produces the PL. However, the share of the joint profit the distributor will capture increases with his bargaining power. So if he earns enough, he will then entrust the production of the PL to the NB manufacturer. This bargaining power argument could partially explain why only few large firms produce PL while smaller firms are more inclined to do it.

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 throws 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 is 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 production capacity. 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).[7] If the production process makes it possible to substitute one production line assigned to the NB to another assigned to the PL with negligible cost, then the constraint should apply to total production. Since the 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 the 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 switching is not possible, 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 PL production.

One could argue that there is large fixed 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 production limit of the manufacturer. However, this would not alter the manufacturer trade-off in the sense that such a fixed cost would have to be paid irrespectively of the choice to produce the PL or not. 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 fixed cost. Since we are more interested in the manufacturer's strategy in producing or not the PL, such formalization of the capacity cost did not appear to be relevant in our

[7] Capacity constraint is formalized in the usual extreme way where the production marginal cost becomes infinite once total quantity produced has reached the limit capacity K.

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

The assumption that capacity constraint applies to 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 his PL to him and therefore, the case where the manufacturer is capacity constrained may not show-up.[8]

The retailer's program when wholesale prices are set to marginal cost is (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

[8] 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 $\widetilde{q}_{NB} < 4 - 8K$.

market according to the remaining production capacity. Indeed, since the quality of the NB is higher than that of the PL, and costs are quadratic, the net value of the national brand is greater than that 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 demanded 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:

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

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

The retailer gets $\pi^{R(K*)} = (1-\alpha)\cdot\Pi^{K*}$ while the NB Manufacturer receives $\pi^{M(K*)} = (1-\alpha)\cdot\Pi^{K*}$.

Proposition 3 *When the branded manufacturer is capacity constrained on both goods, the retailer prefers to turn to an independent firm for PL production.*

One consequence when the manufacturer is capacity constrained on total production is that the quantities of its own national brand product have to be adjusted. The optimal quality of the PL product is indeed higher than in the unconstrained framework in order to enjoy market restriction, this generates a higher PL final price and thus more NB product sold than in the benchmark case. In the above discussion, we implicitly assume that the contract signed between M and R does not modify quantities provided by the NB manufacturer to rival distributors. Taking into account downstream competition may indeed modify the quantities ordered by competing retailers and therefore total quantities produced by the branded manufacturer. This would have an impact on the capacity constraint fulfillment when it applies to both products: for instance, the NB price increase due to PL production reorganization may lead to an increase of demand from rival retailers, making therefore the capacity constraint K more stringent. Situations where the PL is produced by the branded manufacturer would thus become less likely when retailers competition increase.

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 of private label manufacturer. In the framework developed here, PL quality is endogenized and the price of goods does influence the 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 the presence of a production capacity constraint. In this case, the retailer would choose to ask the NB manufacturer for a higher PL quality resulting in increased competition with the NB. Indeed, this leads to lower revenue from the NB product and makes the choice of an independent firm ($cf2$) more attractive for PL production. Moreover, the benefits of efficiency linked to lower production costs in situation ($nb2K$) are always overridden by the gains of bargaining power (since all benefits of 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 the capacity constraint is binding, the NB manufacturer no longer produces the PL for the retailer while he was doing so without constraint. His revenue 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 $4 - 8K < \frac{4}{3}$) lead to equilibrium depicted in Figure 2 (with $q_{NB} \in [\frac{3}{4}, \frac{4}{3}]$).

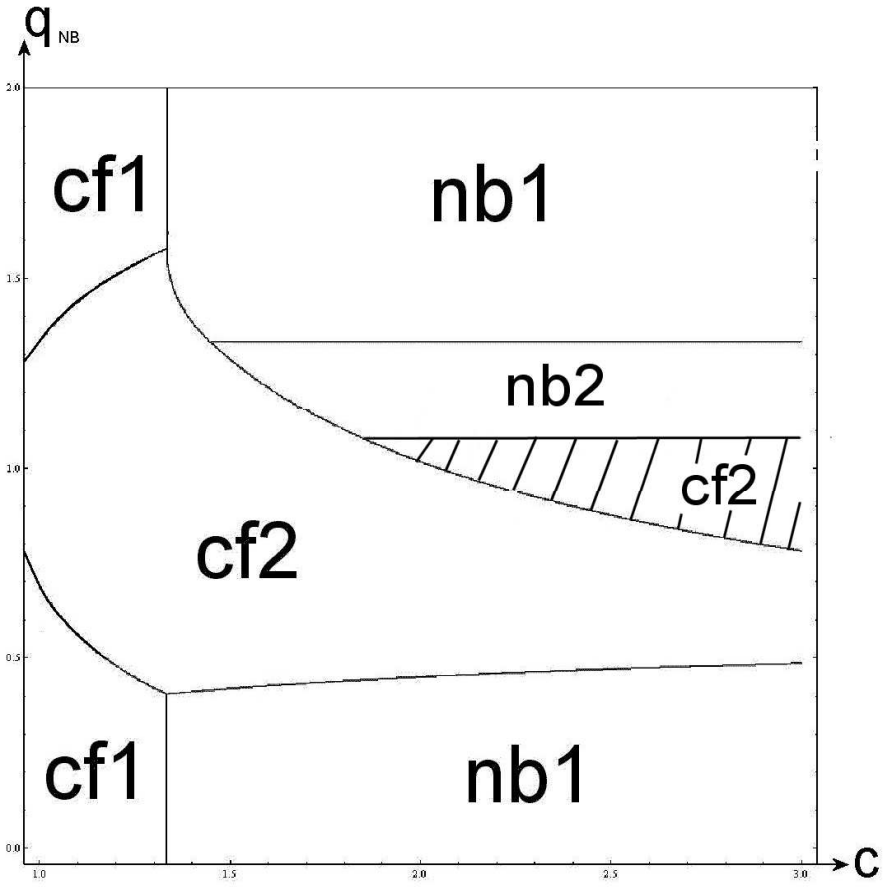

Figure 2: Equilibrium for retailer's products when $\alpha = \frac{1}{4}$ and capacity constraint on NB+PL.

When there is a capacity constraint for the NB manufacturer that applies to both products, the retailer prefers to entrust his 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 revenue 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 assign a production line from one good to another. This could result from specific tasks (or steps) in the production line that are connected intrinsically with the nature of the NB product. Therefore, the manufacturer decision will relate to producing PL with specific extra-capacity that is not used to 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 applied to total production instead of PL production only, the characterization was reversed: the national brand product needed to be of low-enough quality. When the capacity constraint applies only to PL production, an increase in NB quality directly implies an increase in 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:

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

The retailer's program when wholesale prices 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:

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

Figure 3 (computed with $\alpha = \frac{1}{4}$ and $k = 0.235$) depicts the equilibrium product range. Such values where k is not too far from one-third cause the trade-off for the retailer to occur making the branded manufacturer attractive enough for 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.

Proposition 4 *When the branded manufacturer is capacity constrained on PL production only, he may still produce the private label for the retailer.*

When capacity constraint only applies to PL production, there is now a situation where the national brand manufacturer is still selected for PL production, even if the quantities for PL goods are bound. However, if the cost-advantage of the branded manufacturer is small compared 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 selects 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.[9] One direct consequence is to reduce NB revenues while increasing PL ones. The retailer may

[9]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).

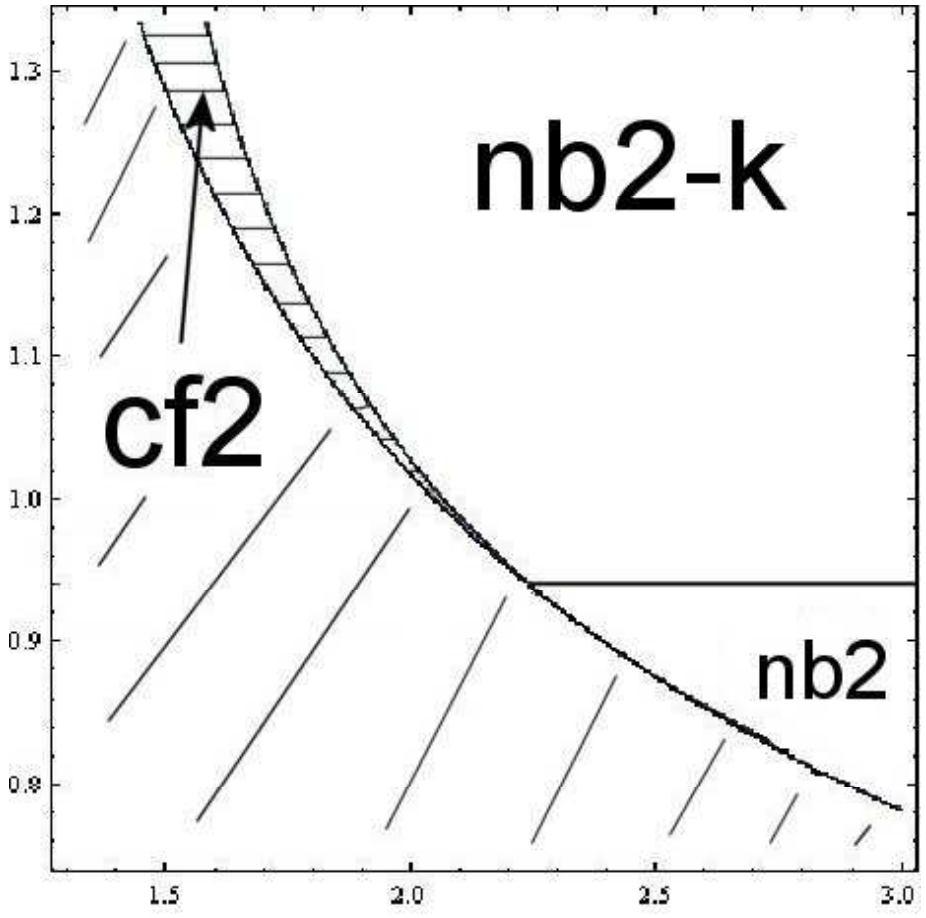

Figure 3: Equilibrium for retailer's products (capacity constraint on PL only) when $\alpha = \frac{1}{4}$ and $k = 0.235$ (depicted zone restricted to $q_{NB} \in [\frac{3}{4}, \frac{4}{3}]$ and $c \in [1.3, 3]$).

thus find it profitable to entrust his PL to the NB manufacturer as long as his cost-advantage is high enough to compensate for the rents on the PL he leaves to the manufacturer. Ultimately, the capacity constraint hurts mainly the NB manufacturer while benefiting the retailer.

4 Incidences on quality and welfare

Once the retailer decides on the range of goods as well as his PL manufacturer, one natural question is to ask about the optimal quality the NB manufacturer may choose for his product. Indeed, the manufacturer may anticipate the retailer's decision (equilibrium) and choose the quality of his national brand given the distributor's strategy. Such a choice will therefore depend on the independent firm's marginal cost (c) and on the bargaining power (α) in the

vertical structure since these two parameters are the determinants of the retailer's decision. The resulting profits for the NB manufacturer according to each possible outcome are the following:

$$\pi^{M(nb1)} = \frac{2\alpha}{27} \; ; \; \pi^{M(cf1)} = 0 \; ; \; \pi^{M(nb2)} = \frac{\alpha}{64} q_{NB}(q_{NB}(5q_{NB} - 16) + 16)$$

$$\pi^{M(cf2)} = \frac{\alpha q_{NB}\left(\sqrt{9c-8}(3cq_{NB}((9c-6)q_{NB}-8)+16) + \sqrt{c}(3q_{NB}(3c((10-9c)q_{NB}+8)-32)+16)\right)}{256\sqrt{c}}$$

$$\text{and } \pi^{M(nb2-k)} = \frac{\alpha}{16} q_{NB}\left(-4k^2 + 2kq_{NB} + (q_{NB}-2)^2\right)$$

The NB optimal quality is the one that maximizes the manufacturer's profits as long as there is no constraint that makes the retailer alter his decision about the product range or PL manufacturer. More precisely, the pattern decision for the manufacturer can be summarized as follows: the optimal (freely) chosen quality belongs to the relevant zone and then the NB quality is set to this (optimal) level; otherwise, by the concavity of profits, the frontier maximizes the manufacturer's benefits. For each case, Figure 4 depicts the optimal NB quality that could be chosen by the NB manufacturer.

This figure calls for some comments. First, a low value of the independent firm's marginal cost, the manufacturer must trade-off between *cf1* and *cf2* outcome. Since in *cf1*, he does not make any profits (PL is produced by the competitive fringe), he chooses q_{NB} such that the retailer selects *cf2*. When c increases, being on the frontier, q_{NB} decreases because the retailer is more likely to sell the NB product (discrimination profits become interesting). However, NB quality may increase as soon as the constraint is no longer binding for the manufacturer because it increases NB sales while it decreases PL revenue and thus the retailer's outside option. Second, for intermediate values of c, the manufacturer's trade-off is degenerated between *cf2* and *nb1*. Maximal profit (constant in c) is obtained under *nb1*, therefore, there is an infinity of optimal NB quality. This situation occurs because in *cf2*, the manufacturer only sells his NB leaving large rents to the retailer due to the PL outside-option in the negotiation. Last, for higher values of c, the NB manufacturer will get the highest profits when he produces both goods (*nb2*). He therefore chooses the binding NB quality such that the retailer does not entrust the PL to the independent firm (unconstrained optimal quality for *nb2* region is $q_{NB}* = 0.8$ when $\alpha = \frac{1}{4}$).

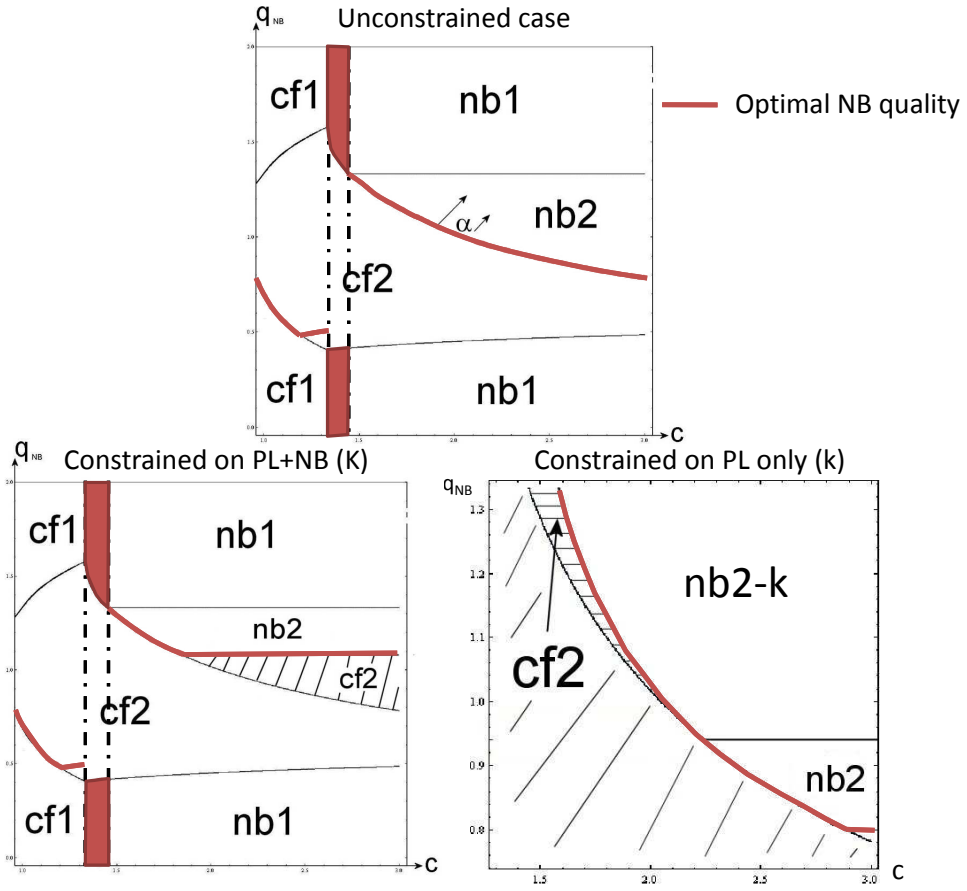

Figure 4: Optimal quality for the NB manufacturer in each possible equilibrium case.

In the case where the national brand manufacturer is capacity constrained on both products, the same reasoning applies. However, one consequence is that the NB quality is higher under capacity constraint (high values of c) because the manufacturer has to prevent the retailer from entrusting his PL to the independent firm (by choosing *cf2*). This higher NB quality translates into larger PL quantities given the capacity constraint in order to give incentives to the retailer for entrusting NB and PL to the NB manufacturer. The same reasoning also applies to the last case where only the PL production is capacity constrained.

The main finding of this analysis on the optimal NB quality is that NB quality increases with the competitiveness of the independent firm. This results from the NB manufacturer strategy of giving the retailer incentives to contract with him on both products in order to secure PL

production.

The retailer uses the PL as a countervailing tool in vertical negotiations with the upstream manufacturer to get better tariff concessions. Therefore, there may be a bias for social welfare when he entrusts his own brand to the competitive fringe because the independent firm is less efficient than the NB manufacturer.

Welfare is compared in situations where both products (NB and PL) are sold to end consumers, that is in cases *(cf2)* and *(nb2)*:

$$W^{cf2*} = \frac{3}{256} q_{NB} \left(q_{NB} \left(9\sqrt{9c-8}c^{3/2} q_{NB} + 9(4-3c)c q_{NB} - 8\sqrt{9c-8}\sqrt{c} q_{NB} - 32 \right) + 32 \right)$$

$$W^{nb2*} = \frac{3}{128} q_{NB} (q_{NB}(5q_{NB} - 16) + 16)$$

$$CS^{cf2*} = \frac{1}{256} q_{NB} \left(q_{NB} \left(9\sqrt{9c-8}c^{3/2} q_{NB} + 9(4-3c)c q_{NB} - 8\sqrt{9c-8}\sqrt{c} q_{NB} - 32 \right) + 32 \right)$$

$$CS^{nb2*} = \frac{1}{128} q_{NB} (q_{NB}(5q_{NB} - 16) + 16)$$

We find that $W^{nb2*} > W^{cf2*}$ in any case. Since the NB price and quality do not change, PL becomes more competitive and increases PL consumers' welfare.[10] However, NB quantities sold are thus lower in $(nb2)$ than in $(cf2)$ and consequently NB consumers' surplus is harmed. Ultimately, the PL effect overrides the NB effect and total consumers' surplus is higher in situation $(nb2)$. From the NB manufacturer's point of view, as previously seen, situation *(nb2)* is always preferred to *(cf2)*. The competitive fringe does not modify total welfare because marginal cost pricing necessarily induces zero profit and bargaining power between the retailer R and the NB manufacturer M does not affect welfare neither since it only changes vertical surplus sharing. The result is that social welfare is higher in *(nb2)*.

Social welfare may thus be harmed by the opportunistic behavior of the retailer when the PL becomes a bargaining chip for the NB negotiation with the manufacturer.

[10]Note that, with the Mussa-Rosen demand function, consumers' welfare depends not only on total quantity of each product sold (given by inverse quality-price ratio) but also on the quality level of each product. Since the PL is of higher quality in *(nb2)* than in *(cf2)*, even if sold at higher price, PL quantity increases (as well as PL consumers' surplus) because of the distribution of consumers' valuation for quality.

Conclusion

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

The decision of the retailer regarding the choice between the two alternative potential producers (the NB manufacturer and an independent firm from the competitive fringe) is not straightforward and its trade-off deserved some economic analysis. When the NB manufacturer's production capacity is not limited, the 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 gains he can get compared to those when dealing with the competitive fringe. However, if the capacity constraint only applies to the private label product due to the 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 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 revenue from the sales of the private label overrides the cost disadvantage of the independent firm.

The conclusions of our article partially confirm branded manufacturers' thinking: they may produce store brands when they are not capacity constrained on total production. However, once the production process is specific to the product by requiring, for instance, additional steps in production utilities (to achieve the expected recipe), then the manufacturers' thinking 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 compensation in the negotiation. First, it should be noted that such an '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). In the long-run, the drawback of such a strategy may override the efficient PL production gains.

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

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