

Is producing a private label counterproductive for a branded manufacturer?

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Abstract

Branded food manufacturers vindicate the use of excess production capacities to justify their production of retailers' brands. We study the distributor's and food manufacturer's private label (PL) strategy for production within a framework featuring endogenous store brand quality, bargaining power, possible differences in production technology and potential capacity constraints for the branded manufacturer. Depending on the structure of capacity constraint (applying to both products or to the PL only), we find that the retailer may prefer to choose an independent firm for the production of the store brand whereas the branded manufacturer is chosen in the case of excess capacity.

Keywords: production, brand competition, capacity constraint, retailing

JEL classification: L11, L13, Q13

1. Introduction

The increasing development of private labels (PLs), products managed and sold by retailers, is unquestionably the most successful distributors' strategy of the last 30 years. In 2006 these products represented up to 25 per cent of goods sold in the USA, 43 per cent in the United Kingdom, 30 per cent in France and 16 per cent in Italy according to the Private Label Manufacturers' Association (PLMA, 2009). Even though these figures conceal a strong heterogeneity across product categories,¹ 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

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1 In sub-sectors of the French agrofood industry such as 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 (such as chocolate, water, soda etc.).

to [Moati et al. \(2007\)](#), the number of agrofood firms that produce PL in France has increased over time and represented 27 per cent of the total number of firms in this sector in 2005. They generated 11.4 per cent of total French agrofood industry revenue. The production of PL is mainly manufactured in small and medium-sized French firms with a market share of 82 per cent in French large food stores in 2006; 12 per cent for French National Brand (NB) manufacturers and the remaining 6 per cent corresponding to foreign agrofood firms. 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 ([Bergès-Sennou et al., 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 ([Mills, 1998](#)). Another consequence of PL development concerns competition in the retail sector. In the absence of PLs, retailers used to sell the same product range of NBs and they were therefore competing on an intra brand basis for consumers’ patronage. However, the appearance of PLs deeply modified this assortment. Characterised 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 with 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

This analysis from the ‘downstream point-of-view’ (retailers) may not only 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 USA, confess that they produce PL for retailers. What could encourage the NB manufacturer to agree to produce a competing good? One answer is that 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 with retailers for the NB products by also selling PL. As argued by NB manufacturers ([Gomez-Arias and Bello-Acebron, 2008](#)), a third possible explanation may be that when they produce PLs, they use excess production capacity that would be costly otherwise. PL production can thus be a way for them to cover costs. However, if the manufacturer agrees to produce the PL, there is a possibility that he will be capacity constrained and thus will have to adapt his NB production.

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

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 widely used when there is a new PL to launch, as mentioned in Hughes (1997). Secondly, the retailer can entrust the production of his store brand to an NB manufacturer. This second solution is less common and might be surprising. Producer choice for the production of PL has been studied less widely 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 is high enough. However, the demand specification used is quite restrictive and the characteristics of goods (PL and NB) are exogenous, excluding the choice of the quality by both the NB manufacturer and the retailer who may use this dimension as a strategic rent-shifting device. Additionally, demand is completely inelastic, which discards any capacity-constraint analysis.

In our article, in addition to the bargaining power *versus* efficiency trade-off demonstrated in Bergès-Sennou (2006), we consider not only the choice of PL quality as a supplementary strategy for the retailer, but also the brand manufacturer counter-strategy by adapting his NB product characteristics. PL quality endogeneity introduces a new non-price competition strategy for the retailer on top of his product range decision. This results in a globally elastic demand where the price of the PL not only affects the competition between the branded product and the store brand, but also changes the total quantity bought by consumers. Additionally, on a short-run basis, we incorporate into the framework production decisions linked to capacity constraints. If the NB manufacturer produces the store brand, it clearly affects its production decision on its NB by introducing a new opportunity cost of producing the PL. Moreover, the PL quality may be adapted by the retailer in order to enjoy maximal gain on the PL with the branded manufacturer by distorting NB competitiveness.

The objective of our article is to investigate precisely both retailer's and NB manufacturer's decisions for PL production. We find that the retailer will not always entrust the production of his PL to the NB manufacturer. When negotiating with the NB manufacturer, the outcome will depend on the relative production cost-advantage of the manufacturer compared with the competitive fringe as well as on the quality of the NB brand. He will select the NB manufacturer only if the NB quality is not too high compared with the quality of its own brand and when the cost-advantage is high enough. Moreover, when the NB manufacturer cannot choose freely his production because he is capacity constrained on the total production (NB and PL), results show that the retailer may not entrust the PL to the brand manufacturer (even if the PL quality would be higher). When capacity constraint only applies to PL, the retailer may jeopardise his decision if the cost disadvantage of the competitive fringe 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 article is organised as follows. The next section presents the economic framework and firms' strategies. Section 2 analyses 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 analysed. Finally, a general discussion with conclusions follows.

2. 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 (NB) of exogenous quality q_{NB} produced by an upstream manufacturer M at a unit cost $c_M(q_{NB}) = q_{NB}^2/2$. The second additional product is a store brand (PL) 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. It is assumed that the quality of the PL is lower than that of the NB: $q_{PL} < q_{NB}$.³ There may be many explanations but the most relevant one is that NB products are heavily advertised by branded manufacturers, whereas store brands are not. This generates a higher willingness-to-pay for NBs than for PLs (see [Bell et al., 2000](#); [Bergès et al., 2009](#)).

To produce the PL, the retailer has two options: either he asks an independent firm from a competitive fringe (I) or he turns to the NB manufacturer (M) 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 NB manufacturer. The bargaining power of the latter will be denoted α and the retailer's will thus be $(1 - \alpha)$. It is important to note that these alternatives for 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 assume that for the same PL quality to be produced, the independent firm incurs a unit-cost disadvantage relative to the branded manufacturer: $c_M(q_{PL}) = q_{PL}^2/2$, whereas $c_I(q_{PL}) = cq_{PL}^2/2$ and $c \geq 1$. This can be because of a technology

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 PLs 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 PLs that have been recently introduced in order to increase consumer loyalty or to attract new consumers. However, for such items, concerning their production, retailers exclusively turn towards small specialized firms, discarding national brand manufacturers. The issue for high-quality PL production cannot be treated within our framework since the trade-off exposed in our article would never occur.

difference coming from an experienced manufacturer (the NB one) or because of the difference in services the NB manufacturer may handle compared with 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 and Rosen \(1978\)](#): $U(\theta, q, p) = \theta q - p$, 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 $[0,1]$.⁴ The timing of the game is as follows:

Step 1: The retailer chooses his product range. He can either sell an NB, a PL or both products. If the retailer chooses to introduce his own PL, he simultaneously selects the product quality (q_{PL}) and who will produce it: the NB manufacturer or 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 the NB, 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 PL 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 PL manufacturer. This choice impacts on the technology used and may thus result in a different PL quality. To evacuate a complicated scheme where PL quality could be changed according to the choice of PL manufacturer, which in turn results in a change in wholesale prices and franchises, the model considers that the retailer decides (and proposes) it all at once.⁵

Step 2: The retailer decides the final prices of the PL (p_{PL}) and/or the NB good (p_{NB}).

The game proposed here takes into account the fact that the two brands strategically interact in the negotiation through one franchise for both products. This assumption reinforces the bargaining position of the NB manufacturer and allows 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

4 PL quality endogeneity creates an asymmetry between the retailer (who controls its product quality) and the manufacturer (who does not). Product differentiation is therefore *de facto* decided by the retailer. Empirically, NB quality does not vary across retailers (indeed, the NB manufacturer cannot adapt quality for each retailer) whereas PL quality does since it is retailer specific. Therefore, in our framework where we consider the equilibrium for a given retailer's chain, we assume NB quality as given for the retailer. This assumption will however be relaxed in Section 4.

5 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.

of making his profits dependent fully on one manufacturer (i.e. zero profit if the negotiation over the NB tariff fails). Moreover, sacrificing his outside-option can be seen as the opportunity cost for the retailer to enjoy NB manufacturer cost advantage.⁶ If this assumption is removed, the only possible outcome is that the NB manufacturer produces the PL, which does not corroborate observed facts. Two explanations can be put forward to explain this. The NB manufacturer may indeed condition the delivery of the PL on the negotiation outcome over the NB and this is taken into account in our model. In addition, it is not easy for a retailer to change suppliers quickly without affecting the characteristics of the PL. 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 \(2006: 322\)](#) as well as [Caprice \(2000\)](#) provide more economic arguments on this issue.

3. Benchmark case: no capacity constraint

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

3.1. Selling only the NB

If the retailer decides to introduce only an NB of quality q_{NB} at a price p_{NB} , consumers buy the good as long as $\theta q_{NB} - p_{NB} > 0 \Leftrightarrow \theta > p_{NB}/q_{NB}$. 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 maximise 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).⁷ The program of the retailer is thus:

$$\max_{p_{NB}} \pi_{NB}^R = (p_{NB} - w_{NB}^*) \left(1 - \frac{p_{NB}}{q_{NB}} \right) - F \quad (1)$$

⁶ This issue was raised thanks to an anonymous referee.

⁷ The detailed analytical framework and its foundations are described in [Osborne and Rubinstein \(1990\)](#).

where

$$w_{NB}^* = c_M(q_{NB}) = \frac{q_{NB}^2}{2}.$$

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

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

$$\pi_{NB}^{R*} = \frac{1 - \alpha}{16}((2 - q_{NB})^2 q_{NB});$$

and

$$\pi_{NB}^{M*} = \frac{\alpha}{16}((2 - q_{NB})^2 q_{NB}) = F^*.$$

3.2. 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 (equilibrium denoted eq. *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:

$$\max_{p_{PL}^{cf1}} \pi^{R(cf1)} = (p_{PL}^{cf1} - w_{PL}^{cf1*}) \left(1 - \frac{p_{PL}^{cf1}}{q_{PL}^{cf1}} \right) - F^{cf1} \quad (2)$$

where

$$w_{PL}^{cf1*} = \frac{c(q_{PL}^{cf1})^2}{2}.$$

The outcome of this maximisation is $p_{PL}^{cf1*} = (1/4)q_{PL}^{cf1}(2 + cq_{PL}^{cf1})$, which leads to $\pi^{R(cf1)*}(q_{PL}^{cf1}) = [(2 - cq_{PL}^{cf1})^2 q_{PL}^{cf1}]/16$. Maximising $\pi^{R(cf1)*}(q_{PL}^{cf1})$ with respect to q_{PL}^{cf1} gives the optimal PL quality, $q_{PL}^{cf1*} = 2/3c$ and an ex-post retailer profit equal to $\pi^{R(cf1)*} = 2/27c$.

A second option for the retailer is to entrust PL production to the branded manufacturer (option denoted eq. *nb1* hereafter). 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 maximises:

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

where $w_{PL}^{nb1*} = (q_{PL}^{nb1})^2/2$.

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

$$\pi^{R(nb1)}(q_{PL}^{nb1}) = \frac{(1 - \alpha)(2 - q_{PL}^{nb1})^2 q_{PL}^{nb1}}{16}$$

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 PL. 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 PL. 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.⁸ Maximising the ex-post profit according to the PL quality leads to optimal quality for the PL when it is produced by the NB manufacturer:

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

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 PL, he balances the gain he can get from the efficient technology proposed by the NB manufacturer (translated by a cost advantage) with his weaker position in the negotiation. This comes from the fact that the manufacturer’s bargaining power also applies to PL tariff conditions. As a consequence, he makes a trade-off between higher quality for his PL at lower cost and rents to leave to the upstream manufacturer. Actually, the NB manufacturer is able to offer a

8 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 excessively high transaction costs in the short run so that the retailer’s threat at this stage is marginal.

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 branded product.

3.3. 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 a PL of quality $q_{PL} < q_{NB}$ sold at a price p_{PL} , demand is as follows:

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

while

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

The first possibility, like in the previous case, is to entrust the PL to an independent firm (eq. *cf2*). If an agreement is found, then $w_{NB}^{cf2} = q_{NB}^2/2$. Regarding the PL, since the production comes from the competitive sector, it is also set to marginal cost: $w_{NB}^{cf2*} = c(q_{PL}^{cf2})^2/2$. Therefore, the retailer's program is to maximise:

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

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:

$$\begin{aligned} p_{NB}^{cf2*} &= \frac{1}{4} q_{NB} (2 + q_{NB}); & q_{PL}^{cf2*} &= \frac{1}{4} q_{NB} \left(3 - \frac{\sqrt{9c - 8}}{\sqrt{c}} \right) \\ p_{PL}^{cf2*} &= \frac{q_{NB} [\sqrt{c}(12 + (9c - 4)q_{NB}) - \sqrt{(9c - 8)(3cq_{NB} + 4)}]}{32\sqrt{c}} \end{aligned}$$

leading to the following vertical profit to be shared between the retailer and the manufacturer:

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

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 is positive, if no agreement is reached with the NB

manufacturer. If the retailer refuses an agreement on the NB with the branded manufacturer, he still can sell his PL and put one product (instead of two) on the shelves. In such a case, he cannot change quality since the quality choice was made at stage 1 (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. In case of disagreement, the retailer's reservation profit is therefore given by:

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

leading to

$$\tilde{p}_{PL} = \frac{1}{4} q_{PL}^{cf2*} (2 + c q_{PL}^{cf2*})$$

and

$$\tilde{\pi}^{R*} = \frac{(3\sqrt{c} - \sqrt{9c - 8})q_{NB}(8 - 3cq_{NB} + \sqrt{c(9c - 8)}q_{NB})^2}{1024c}$$

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: $\pi^{R(cf2)*} = (1 - \alpha)(\Pi^{cf2*} - \tilde{\pi}^{R*}) + \tilde{\pi}^{R*}$. The retailer will pay the NB manufacturer a franchise fee $F^{cf2*} = \alpha(\Pi^{cf2*} - \tilde{\pi}^{R*})$ that will also depend on his relative bargaining power and on the disagreement payoff of the retailer.

The second possibility is to entrust the PL production to the NB manufacturer (eq. *nb2*). In this case, the retailer profits depend on the NB and PL production from the same manufacturer. To model this particular choice, we follow [Bergès-Sennou \(2006\)](#) and assume that the franchise negotiated with the NB manufacturer concerns both the PL and the NB. 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 thus translates 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 no longer has a reservation profit since both goods are negotiated jointly. One could think about the possibility for the retailer of changing 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 maximise:

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

This results in

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

and

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

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

3.4. Benchmark: the retailer’s product range choice

All the subgames being solved, we 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 $\alpha = 1/4$.

Proposition 1. For excessively low or high values of the NB quality, the retailer only sells his PL, whereas for intermediate values, it is in the retailer’s interest to sell the NB product in addition to his own PL. 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 PL is more competitive compared with the branded product: he therefore chooses to sell exclusively the PL good. This outcome prevails in situations (eq. *cf1*) and (eq. *nb1*) at the bottom of Figure 1. 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 (eq. *cf1*). Indeed, the revenue

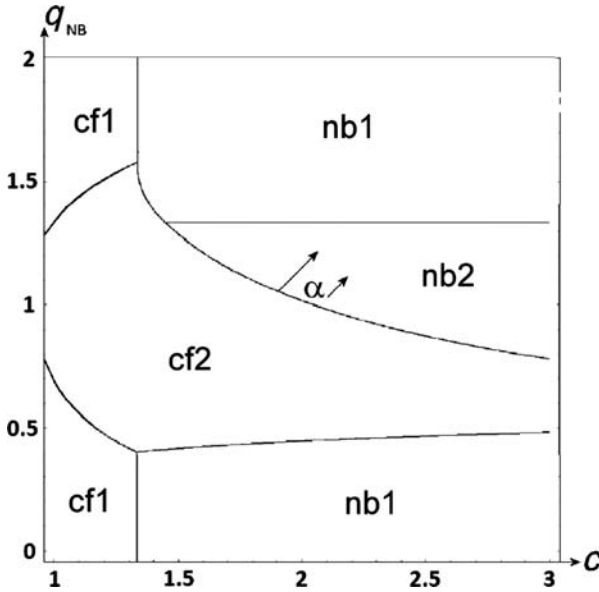


Fig. 1. Equilibrium for retailer's products when $\alpha = 1/4$.

of the PL then goes entirely to the retailer. However, if this cost increases, it becomes profitable for the distributor to have his PL produced by the NB manufacturer (eq. *nb1*). An independent firm in this case turns out to be too inefficient compared with the rents the retailer has to leave to the NB manufacturer (bargaining process). Note that, for a given NB 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 NB is higher, the retailer sells both products (areas *cf2* and *nb2*). The trade-off for the PL manufacturing between (eq. *cf2*) and (eq. *nb2*) 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 $\alpha < \tilde{\alpha} = (43 - \sqrt{57})/64$). PL production is entrusted to the NB manufacturer (eq. *nb2*) when the cost disadvantage of the independent firm is too high and jeopardises PL profitability. Moreover, the NB is produced only if there is a positive demand (NB price needs to be lower than consumers' willingness to pay), which is the case when $q_{NB} < 4/3$ translating into an upper limit for area (*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 (as depicted by areas *cf1* and *nb1* at the top of the figure). The trade-off for its production fully depends on the unit cost c as in the first situation when q_{NB} was low.

When the bargaining power of the NB manufacturer increases, the retailer will be less inclined to entrust its PL to the branded manufacturer. For a given

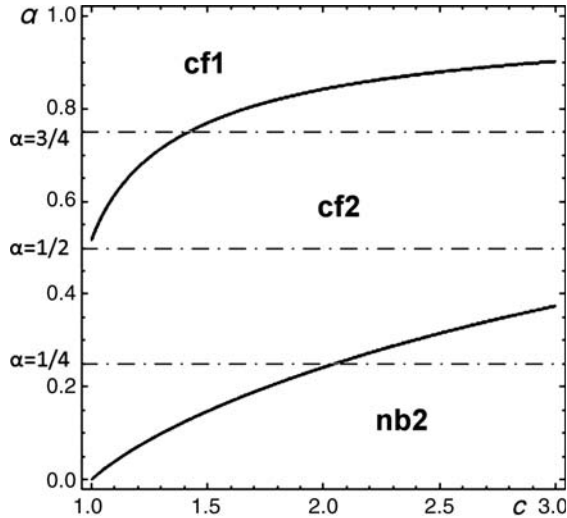


Fig. 2. Equilibrium for retailer's products when $q_{NB} = 1$.

NB quality, the trade-off between bargaining power and efficiency is depicted in Figure 2.

When α is small, the retailer chooses the NB manufacturer to produce its PL even if the NB manufacturer does not have a large comparative cost advantage. For intermediate values of α , the retailer cannot capture enough rent from the negotiation with the NB and always prefers his PL to be produced by an independent firm. Finally, if the bargaining power of the NB manufacturer becomes too large, the retailer modifies his product range by delisting the NB.⁹ 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 stylised facts where only 12 per cent of PL goods are produced by French branded manufacturers.

Actually, as in Bergès-Sennou (2006), the bargaining power of the manufacturer reflects his ability to extract rents from the negotiation with the retailer. 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 on 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 so.

9 Note that since the exogenous level of the NB is set to 1 in Figure 2, equilibrium *nb1* vanishes as a high bargaining power of the NB manufacturer results in low rents for the retailer on its PL product.

One interesting outcome relies on the PL quality level with respect to the introduction of the NB product. For instance, when $q_{NB} = 3/2$, PL quality is higher under eq. *cf1* and eq. *nb1* (without NB sold) than under eq. *cf2*. This emphasises 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 finds 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 such a strategy to be profitable 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 consider the case where the manufacturer is capacity constrained.¹⁰ He may therefore have to choose his production scheme if asked by the retailer to produce the PL.

4. 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).¹¹ 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. We assume that the qualities of PL and NB are subjectively considered as different by consumers because of marketing strategies ($q_{NB} > q_{PL}$), even if the products' characteristics may be objectively similar. In such a case, a capacity constraint applying to total production means that it is easy for the manufacturer to reallocate the production process between the NB and the PL if needed. On the contrary, when

10 While the long-run analysis is given by Section 1, capacity constraint may be considered even when contracts are efficient in the short-run. The manufacturer may indeed fail to choose the right capacity for the long-run equilibrium because, for instance, the evolution of demand may not have been correctly anticipated.

11 Capacity constraint is formalised in the usual extreme way where the production marginal cost becomes infinite once total quantity produced has reached the limit capacity K . Also, there could be a fixed cost to be paid by the firm based on the production capacity limit: $f(K)$ where (\cdot) 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 irrespective 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 a formalization of the capacity cost did not appear to be relevant in our analysis.

switching is not possible, then capacity constraint should apply only to the PL production quantities. This implies that the manufacturer has an excess production capacity that he chooses to devote exclusively and irreversibly to PL production.

There may be some potential ambiguity between the assumptions of production process substitutability and final goods substitutability.¹² However, there is no clear relationship between the two. It is not because a manufacturer can switch easily between two production processes that the goods produced are necessarily close substitutes in the end. Indeed, one production process with a specific number of input processing steps may lead to different final goods that are not close substitutes. Input combinations can be changed without using a different production process (for instance, for the same production line, changing cacao and/or milk content may result in very differentiated chocolate products).

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

4.1. Capacity constraint applies to both NB and PL production

The assumption that capacity constraint applies to total production is characterised by:

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

The above inequality boils down to $k > 1/3$. For the total demand to be constrained, the NB quality has to be low enough. The substitution pattern between products results in an increased PL demand when the NB quality decreases. Due to Mussa and 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 (eq. nb2), the bargaining power α must satisfy:

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

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.¹³

The retailer's program when PL is produced by the NB manufacturer and wholesale prices are set to marginal cost is (superscript K will denote variables

12 We thank one anonymous referee for pointing out this issue on product characteristics.

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

in this setting):

$$\begin{aligned} \max_{(p_{NB}^K, p_{PL}^K, q_{PL}^K)} \Pi^K &= \left(p_{NB}^K - \frac{q_{NB}^2}{2} \right) \left(1 - \frac{p_{NB}^K - p_{PL}^K}{q_{NB} - q_{PL}^K} \right) + \left(p_{PL}^K - \frac{(q_{PL}^K)^2}{2} \right) \\ &\times \left(K - 1 + \frac{p_{NB}^K - p_{PL}^K}{q_{NB} - q_{PL}^K} \right) - F^K. \end{aligned}$$

This implicitly assumes an ‘efficient rationing rule’ for consumers between PL and NB, as described in [Tirole \(1988: 213\)](#). 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 that of the PL and costs are quadratic, the net value of the NB is greater than that provided by the PL from a vertical industry point-of-view. The maximising profit price for the PL is:

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

This generates a quantity demanded for each product equal to:

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

and

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

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:

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

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

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

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

$$\begin{aligned} \Pi^{K*} &= \frac{1}{54} \left[2 - 12K + 6K^2 + 20K^3 \right. \\ &\quad \left. - 2 \left(7K^2 + 4K(q_{NB} - 1) + (q_{NB} - 1)^2 \right)^{\frac{3}{2}} \right. \\ &\quad \left. - 6q_{NB} - 30Kq_{NB} + 48K^2q_{NB} + 6q_{NB}^2 + 15Kq_{NB}^2 - 2q_{NB}^3 \right] \end{aligned} \tag{8}$$

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

Proposition 2. 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 NB 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 the manufacturer and the retailer 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 fulfilment when it applies to both products: for instance, the NB price increase due to PL production reorganisation may lead to an increase in demand from rival retailers, thereby making the capacity constraint K more stringent. Situations where the PL is produced by the branded manufacturer would thus become less likely when competition increases.

Bergès-Sennou (2006) emphasised the importance of the trade-off between efficiency and bargaining power in the retailer's choice of PL manufacturer. In the framework developed here, PL quality is endogenised 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 this 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 more intense competition with the NB. Indeed, this leads to lower revenue from the NB product and makes the choice of an independent firm (eq. *cf2*) more attractive for PL production. Moreover, the benefits of efficiency linked to lower production cost in equilibrium (*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.

Simulations made for $\alpha = 1/4$ and $K = 0.37$ (since $4 - 8K > 0.8$ and $4 - 8K < 4/3$) lead to equilibrium depicted in Figure 3 (with $q_{NB} \in [(3/4, 4/3]$). The capacity constraint condition is relevant when $q_{NB} \leq 4 - 8K$, translating into $q_{NB} \leq 1.04$. Then, when the capacity constraint is binding, the NB manufacturer no longer produces the PL for the

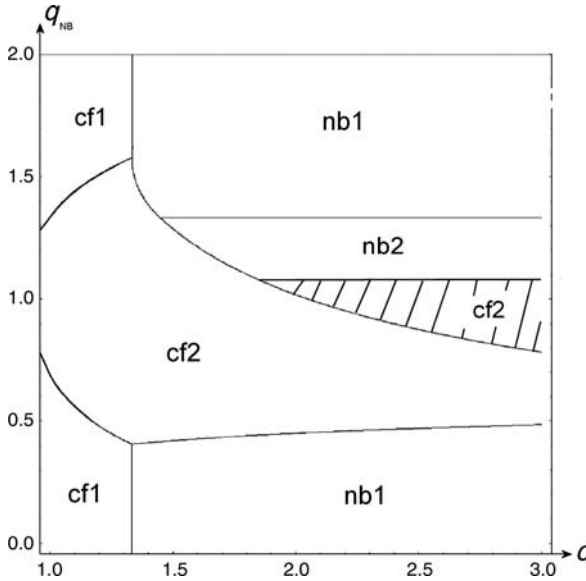


Fig. 3. Equilibrium for retailer's products when $\alpha = 1/4$ and capacity constraint on NB + PL.

retailer while he was doing so without constraint (dashed area). 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.

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.

4.2. Capacity constraint only applies to the PL production

Contrary to the previous section, we could 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 characterised by (superscript k will denote such setting):

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

Note that when capacity constraint applied to total production instead of PL production only, the characterisation was reversed: the NB 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:

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

The retailer’s program when wholesale prices are set to marginal cost is thus:

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

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

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

Total quantities produced at the equilibrium are:

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

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

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

and

$$\pi^{m(k*)} = \alpha \frac{q_{NB}}{16} (2kq_{NB} + (q_{NB} - 2)^2 - 4k^2)$$

Figure 4 (computed with $\alpha = 1/4$ and $k = 0.235$) depicts the equilibrium product range. The manufacturer is capacity constrained when $q_{NB} \geq 4k = 0.94$ and the retailer withdraws the PL in the dashed area. 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 3. When the branded manufacturer is capacity constrained on PL production only, he may still produce the PL for the retailer.

When capacity constraint applies only to PL production, the NB manufacturer is still selected for PL production (plain area $nb2-k$), even if the quantities for PL goods are bound. However, if the cost-advantage of the

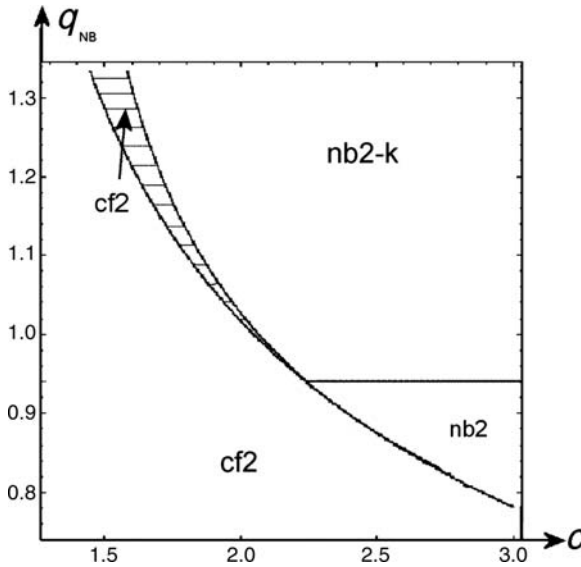


Fig. 4. Equilibrium for retailer's products (capacity constraint on PL only) when $\alpha = 1/4$ and $k = 0.235$ (depicted zone restricted to $q_{NB} \in [3/4, 4/3]$ and $c \in [1.3, 3]$).

branded manufacturer is small compared with an independent firm, the retailer finds it more profitable to withdraw the PL from M and entrust his store brand production to the competitive fringe (dashed area).

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 with (eq. $cf2$). 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 but to adapt his production by reducing his NB quantity without changing its price.¹⁴ One direct consequence is to reduce the revenues from the NB while increasing those from the PL. The retailer may 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 mainly hurts the NB manufacturer while benefiting the retailer.

5. 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 adequately choose the quality of his NB given the distributor's strategy. Such a choice will therefore depend on the

¹⁴ 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 \(1997\)](#).

independent firm's marginal cost (c), on the bargaining power (α) in the vertical structure and on the capacity constraint scheme since these three parameters are the determinants of the retailer's decision. The resulting profits for the NB manufacturer according to each possible outcome are the following:

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

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

and

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

The NB optimal quality is the one that maximises the manufacturer's profits as long as there is no constraint that makes the retailer altering his decision about the product range or PL manufacturer. More precisely, the pattern decision for the manufacturer can be summarised as follows: the optimal (freely) chosen quality is interior to the relevant zone and then the NB quality is set to this (optimal) level; otherwise, because of the assumption on the concavity of profits, the chosen quality is the one belonging to the frontier. For each case, Figure 5 depicts the optimal NB quality that could be chosen by the NB manufacturer in each possible situation regarding the capacity constraint and according to the cost of the rival-independent firm.

Proposition 4. The optimal NB quality chosen by the manufacturer, according to PL characteristics, increases with the competitiveness of the independent firm.

Proposition 4 is illustrated by Figure 5. First, for a low value of the independent firm's marginal cost, the manufacturer faces a trade-off between the eq. *cf1* and eq. *cf2* outcomes. Since in eq. *cf1*, he does not make any profits on the PL (produced by the competitive fringe), he chooses q_{NB} such that the retailer selects eq. *cf2*, that is for intermediate values of NB quality. When c increases, being on the frontier, q_{NB} decreases because the retailer is more likely to sell the NB product (discriminating demand in quality by selling both goods). 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. Secondly, for intermediate values of c , the manufacturer's trade-off is degenerated between eq. *cf2* and eq. *nb1*. Maximal profit (constant in c) is obtained under eq. *nb1* and there is therefore a range of low or high optimal NB quality, depicted by the shaded areas in Figure 5. This situation

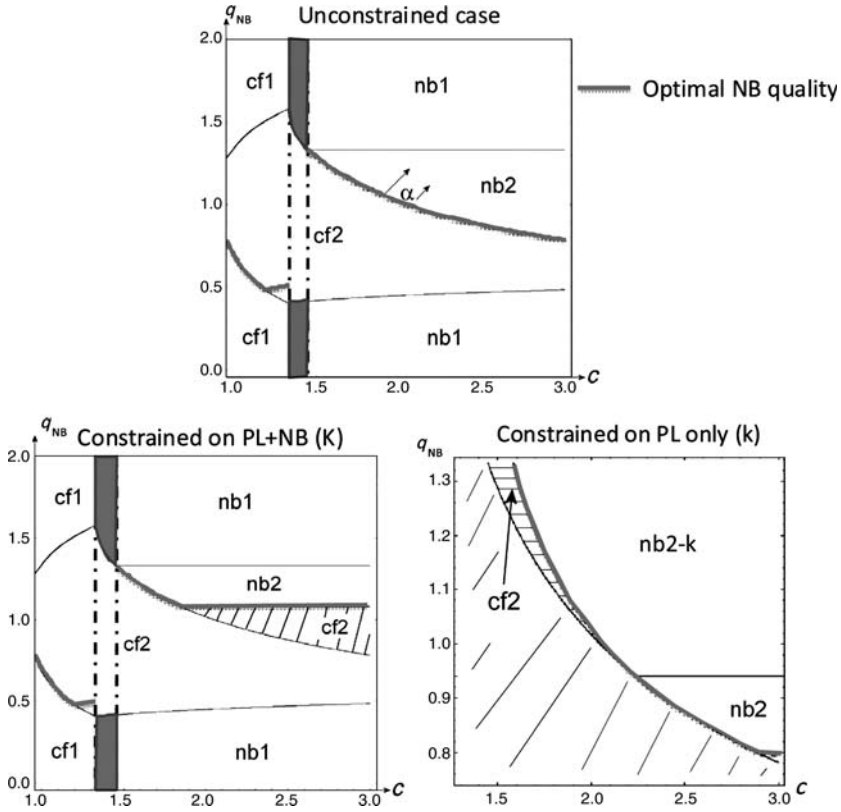


Fig. 5. Optimal quality for the NB manufacturer in each possible equilibrium case.

occurs because in eq. *cf2*, the manufacturer sells only his NB leaving large rents to the retailer due to the PL outside-option in the negotiation. Finally, for higher values of *c*, the NB manufacturer will get the highest profits when he produces both goods (eq. *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 eq. *nb2* region is $q_{NB}^* = 0.8$ when $\alpha = 1/4$).

In the case where the NB 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 eq. *cf2*). This higher NB quality translates into larger PL quantities (given the capacity constraint) in order to give incentives to the retailer for entrusting the 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 NB manufacturer's strategy is to give the retailer

adequate 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. There may be some negative effects for social welfare when he entrusts his own brand to the competitive fringe since the independent firm is less efficient than the NB manufacturer. Welfare and consumers' surplus are compared in situations where both products (NB and PL) are sold, that is, in cases (eq. *cf2*) and (eq. *nb2*):

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

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

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

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

In the specific case where $c = 1$, the NB manufacturer has no efficiency advantage and therefore, social welfare is the same under (eq. *nb2*) and (eq. *cf2*). In other cases, we find that welfare is higher when the NB manufacturer produces the PL: $W^{nb2*} > W^{cf2*}$ because the PL becomes more competitive and increases PL consumers' welfare.¹⁵ However, NB quantities sold are lower in (eq. *nb2*) than in (eq. *cf2*) and consequently NB consumers' surplus is reduced. Ultimately, the PL effect overrides the NB effect and total consumers' surplus is higher in (eq. *nb2*): $CS^{nb2*} > CS^{cf2*}$. From the NB manufacturer's point of view, as previously seen, (eq. *nb2*) is always preferred to (eq. *cf2*). The competitive fringe does not modify total welfare because marginal cost pricing necessarily induces zero profit and bargaining power between the retailer and the NB manufacturer does not affect welfare either, since it only changes vertical surplus sharing. The result is that social welfare is higher in (eq. *nb2*).

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

15 Note that with the Mussa and Rosen demand function, consumers' welfare depends not only on total quantity of each product sold (given by the inverse quality-price ratio) but also on the quality level of each product. Since the PL is of higher quality in (*nb2*) than in (eq. *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.

6. Conclusion

PL production is a key issue for the upstream food industry in terms of prospects. An NB manufacturer who competes for the production of a PL may find it profitable to produce the PL rather than letting the PL be produced by an independent firm. The decision of the retailer regarding the choice between the two potential producers (the NB manufacturer and an independent firm from the competitive fringe) is not straightforward and deserves 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.

We show that introducing capacity constraints also matters. Assuming that the NB manufacturer may not be able to produce the total quantity required by the retailer when agreeing to manufacture the PL, we find that the retailer will turn to the independent firm for the store brand rather than accepting the production reorganisation proposed by the NB manufacturer. However, if the capacity constraint applies only to the PL product due to the specificity of the production process, the retailer may accept to entrust his own brand to the NB manufacturer. Indeed, the PL then benefits from a higher quality and a higher price in order to limit store brand quantities such that capacity constraint is fulfilled. The conclusions of our article thus 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 (translating into significant switching-costs between production technologies), then the manufacturers' thinking is partially true. The retailer may indeed entrust the PL to the NB manufacturer even if capacity constrained, and the latter finds it is more profitable to produce the PL rather than letting another firm do so.

The results found in this article may shed some light on the potential impacts on the agrofood sector. First, the quality of food products provided on the market depends on two forces: bargaining power of the retail industry and production reorganisation by manufacturers due to capacity constraints. Indeed, when the retail industry becomes more concentrated (which is the observed trend in the European retailing sector), we can reasonably suppose that retailers' bargaining power increases. According to our results, this could lead branded manufacturers to produce PL at a lower cost than independent firms, increasing the average quality of food commodities. Moreover, an increase in independent firms' competitiveness may push the NB manufacturer to increase its NB quality in order to keep PL production, eventually resulting in higher quality for both products.

Secondly, our model gives some insights into the production structure of the agrofood industry. For categories of products where branded manufacturers have a strong image (must-stock items for instance), PL are more likely to be produced by a set of independent firms specialised in store brand production. However, if NB competition increases on shelves, this may lower brand manufacturers' position relative to retailers, jeopardising their initial

decision about no PL production. Additionally, PL production by branded manufacturer seems to depend on how total production is organised within the factories. A brand manufacturer dividing its total production between different plants may indeed have an incentive to leave the PL production exclusively to some units (up to their capacity). Conversely, a manufacturer operating its total production in one single factory may find it difficult to change the production mix between PL and NB, resulting in no PL production at all.

Finally, our findings also tackle the product diversity issue: when the NB quality relative to PL is quite high (or too low), the retailer may find it profitable to delist the NB, thereby reducing product diversity for consumers. Such a decision clearly impacts social welfare in the sense that PL introduction may lead to NB eviction, reversing the classic conclusions about welfare improvement after PL commercialisation. In addition to this effect, the opportunistic retailer's decision on PL production (biased through market power or capacity constraint issues) may not coincide with the optimal outcome where the NB manufacturer should be selected (lower production cost).

A limitation of our model is that it does not take into account the upstream competition between different NBs. Increasing the number of branded manufacturers would probably generate a decrease in NB prices, making the PL less attractive (because of its lower quality), resulting in a less valuable outside-option for the retailer. This may less likely lead to equilibria where the PL is produced by an independent firm. Besides, increased upstream competition could force the branded manufacturer to produce the PL 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. Secondly, 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 modelled). In the long run, the drawback of such a strategy may override the efficient PL production gains.

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