Do all Private Labels affect all National Brands prices?

Christophe Bontemps, Valérie Orozco
University of Toulouse-INRA

& Vincent Réquillart
University of Toulouse-INRA & IDEI

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Abstract

We study the price response of national brands to the development of private labels. We use monthly data from a consumer survey reporting their purchases for 218 food products. We show that when private labels have a significant effect on national brands prices (144 cases over 218), this effect is positive (89%). We also show that the increase in the prices of national brand products is explained by a strategy of product differentiation. Furthermore, price reaction of national brands differs with the type of private labels they are facing. Finally, we show that private labels development affects less the prices of second-tier brands than prices of the leading brand.

Keywords : private labels, pricing, empirical models, food products.
JEL : L81, Q13, D40

1 Introduction

Retailers play a key role in the food chain. They sell about 75% of food products to final consumers (INSEE, 2004). Among other decisions, they set consumer prices and determine the assortment of goods to be sold. By developing private labels (PL), their own brands, they now play an active role in the production of final goods.[1] These products, which now represent 10% to 40% of their food sales in the different EU countries are a strategic tool used by retailers to increase profits.

Within the food chain, private labels provide additional market power to retailers. Thus, by developing its own product a retailer is less dependent from the upstream firms. The lower dependency reinforce the bargaining position of the retailer who can thus extract more profits. Private labels also change the competition among retailers. Because a private label is a specific product of a given retailer, its presence increases the differentiation among retailers which could potentially soften the competition in price among retailers. Private label is also a way for retailers to attract customers and to built store loyalty. However, many questions remain : How prices of National Brands (NB) change with private labels development? Do the different categories of private labels identically affect national brands prices? Are the prices of leading national brands differently affected than prices of other national brands? Are changes in the prices of national brands explained by a change in their characteristics? The objective of this paper is to give some empirical hints on these questions by examining the price reaction of national brands to the development of private labels in France.

The effects of private label development on prices remains an open empirical question. Theoretical models have mainly analyzed this question in a framework of a vertical structure between producers and retailers. Depending on the way the demand is modeled and depending on the form of the contract, the impact of private label development on national brands prices are different.[2] Empirical models also provide different answers. For example, Ward *et al.* (2002) conclude to a positive impact on national brand prices of a private label development. They found this result rather systematically among a large number of food product categories. On the other hand, Bonfrer and Chintagunta (2004) conclude to more mixed results on how national brands prices change when private labels are introduced.

[1] According to the Private Label Manufacturers' Association (PLMA), "[Private label] products encompass all merchandise sold under a retailer's brand. That brand can be the retailer's own name or a name created exclusively by that retailer. In some cases, a retailer may belong to a wholesale group that owns the brands that are available only to the members of the group.

[2] For a recent survey on this literature, refer to Berges *et al.*(2004)

They conclude to a negative price impact in 46% of cases even if at the aggregate level they conclude to a positive impact.

Due to the data we have, we use a methodology that is similar to the one developed by Ward *et al.* (2002). The paper is also a generalization of the analysis defined in Bontemps *et al.* (2005). However, we develop the work in additional directions.

First, theoretical models suggest that the positioning of private label is a key element of the strategy of a retailer (Scott-Morton and Zettelmeyer, 2004, Bontems, 2005). It is now well established by marketing studies that there exist at least three categories of private labels ('low price', 'me-too' and 'high quality'). These different private labels are targeted to compete with specific class of products. In broad term, the 'low price' category is a response of the main retailing chains to the development of hard discounters. They are thus used in priority for competition among retailers. The 'me-too' products are the private labels used by retailers to compete with NB. They are used in priority to get more bargaining power vis-à-vis the upstream producers. Finally, the high quality products whose development is more recent are an attempt by retailers to built reputation and are perhaps more a way to attract new consumers (and thus to deal with competition among retailers). If these different categories of private labels are developed for alternative purposes, then we should find that the prices changes of national brands to the development of private label differ depending on the type of private labels.

Second, theoretical models suggest that national brands producers could react to private labels development by a strategy of product differentiation and in particular by modifying 'quality' (Mills, 1999: Bontems 2005). If this is the case, then this would create a change in the price of national brands that does not result from a change in the pricing strategy but rather in the change of the product. We thus want to separate a price effect at given characteristic and a price change due to a change in characteristics.

Third, recent analysis suggests that the different national brands could be differently affected by private label entry. For example Scott-Morton and Zettelmeyer (2004) show that in a context of limited space, a retailer that introduces a private label positions it closed to the leading brand. Moreover, they show that the retailer no longer sells the 2nd NB. Sayman, Hoch and Raju (2002) also show that the retailer should target the leading brand when introducing a private label. Both studies find some empirical evidence that support their theoretical analysis. However, they also find cases for which private labels are not targeted towards the leading NB. Du, Lee and Staelin (2006) develop a theoretical model that includes

three products (two national brands and one private label). They show that in many situations, it might be more profitable for the retailer to position the private label close to the 2nd national brand. Thus we want to investigate if the prices of the different national brands are identically or differently affected by private label development.

To address these issues, using data from a panel of consumers, we built time series of market shares and prices of national brands and private labels for different food products. We then study how prices of the different national brands react to the development of different private labels. In Section 2, we briefly summarize the main findings of the recent empirical literature. Then, Section 3 presents the methodology used to estimate the impact of private labels development on national brands prices in France. We describe the data used in Section 4, provide some descriptive statistics in Section 5. In Section 6 we present the empirical models that are estimated. We report and discuss the the results in Section 7 , and conclude in Section 8.

2 An overview of recent empirical studies on the impact of private labels development

Recent empirical studies investigate the impact of private label development on prices. Ward *et al.* (2002) study the impact of the development of private label in the US. They use monthly data on prices, market shares, and advertising expenses for 34 product categories. For each category, they analyze how national brands react to the development of private labels. They show that an increase in the private label market share is consistent with:

- An increase in the price of national brands (or no impact).
- A decrease in the price of private labels (or no impact).
- A negative impact or no impact on average prices.
- A decrease in advertising activity for national brands.

Using the same methodology, Bontemps *et al.* (2005), using French data on 6 dairy products, show that an increase in the private label market share is consistent with an increase in the price of national brands. Gabrielsen *et al.* (2002) study the impact of the introduction of private labels in Norway for 83 products. For each product, they study changes in national brand prices over time and distinguish the period before the entry of private labels from the period after entry. When

the impact of private labels introduction is significant (17 cases over 83 products) the impact is positive (15 cases). The introduction of private label induces an increase in national brand prices. Moreover their results suggest that the increase in national brand prices is larger for leading and nationally distributed brands.

These three studies thus conclude to a positive impact on national brand prices from private label development. However, Chintagunta, Bonfrer and Song (2002), using data on sales from different stores of a large supermarket chain, study the impact of the introduction of private labels in the breakfast cereal market. They show that private label introduction leads to a decrease in the price of the leading national brand, a decrease in the promotional activities of the national brand and no change in the profit margin of the retailer on the national brand. Bonfrer and Chintagunta (2004) analyse the impact of PLs entry in 35 products categories. They obtain mixed results. In about half of the cases surveyed (19 over 35 cases), the study finds that the entry of private labels leads to an increase in national brand prices. Whereas, in the remaining cases, it leads to a price decrease.[3]

All these studies consider private labels as an homogeneous group and national brands as another one and mainly evaluate the effect of private labels development on national brands prices. However, as discussed in the introduction, there exist different types of private labels that might compete in a different way with national brands. Similarly, the different national brands might be differently affected depending on the exact positioning of the private labels. Thus, a more detailed analysis is needed on the price impacts of private label development. Ward *et al.* (2002) test for different changes in the prices of the different national brands. They do not find strong evidence that the prices of the different national brands are differently affected. Rather they conclude that whatever the NB is leader or not, the price effect is identical. Bontemps *et al.* (2005), show that changes in the national brands prices differ with the type of private labels they are facing. The study also reveals that the price increase in national brand products is partly explained by a strategy of product differentiation. Pauwels and Srinivasan (2004) show that the price change of leading national brands and second-tier brands can differ. They find an increase in the price in leading brands while they find, in some cases, a decrease in the price of second-tier brands after the entry of a private label.

[3]They also study the price effect of entry of a national brand. They obtain a similar result as in 34 cases (over 65) they conclude to an increase in the prices of incumbents.

3 Model

The models that can be estimated are strongly constrained by the available data. In the literature two mains sources of data are used, data from consumers panel and data from retailers panel. In the latter case, the researchers have the information of prices and sales for different shops. They can thus easily trace the entry of a given private label as well as trace the evolution of prices. When using these data, the researchers frequently evaluate the price effect of entry by using dummies variables that signal if a private label is present or not. The coefficient of the dummy provides the information about the price effect. On the contrary, with consumers panel, the researchers do not have precise information about prices in a given shop (in practice, even in a given chain, the price of the same product can vary substantially among the shops; this is particularly the case for national brands while it is not for private labels).[4] Then, researchers generally analyze the price effects of private label development by using a reduced form regressing the prices of national brands on various variables.

Because there is no single clear view of the impact of private label development on the prices of national brands, in this paper we test different models in reduced forms. We will investigate the effects of the development of different types of private labels on the average price of national brands as well as on the prices of the main national brands. We will also introduce an index of differentiation for national brands in order to analyse if price changes are explained by a change in the characteristics of national brands. Extending Ward *et al.* (2002) and Bontemps *et al.* (2005) we propose the general reduced-form specification for each product category $k \in \{1, \cdots, N_k\}$:

$$lnP_k^i = \sum_j \beta_{k,j} \cdot lnMS_{k,j} + \gamma_k \cdot I_k^i + \sum_s \alpha_s \cdot \delta_s + C + \varepsilon_k \qquad (1)$$

with P_k^i the price of the i*th* national brand for the product category k, $MS_{k,j}$ the j*th* private label market share for the product category k, I_k^i is an index of differentiation of the i*th* national brand for product category k, δ_s quarterly dummies, C the constant, and ε_k is the remaining idiosyncratic error term.

For each empirical model (see Section 6), we test for autocorrelation and correct it using the Cochrane-Orcutt method. Since market shares may be endogeneous, we conduct the Hausman test of endogeneity using appropriate instru-

[4] see Table 7 in the Appendix

ments.[5] For each product category, we first test relevance and validity of the instruments.[6] Then, using a Hausman test, we compare the parameters estimated in the regressions performed with and without instruments. Within each model, we also perform Wald Tests to compare the magnitude of the different effects as measured by the estimated coefficients.

4 Data

We use data from the TNS-SECODIP French Consumer Panel, providing information on household's purchases on 218 product categories for four years (1998-2001).[7] We define 52 periods of 4 weeks over the whole period. For each product category k, we build a monthly time series of prices and market shares for the different types of brands. More precisely, the variables introduced in the general model (equation 1) are:

- The price of the brand i is the ratio between the value and the volume of purchases of brand i during the period. The price is either computed for national brands (NB) considered as a whole or for each of the three leading national brands (NB_i) and is deflated over the period.

- The market share of brand j is simply the ratio between the volume of brand j purchased during the period, over the volume of all brands purchased during the same period. We define five main types of brands. The first two are traditionally considered as private labels, the third corresponds to low-price products, while the last two are producer brands. They are defined as follows:

  HD : *Hard Discount* products are sold exclusively by hard discounters.

  PL : *Private Labels* (*sensu stricto*) are developed exclusively by retailers. Within this category we distinguish three subtypes based on the analysis of each PL price distribution in each store, *i.e.* :

[5] Available instruments are the lagged PL market shares for each type of private labels for the current product category, the lagged index of differentiation of national brands if needed, as well as the private labels market shares for other products, and other characteristics of the market (number of producers, number of brands, etc.).

[6] To test the relevance of instruments, we check their significance on the first stage regression. To test the validity of instruments, we perform the Sargan overidentification test.

[7] TNS-Secodip (Société d'Etudes de la Consommation, de la DIstribution et de la Publicité) collects weekly consumption of more than 8,000 French households.

PL_{eco} *Economic Private Labels* correspond to private labels sold at very low prices,

PL_{stand} *Standard Private Labels*. In particular, 'me-too' products belong to this category,

PL_{prem} *Premium Private Labels* are either thematic private labels or found on a specific submarket.

FP : *First Price* products are brands sold at low prices. We define them as brands that are neither HD nor PL, and whose price is lower or equal to the price of HD products. They are generally considered as the response of supermarkets and hypermarkets to the development of hard discounters. However they are not private labels as these brands are not specific to a retailer (or to a chain); and are producer brands.

NB : *National Brand* products that are sold in more than 50% of French regions. For each product category, we also define the three first leading brands, NB_1, NB_1 and NB_3.

RB : *Regional Brand* products are other brands sold in less than 50% of French regions.

- Index $I_k^i = \frac{Vol^{Spe}_{k,NB^i}}{Vol_{k,NB^i}}$, is the index of differentiation of national brand *i*, defined as the ratio between the sales of national brand *i* within a specific subcategory over total sales of national brand *i* for product category *k*. This index is also defined for the whole set of national brands. A high value of the ratio I_k^i means that national brand producers target their production to the specific subcategory.

The specific subcategory is defined as a set of products that are more 'sophisticated' products (as compared to the whole category), priced at a higher price and for which national brands have frequently a high market share. The definition of the differentiation index requires a case-by-case definition of a specific subcategory (based on the analysis of the characteristics of the goods that composed a product category), for each product category. Empirical models (see Section 6) including this index will thus be estimated on a smaller number (21) of product categories.

5 Some descriptive statistics

In this section we present descriptive statistics on the 21 product categories for which we have defined a specific subcategory. When possible we indicate the results we get over the complete set of products, that is over 218 product categories.

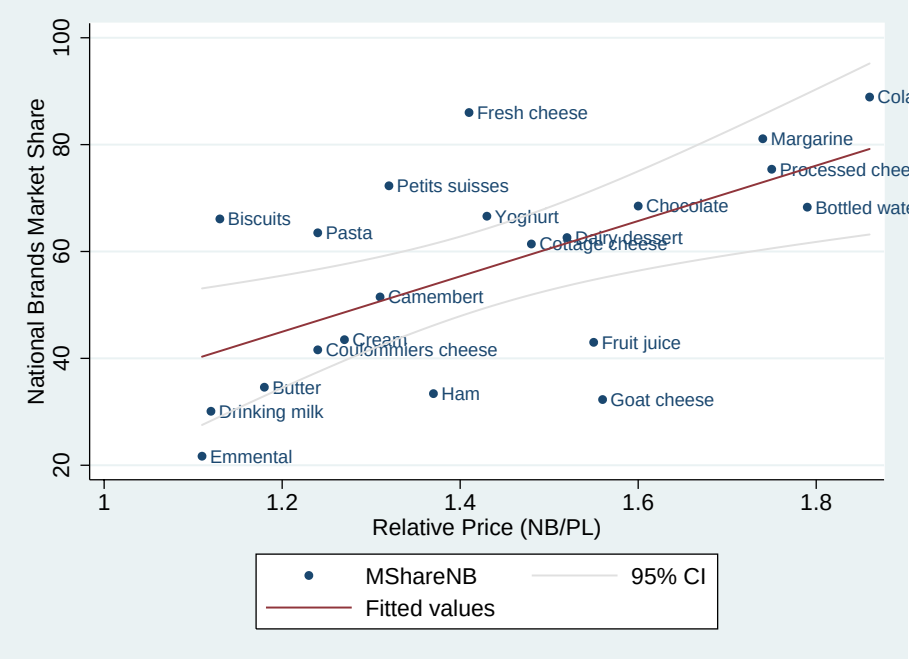

Figure 1: *National Brands Market Share vs Relative Price*

On Figure 1, national brands market shares are plotted against relative prices, defined as P_{NB}/P_{PL}, for 21 product categories. We note a significant (p-value = 0.006) and positive relation between the national brands market shares and the relative price. The higher the relative price, the larger the national brands market shares. This *a priori* counter-intuitive relationship is coherent with the analysis developed by Mills (1995) which takes into account the differentiation between national brands and private labels. As explained by Mills in prediction 2 (p.523), "*In a cross section of product categories where retailers sell both national brands and private labels, the private labels' share of category unit sales (...) vary in-*

versely with Δ_p (difference in national brand and private label prices)".[8] Thus, when national brands market share is low, this means that for the consumer the perceived quality of national brands and private labels are similar. The price competition is thus tougher. On the contrary, if the national brand is perceived of significant higher quality, then a 'large' difference in price is compatible with a large market share for national brands. We obtain a similar result using the whole product categories (see Figure 2 in the Appendix)

Table 1 displays some statistics for private labels (PL+HD) and national brands for the 21 product categories. Within each category, the national brands product price is greater than the average price (set at the index 100). Conversely, the private labels price is smaller than the average price in most cases. The market shares of national brand products vary greatly across categories (from 18 % for emmental up to around 80% for colas and fresh cheese). Private labels market shares are less variable and rarely reach 50% (ranging from 14.30% for fresh cheese to 61.4% for ham).

The per-period (4 weeks) variation of market share (ρ in Table 1) reveals a significant development of private labels over the period. For all the product categories but two, when the trend coefficient of private labels (PL+HD) is significant, it is positive.[9] The average growth of private label market share is greater than 1‰ per period on several markets and is even close to 3‰ for some products. Conversely, national brands market share decreases in most cases. Their market shares increase only in two product categories (margarine and cream).

[8] In Figure 1 we report the NB market share, and not the PL market share as in Mills (1995), explaining our positive relationship.

[9] This result is confirmed by an exhaustive analysis on the 218 products showing that over the 156 significant trend coefficients of private labels market shares, 134 are positive (86%).

Table 1: Market Shares and Price index of Private Labels ($PL+HD$) and National Brands (NB) over the period 1998-2001. Trends are from the regressions $Y = \nu + \rho\ time + \sum_{i=1}^{3} \delta_i\ Quarterly\ Dummies$ for $Y = price$ or $Y = market\ share$

	MS_{PL+HD}		MS_{NB}		$Price_{PL+HD}$		$Price_{NB}$	
	average	ρ	average	ρ	index	ρ/ν	index	ρ/ν
Drinking milk	32.20	2.848***	25.00	-2.027***	101.79	1.639***	120.86	4.607***
Butter	30.60	-.204**	29.30	-.274***	97.44	1.179	118.36	2.943**
Camembert	40.00	1.834***	44.40	-.892***	85.17	.707	116.21	2.353
Cottage cheese	40.40	.763***	51.50	-.146	78.50	1.412***	119.28	4.408***
Processed cheese	14.40	.855***	66.60	-.02	69.84	2.667	113.25	1.945
Yoghurt	37.40	.455***	56.90	-.389**	79.55	.719	117.15	2.744***
Dairy dessert	42.10	1.141**	50.50	-.906***	79.03	2.538*	124.03	1.718*
Petits suisses	32.80	2.258***	65.80	-2.275***	80.91	-.786	109.98	.889
Emmental	41.40	2.08***	18.00	-.274*	101.45	.057	121.00	1.916
Margarine	24.40	-1.096***	66.20	1.146***	60.90	-.605	122.54	3.763
Coulommiers cheese	54.10	3.327***	35.50	-3.289***	90.86	-.406	117.88	2.709***
Cream	47.80	1.042***	36.60	.201*	89.75	.203	119.00	.242
Fresh cheese	14.30	.798***	79.00	-.71*	70.87	1.012	108.95	2.611
Bottled water	17.40	1.399***	46.00	-1.769***	77.29	-1.895***	148.55	.611***
Pasta	39.50	.825	54.30	-.646	81.52	-1.109	116.94	-.379
Biscuits	20.70	1.075***	57.10	-.839***	96.56	2.217	115.83	2.396**
Chocolate	34.30	.773**	53.40	-.56**	75.37	1.538	128.31	.717
Ham	61.40	2.04***	23.50	-.719**	95.00	10.848	142.04	10.307
Goat cheese	33.50	2.883***	23.50	-.32	88.44	.217	137.90	.282
Fruit juice	61.20	1.673***	30.40	-.461**	83.44	-.127	141.49	2.948***
Colas	20.20	.165	77.80	-.16	49.83	-1.844***	114.34	1.903***

Notes : ***, ** and * indicate the significance of the estimated ρ at the 1%, 5% and 10% levels.
ρ and ρ/ν are given in ‰. Market Shares are in percentages of the total volume purchased.
Prices index are percentages of the average price (index 100) on the whole market.

With respect to prices, we define the ratio ρ/ν as an approximation of the per-period rate of growth of the price evaluated at the first period.[10] It is interesting to note that for all the products but one, when the trend coefficient of national brands prices is significant, it is positive. Thus, national brands prices usually increase by more than 1‰ up to 4‰ per period of 4 weeks.[11]

6 Empirical models

We present the eight different models that are estimated. All models are derived from the general model defined in equation 1 and recalled bellow :

$$\textbf{(1)} \quad lnP_k^i = \sum_j \beta_{k,j} \cdot lnMS_{k,j} + \gamma_k \cdot I_k^i + \sum_s \alpha_s \cdot \delta_s + C$$

Models		Framework		Number of products
M1:	$i = NB$	$j = PL + HD$	I_k^i=0	$N_k = 218$
M2:	$i = NB$	$j = PL + HD$	$I_k^i = I_k = \frac{Vol_{k,NB}^{Spe}}{Vol_{k,NB}}$	$N_k = 21$
M3:	$i = NB$	$j \in \{PL, HD, FP\}$	$I_k^i = 0$	$N_k = 218$
M4:	$i = NB$	$j \in \{PL, HD, FP\}$	$I_k^i = I_k = \frac{Vol_{k,NB}^{Spe}}{Vol_{k,NB}}$	$N_k = 21$
M5:	$i = NB$	$j \in \{PL_{eco}, PL_{stand}, PL_{prem}, HD, FP\}$	$I_k^i = 0$	$N_k = 15$
M6:	$i = NB$	$j \in \{PL_{eco}, PL_{stand}, PL_{prem}, HD, FP\}$	$I_k^i = I_k = \frac{Vol_{k,NB}^{Spe}}{Vol_{k,NB}}$	$N_k = 15$
M7:	$i \in \{NB_1, NB_2, NB_3\}$	$j \in \{PL, HD, FP\}$	$I_k^i = 0$	$N_k = 21$
M8:	$i \in \{NB_1, NB_2, NB_3\}$	$j \in \{PL, HD, FP\}$	$I_k^i = \frac{Vol_{k,NB_i}^{Spe}}{Vol_{k,NB_i}}$	$N_k = 21$

[10] That is the ratio between the coefficient of the linear trend and the value of the constant.

[11] This result is also confirmed on the 218 product categories since 87% of the significant rate of growth coefficients are positive.

Model M1 is similar to the model estimated by Ward *et al* (2002). We estimate this simple model in order to compare our results with their results on the US market. Model M2 is similar to the one developed by Bontemps *et al* (2005). The index of differentiation is used to control for a change in the price of national brands due to a change in the aggregate of goods that compose a product category.[12] Models M3 and M4 are developed to test if different brands (Private Labels *sensu stricto*, Hard Discount products and First Price brands), have or not a different price effect. In models M5 and M6, we further analyse the role of private labels. We thus distinguish the three types of private labels. Because the definition of the different types of private labels is based on a price analysis of these brands within a retailer, we have worked on the three largest retailers (rather than to all retailers). [13] Finally in models M7 and M8 we analyze if the prices of the different national brands are differently affected by the development of private labels.

7 Results

Question 1 : What is the impact of Private Label development on National Brands prices?

From model M1, we conclude that private labels development has a significant and positive impact on national brands prices. This result is in line with Ward *et al.* (2002) findings and is extended on a larger number of product categories and in a different country.

Table 2: Positive β in Model M1 on the 218 product categories

		Significant	Positive
Model M1	β_{PL+HD}	116	103 (89%)

Detailed results on the 21 products categories are gathered in Table 8

As explained above, we tested for endogeneity. In most cases, the parameters

[12] An alternative strategy would have been to define a Paasche index of price.

[13] The three largest retailers in France represent more than 40% of the total sales. We worked on 15 products rather than 21 as in some cases, no private label were present in a given retailer.

estimated with instrumental variables are not significantly different from the parameters estimated without instrumental variables. Moreover, in cases where endogeneity is detected, the corresponding coefficients in the regressions performed with and without instruments are very close (and of the same sign).[14]

As explained in Bontemps *et al.* (2005), national brand producers can react to private label development using a product differentiation strategy, or developing new products. In that case the 'average quality' of national brands increase over time because national brands sales are more concentrated on 'high quality' products, this might also explain an increase in their average price. We thus ask:

Question 2 : When controlled for quality effect, is the impact of PL development on NB prices still positive?

The index of differentiation defined for national brands (Model M2) has a very significant and positive impact on national brands prices. The index is highly significant in 18 cases out of 21 (see Table 8). Moreover, Model M2 is considered better than Model M1 in most cases.[15] Finally, in Model M2, when significant (15 cases out of 21) the private label market share has still a positive impact on national brands prices. This confirms the results of Bontemps *et al.* (2005). An alternative way to deal with this question would be to define a Paasche price index and to regress it against the same variables.

Previous empirical studies did not consider the differences between Private Labels and Hard Discount brands. As shown on a small number of cases by Bontemps *et al.*(2005) the price effect of private labels development and hard discount products are not identical. This is somewhat understandable as these two brands are not used for the same objective.[16]

Question 3 : Are the price effects of PL, HD and FP products different?

While Bontemps *et al.* conclude that an increase in hard discount (and first-

[14]As a consequence, in table 8,we only report the regression results obtained without instrumental variables.

[15]The best model is evaluated according to the AIC and BIC criteria.

[16]Moreover, in the case of competition between PL and NB, the same retailer sets both prices while HD retailer only sets the price of HD products(as this retailer does not sell NB).

price) products has a negative impact in almost half of the cases studied, we find that the impact of each of the three types of brands is, when significant, almost always positive.

Table 3: Positive β in Model M3 on the 218 product categories

		Significant	Positive	
Model M3	β_{PL}	108	99	(91%)
	β_{HD}	89	79	(89%)
	β_{FP}	73	57	(78%)

See Table 8 for the results, on Models M3 and M4, on the 21 product categories

Can we detect some differences in the magnitude?

To test the relative impact of HD, FP and PL brands, we use the Wald tests of equality between β's, and compare their values. When significant, we obtain :

Table 4: A comparison of the β's on Model M3

		$\beta_{HD} \leq \beta_{PL}$			
		False	True	N. S.	
$\beta_{FP} \leq \beta_{PL}$	False	11	2	5	
	True	5	**96**	5	
	N.S.	15	5	0	
					144

Results of the test for 144 products having at least one significant β in Model M3

Results of the test for the 21 product categories are in Table 8

In 2/3 of the cases, Private Labels (*sensu stricto*) have the largest impact. We thus conclude that there are some differences in the PL, HD and FP effects magnitudes and that :

$$\begin{aligned} \beta_{HD} &\leq \beta_{PL} \\ \beta_{FP} &\leq \beta_{PL} \end{aligned}$$

Thus, the impact on national brands prices of an increase in the market share of private labels is always larger than (or at least equivalent to) the impact of a similar increase in the market share of either HD or FP. On the contrary, it is not possible to systematically rank the respective impact of an increase in the market share of HD and FP.

Thus, it seems that national brands products do react positively to an increase in the market shares of their different competitors even if this reaction is of lower magnitude.

The role of the differentiation strategy in explaining national brands prices is confirmed by the results of Model M4 (see Table 8). Indeed, in 17 cases out of 21, the best model includes the differentiation index. The relevance to introduce different private label categories is also confirmed as Models M3 and M4 are considered as the best models in 13 cases out of 21.

As shown above, it is possible to rank the impact of the different brands. However, the value of the β's differ from one category to another one. We thus investigate if we can find some market characteristics that could explain the differences in the β's among product categories.

Question 4 : Are the effects different among products?

We use the 144 product categories that exhibit at least one significant β in the regression Model M3. First, using characteristics of the product categories, we do a cluster analysis of the product categories. We use different variables describing market structure (number of brands, markets shares, relative prices, Herfindahl index, number of varieties concerning the product, number of producers, number of shops where the product is sold, trends of market shares and prices, ...) and consumer's behavior (loyalty index, interval between two purchases, ...).

Thanks to a principal component analysis, we select variables to reduce the dimension of the dataset. The clustering suggests two groups of products.[17] Group 1 includes 73 products categories for which market is concentrated (higher Herfindahl index), households are "loyal" to national brands, coefficient of variation of the average price and time interval between two purchases are higher.[18] Group 2

[17] We use the Calinski and Harabasz index.

[18] Loyalty index is defined for each household, as the total sales of national brands over the total

includes 71 products. In this group, there are a larger number of national brands and hard discount products, more producers, private labels market share is larger and the number of varieties greater, relative price of national brands higher, number of observations higher, more brands, more PL.

Table 5: Equality tests and statistics on the β's in each cluster

		Group 1		Group 2		
		Mean	(s. e.)	Mean	(s. e.)	Equality Test
Model M1	β_{PL+HD}	.077	(.0126)	.174	(.0289)	rejected
	β_{PL}	.078	(.0115)	.189	(.0284)	rejected
Model M3	β_{HD}	.042	(.0069)	.072	(.0156)	accepted
	β_{FP}	.050	(.0170)	.042	(.0133)	accepted

The equality test performs t-test on the equality of means. The result of this test is given at a 95% confidence level.

Then, we perform equality test between these two groups for each of the three coefficients measuring the impact of private label development on national brand prices, namely β_{PL+HD} in Model M1, β_{PL}, β_{HD} and β_{FP} in Model M3. We report in Table 5 the results of these tests as well as statistics on the β's on Models M1 and M3 within each cluster.

Besides some products characteristics, the β_{PL+HD} of Model M1 and the β_{PL} of Model M3 differ between the two clusters. Cluster 2 have a larger β_{PL} meaning that the impact on national brands products of this group is higher than the products of cluster 1. In other words, products with a large number of varieties, frequently bought, with a high private labels market share are products for which PL (sensu stricto) have a stronger impact on national brands prices than the other cluster.

Question 5 : Do all private labels have the same effects?

As explained in the introduction, there exist at least three categories of private labels. Results (Table 9), suggest that the 'standard' private labels (PL_{stand}) have a significant and positive impact on NB prices. The 'low-priced' private labels

sales.

(PL_{eco}) do have a positive impact but of lower magnitude while 'premium' private labels (PL_{prem}) do not have any significant impact.[19]

Until now, we have analyzed what happens to the average price of national brands when private labels are developed. As suggested by theoretical papers (Scott-Morton and Zettelmeyer (2004), Du, Lee and Staelin (2006)), the different national brands might be affected differently. [20]

Question 6 : Is each of the three leading national brands identically affected?

For each product category, we consider the three leading national brands. As shown in Table 11, market shares of the leading brands vary significantly among product categories. For example, in the colas industry, the first three leading national brands represents 99% of the market share of all national brands. Moreover, in this market, national brands also have a significant market share (78%). Conversely, for other product categories the market share of the first three leading brands represents less than 50% of the market share of all national brands (which is in some cases rather small).

Businessmen frequently argue that with private labels development second-tier national brands will suffer more than leading brands. This analysis implicitly relies on the idea that shelf space is scarce and thus when introducing a private label in a shop the retailer will remove a national brand. And the retailer will generally removes the NB_2 or NB_3 and not NB_1 (exactly as is shown by Scott-Morton and Zettelmeyer, (2002)). A descriptive analysis (Table 11) does not confirm this view. If, as a general fact, the market share of national brands decrease, there is no evidence that NB_2 or NB_3 experience a larger decrease in their market shares than NB_1. Furthermore, in some cases the contrary happens. [21]

With respect to the main question addressed in this paper, results from Model M7 clearly confirm what was stated for the aggregate of national brands (Table

[19] When the trend coefficient of each type of Private Label is significant, it is positive (except for one or two product categories) (see in Table 10). Moreover, we didn't find any endogeneity in models M5 and M6.

[20] Ward *et al.* (2002) have investigated this question and they did not find any significant differences among the brands

[21] Obviously these trends are the results of many mechanisms, the development of private labels is only one reason among others. Thus, if the impact of private labels is the one anticipated by businessmen, this means that there exists others important mechanisms going in the opposite direction.

12). When significant the β's are positive whatever the first three national brands. Comparison between elasticities leads to the conclusion that, in most of the cases we have $\beta_{PL_{NB_1}} \geq \beta_{PL_{NB_2}}$ and $\beta_{PL_{NB_1}} \geq \beta_{PL_{NB_3}}$. In other words, the impact on NB_1 prices is larger than the impact on the NB_2 or NB_3 prices. This result is different from Ward *et al.* (2002) who did not find differences among NBs. It is difficult to interpret this result. If a private label is targeted against NB_1, a retailer might find profitable to increase the prices of NB_1 (in order to discriminate among consumers) in a larger extent than prices of NB_2 and NB_3 which are less substituable with the private label.

Table 6: Inequalities between β's

	$\beta_{PL} \geq \beta_{HD}$ and $\beta_{PL} \geq \beta_{FP}$
Over All NB	19 cases out of 21
Over NB_1	20 cases out of 21
Over NB_2	20 cases out of 21
Over NB_3	17 cases out of 21

See Table 13 for details.

Finally, in Table 6, we report the results of the test for the impact of different private labels on the prices of the three leading national brands. We find that the results from the analysis of the aggregate of national brands ($\beta_{HD} \leq \beta_{PL}$ and $\beta_{FP} \leq \beta_{PL}$) still hold for each of the three leading national brands.

8 Concluding Remarks

The results obtained in this empirical analysis are remarkably robust. When we detected a significant impact of private labels development on the prices of national brands, this effect is positive in about 90% of cases. This confirms results found by Ward *et al* (2002) on US data and extend the study developed by Bontemps *et al* (2005). When controlling for a quality effect, we find that the impact of private labels development on national brands prices is still positive.

Moreover, results give also support to our additional ideas developed in this paper. First, the impact of the different brands (Private Labels *sensu stricto*, Hard

Discount products and First Price brands) is not identical. Even if we found positive effects for each of the three brands, the increase in the national brand prices vis-à-vis a development of hard discount products or first-price products is lower than vis a vis a development of Private Labels.

Second, thanks to a deeper analysis within the private labels, we underline different amplitude of the impact on prices. The standard private labels, which can be considered as 'me-too' products, have the strongest impact on national brands prices. The economic private labels have a lower impact. Concerning the premium private labels, we didn't find any significant impact.

Finally, our results suggest that the leading national brands prices are differently affected by private label development. Indeed, Private Labels (*sensu stricto*) development affects less the prices of second-tier brands than prices of the leading brand.

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Appendix

Table 7: Prices distribution of NB, PL and FP in one of the main national chain, from January to March 1998

	Coefficient of Variation of Price ($\frac{\sigma}{\mu}$)		
	Leading NB	Leading PL	Leading FP
Drinking milk	46.31	11.22	1.71
Butter	10.37	5.63	2.97
Camembert	7.93	16.64	2.22
Cottage cheese	34.22	28.40	19.50
Processed cheese	17.54	.	7.00
Yoghurt	44.51	32.07	10.02
Dairy dessert	45.78	178.20	30.00
Petits suisses	31.59	15.58	.
Emmental	17.59	7.24	25.06
Margarine	9.81	22.23	19.55
Coulommiers cheese	12.72	7.31	1.76
Cream	24.57	20.53	3.45
Fresh cheese	12.10	9.76	9.47
Bottled water	13.93	24.24	36.43
Pasta	40.59	8.76	0.00
Biscuits	30.42	27.19	62.54
Chocolate	24.17	25.14	14.61
Ham	22.55	22.09	0.91
Goat cheese	29.78	9.64	13.82
Fruit juice	30.75	29.67	34.98
Colas	28.53	22.41	5.38

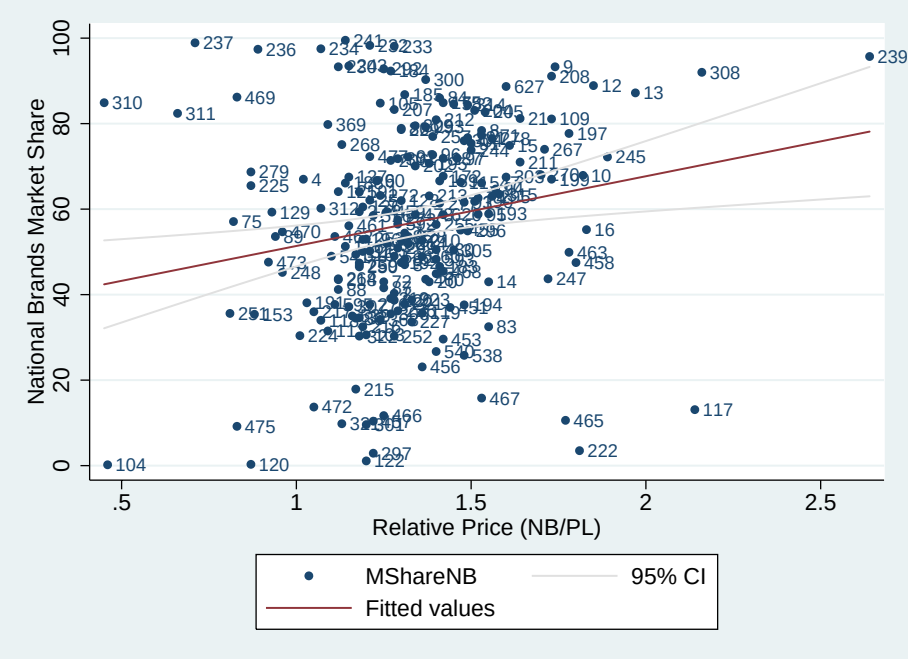

Figure 2: *National Brands Market Share vs Relative Price for all the product categories*

Table 8: National brands price reaction to the development of private labels for 21 product categories

	Model M1	Model M2		Model M3			Model M4				Test
Product	β_{PL+HD}	β_{PL+HD}	γ	β_{PL}	β_{HD}	β_{FP}	β_{PL}	β_{HD}	β_{FP}	γ	$\beta_{PL} \geq \beta_{HD}$ & $\beta_{PL} \geq \beta_{FP}$
Drinking milk	.442***	.357***	1.292***	.299***	.206***	.287***	**.242****	**.178****	**.198****	**.823****	true
Butter	.02	.032	.143*	**.053***	**.011**	**.113****	.055*	.013	.1**	.116	true
Camembert	-.053	-.023	.268***	-.017	-.024*	.007	**.002**	**-.018**	**.006**	**.27*****	true
Cottage cheese	.034	**.004**	**.561*****	-.052	.069**	-.0008	-.035	.042	.006	.484***	
Processed cheese	-.188***	**-.022**	**.688*****	-.008	-.001	-.297***	-.003	-.008	.004	.701***	true
Yoghurt	.089*	**.072**	**.393****	.02	.051**	-.00007	.022	.041*	0	.301	
Dairy dessert	.308***	.31***	.039	**.31*****	**.067*****	**.038***	.325***	.067***	.04*	.133	true
Petits suisses	.075**	.067*	.645	.067**	.014	-.012	**.06****	**.015**	**-.016***	**.775***	true
Emmental	.315***	.266***	.193*	**.512*****	**.169*****	**.459*****	.52***	.164***	.492***	.085	true
Margarine	.045**	**.05*****	**.352****	.019	.018*	-.01	.025	.017*	-.007	.336**	
Coulommiers cheese	.087*	.269***	.737***	.253***	.048***	.041***	**.216*****	**.044*****	**.031*****	**.432*****	true
Cream	.149**	.093	.444***	.185***	.06**	.036*	**.141****	**.039**	**.036***	**.444*****	true
Fresh cheese	.024*	**.02***	**.538*****	.018*	.001	-.0002	.012	.006	.002	.537***	true
Bottled water	.031	.055*	2.415***	.011	.006	.043	**-.016**	**.026*****	**.203*****	**2.775*****	
Pasta	.272***	.251***	1.664***	.256***	.045**	-.015	**.23*****	**.043****	**-.016**	**1.466****	true
Biscuits	.09**	.094***	1.252***	.199***	.003	.075***	**.086*****	**-.002**	**.068****	**1.167*****	true
Chocolate	.227***	.187***	.548**	.132***	.087***	.039	**.117****	**.074*****	**.034**	**.463****	true
Ham	.452***	.405***	-.148	**.516*****	**.098****	**.108*****	.485***	.095**	.105***	-.09	true
Goat cheese	.023	**.088****	**.38*****	.124**	.03	.184**	.092*	.028	.064	.329***	true
Fruit juice	.25***	**.27*****	**1.251*****	.138*	.106***	-.003	.181***	.098***	.007	1.223***	true
Colas	.114***	**.103*****	**.383***	.074***	.037	-.001	.076***	.023	.0005	.475**	true

Notes : ***, ** and * indicate the significance of the estimated β at the 1%, 5% and 10% levels.
Not reported are three quarterly dummies and a constant.
"true" means that the inequalities hold (for significant β's) or that the equality is verified (Wald test)
Best model (**in bold**) is evaluated regarding the AIC and BIC criterions and the significance of the parameters.
When autocorrelation was detected, we performed regression using the Cochrane-Orcutt method to correct auto-correlated residuals.

Table 9: National brands price reaction to the development of private labels for 15 product categories (Model M5)

	β_{PL}	$\beta_{PL_{eco}}$	$\beta_{PL_{stand}}$	$\beta_{PL_{prem}}$	$\beta_{PL_{HD}}$	$\beta_{PL_{FP}}$	$\beta_{PL_{stand}} \geq \beta_{PL_{prem}}$	$\beta_{PL_{stand}} \geq \beta_{PL_{eco}}$	$\beta_{PL_{eco}} \geq \beta_{PL_{prem}}$
Drinking milk	.262***	.015	.125***	.028***	.107***	.296***	true	true	true (=)
Butter	.169*	.005	-.008	.034***	.03	.214*	true (=)	true (=)	false
Camembert	.041	.037***	-.076**	.006	.059***	-.023**	false	false	true
Cottage cheese	.149**	.061***	.042	.03***	.05*	-.007	true (=)	true(=)	true (=)
Yoghurt	.316***	.058***	.26**	.008	-.055	-.009	true	true(=)	true
Dairy dessert	.17**	.06***	.085	.003	.053**	-.012	true (=)	true(=)	true
Coulommiers cheese	.297***	.115***	.131***	.003	.007	.037***	true	true(=)	true
Cream	.241***	.045	.33***	.013***	.062***	.067**	true	true	true (=)
Bottled water	-.023	-.009	-.038	.007	0	.122	true (=)	true(=)	true (=)
Pasta	.221***	.069***	.191***	.005	.025	.003	true	true	true
Biscuits	.054*	.005	.11***	.022	-.023	.09	true (=)	true	true (=)
Chocolate	.107***	-.0008	.105***	.009	.059***	.05**	true	true	true (=)
Ham	.588***	.147***	.387***	.007	.024	.026	true	true	true
Fruit juice	.282***	.144***	.178***	-.007	.062	-.006	true	true(=)	true
Colas	.083***	.032**	.078***	.002	-.02	-.001	true	true(=)	true

Notes : ***, ** and * indicate the significance of the estimated β's at the 1%, 5% and 10% levels.
Results of the equality tests are the same for Model M6
The first column corresponds to the coefficient β_{PL} of Model M3 (to be compared to Model M4)

Table 10: Market Shares of the different brands and the different types of private labels over the period 1998-2001 in the 3 largest stores and for 15 product categories. Trends are from the regressions $Y = \nu + \rho\ time + \sum_{i=1}^{3} \delta_i\ Quarterly\ Dummies$ for $Y = market\ share$

	MS_{HD}	MS_{MN}	MS_{FP}	MS_{RB}	MS_{PL}		$MS_{PL_{eco}}$		$MS_{PL_{stand}}$		$MS_{PL_{prem}}$	
					average	ρ	average	ρ	average	ρ	average	ρ
Drinking milk	10.80	29.10	43.60	2.50	24.80	1.797***	2.40	.104***	13.80	1.481***	0.50	.101***
Butter	5.30	30.70	30.80	7.70	30.80	-.305***	3.50	-.652***	26.90	.08	0.70	.359***
Camembert	12.30	45.40	7.00	8.70	39.00	2.816***	6.50	2.155***	31.00	.553***	1.50	.31***
Cottage cheese	9.30	52.40	4.50	2.80	40.30	1.135***	2.00	.982***	38.20	-.042	0.30	.097
Yoghurt	9.50	59.30	3.00	0.60	37.10	.726***	2.80	.808***	34.20	-.084	0.00	.014**
Dairy dessert	11.70	50.10	5.10	0.30	44.50	1.107***	3.70	.621***	39.70	.219	1.10	.286***
Coulommiers cheese	14.20	37.40	4.70	4.20	53.70	4.741***	15.60	3.965***	36.20	.867	1.90	-.053
Cream	11.90	38.90	11.00	3.20	46.90	1.483***	8.30	1.433***	38.40	-.066	0.30	.123***
Bottled water	4.20	48.20	33.10	2.60	16.10	1.028***	6.60	.838***	8.30	.072	1.20	.064
Pasta	12.60	61.10	4.30	1.50	33.10	.355*	5.10	-.562***	25.10	.622***	2.90	.307***
Biscuits	6.60	68.20	13.10	1.00	17.70	1.66***	0.50	-.063	8.20	1.396***	9.20	.274**
Chocolate	10.80	58.30	13.10	0.20	28.40	1.022***	5.40	.317***	18.30	.801***	4.70	-.014
Ham	17.40	24.80	4.50	0.60	70.10	1.406***	18.10	1.226***	48.10	-.125	0.20	-.049*
Fruit juice	20.40	33.90	4.20	1.40	60.50	2.211***	18.50	1.813***	40.40	.617**	1.60	-.035
Colas	11.50	87.20	0.50	0.10	12.20	-.222*	2.20	-.013	9.30	-.249**	0.60	.041

Notes : ***, ** and * indicate the significance of the estimated ρ at the 1%, 5% and 10% levels.
ρ is given in ‰. Market Shares are in percentages of the total volume purchased.

Table 11: Market Shares of Leading National Brands over the period 1998-2001. Trends are from the regressions $Y = \nu + \rho\ time + \sum_{i=1}^{3} \delta_i\ Quarterly\ Dummies$ for $Y = market\ share$

Product	MS_{NB}		MS_{NB_1}		MS_{NB_2}		MS_{NB_3}	
	average	ρ	average	ρ	average	ρ	average	ρ
Drinking milk	25.00	-2.027***	9.30	-.39***	8.70	-.769***	3.80	.125
Butter	29.30	-.274***	8.00	.113**	5.30	-.018	4.50	.141***
Camembert	44.40	-.892***	12.90	-.482***	11.20	-.039	4.70	.059
Cottage cheese	51.50	-.146	31.70	-.31	11.80	-.858***	2.50	.23***
Processed cheese	66.60	-.02	34.00	-.402	10.40	.622	4.00	-.116
Yoghurt	56.90	-.389**	28.30	.364***	14.10	-.449***	9.40	-.053
Dairy dessert	50.50	-.906***	24.90	-1.111***	18.20	-.09	1.80	-.442***
Petits suisses	65.80	-2.275***	33.50	-2.044***	23.30	-.076	3.80	.246**
Emmental	18.00	-.274*	9.20	.013	3.30	.041	2.70	-.027
Margarine	66.20	1.146***	16.50	.196*	9.90	.905***	6.40	-.019
Coulommiers cheese	35.50	-3.289***	10.80	-.798**	9.90	-.298**	3.90	-.612***
Cream	36.60	.201*	12.70	-.78**	8.60	-.263**	6.00	-.684***
Fresh cheese	79.00	-.71*	13.80	-.383*	10.30	-.503***	13.30	-.359**
Bottled water	46.00	-1.769***	8.10	-.574***	6.00	-.488***	5.20	-.477***
Pasta	54.30	-.646	26.70	.33**	10.50	.182	8.30	.705**
Biscuits	57.10	-.839***	18.00	-1.366***	13.40	.752***	8.50	.485***
Chocolate	53.40	-.56**	9.30	-.256	7.80	-.596***	9.20	.163
Ham	23.50	-.719**	10.40	-.6***	6.90	.558***	3.30	-.094
Goat cheese	23.50	-.32	6.00	-.59***	5.10	-.046	1.80	-.444
Fruit juice	30.40	-.461**	6.90	-.113**	3.50	.197***	3.70	-.222***
Colas	77.80	-.16	65.80	.119	9.70	.383***	1.90	-.588***

Notes : ***, ** and * indicate the significance of the estimated ρ at the 1%, 5% and 10% levels.
ρ is given in ‰. Market Shares are in percentages of the total volume purchased.

Ordering the effect of PL between the Leading National Brands

Table 12: Ordering the impacts between Leading National Brands (comparison of the elasticities in Model M7)

Product	$\beta_{PL_{MN_1}}$	$\beta_{PL_{MN_2}}$	$\beta_{PL_{MN_3}}$	$\beta_{PL_{MN_1}}$ vs $\beta_{PL_{MN_2}}$	$\beta_{PL_{MN_1}}$ vs $\beta_{PL_{MN_3}}$
Drinking milk	.292***	.468***	.019	<	>
Butter	.031	-.081	-.011	ns	ns
Camembert	.024	.002	.33***	ns	<
Cottage cheese	-.096	.114	-.207	ns	ns
Processed cheese	0	.009	-.1***	ns	>
Yoghurt	-.0006	.071	-.037	ns	ns
Dairy dessert	.354***	.188**	.146	>	>
Petits suisses	.109***	.057	-.016	>	>
Emmental	.416***	.441***	.663***	<	<
Margarine	.146***	-.017	.048**	>	>
Coulommiers cheese	.075***	.15***	.075**	<	>
Cream	.163*	.497***	.064	<	>
Fresh cheese	.028*	.013	.036**	>	<
Bottled water	.051**	-.066	-.043	>	>
Pasta	.302***	.107*	.111	>	>
Biscuits	.275***	-.008	.22***	>	>
Chocolate	.162	.179	-.089	ns	ns
Ham	.458***	.83***	.472**	<	<
Goat cheese	-.109	.035	-.09	ns	ns
Fruit juice	.134	.023	.669***	ns	<
Colas	.074***	.005	.022	>	>
	all >0	all >0	all >0 but one		

Table 13: Leading National brands price reaction to the development of private labels for 21 product categories (Model M7)

Product	NB_1				NB_2				NB_3			
	β_{PL}	β_{HD}	β_{FP}	**Test** $\beta_{PL} \geq \beta_{HD}$ & $\beta_{PL} \geq \beta_{FP}$	β_{PL}	β_{HD}	β_{FP}	**Test** $\beta_{PL} \geq \beta_{HD}$ $\beta_{PL} \geq \beta_{FP}$	β_{PL}	β_{HD}	β_{FP}	**Test** $\beta_{PL} \geq \beta_{HD}$ $\beta_{PL} \geq \beta_{FP}$
Drinking milk	.292***	.295***	.175	true	.468***	.161***	.403***	true	.019	.071***	.026	not true
Butter	.031	.003	.094	true	-.081	-.033*	.013	true	-.011	-.0006	.051	true
Camembert	.024	-.009	-.01	true	.002	-.012	.015*	true	.335***	.133***	-.065*	true
Cottage cheese	-.096	.071**	-.016	not true	.114	.134**	.014	true	-.207	-.001	.028	true
Processed cheese	0	.003	-.046*	true	.009	.02	.036*	true	-.1***	.01	.013	not true
Yoghurt	-.0006	.041	.018	true	.071	.072**	-.047**	true	-.037	.032	.029	true
Dairy dessert	.354***	.027	.059**	true	.188**	.074**	.06**	true	.146	.097**	.12***	true
Petits suisses	.109***	.039**	-.012	true	.057	-.004	-.017	true	-.016	-.01	-.006	true
Emmental	.416***	.152***	.452***	true	.441***	.052	.209	true	.663***	.296***	.893***	true
Margarine	.146***	.011	-.03	true	-.017	.015	.004	true	.048**	.01	.012	true
Coulommiers cheese	.075***	.018	.017**	true	.15***	.032***	.023***	true	.075**	.029***	.049***	true
Cream	.163*	.048	.031	true	.497***	.071	-.004	true	.064	-.003	-.042	true
Fresh cheese	.028*	.0006	.029	true	.013	-.013	.011	true	.036**	-.029	-.015	true
Bottled water	.051**	.019***	.042	true	-.066	-.073***	-.028	true	-.043	.014	-.025	true
Pasta	.302***	.039*	.015	true	.107*	.04	-.021	true	.111	-.019	-.01	true
Biscuits	.275***	.053	.038	true	-.008	-.005	.124***	not true	.22***	-.136**	.132	true
Chocolate	.162	.067	-.038	true	.179	.089*	.019	true	-.089	.093**	.054	not true
Ham	.458***	.064	.067	true	.83***	.148	.04	true	.472**	.088	.017	true
Goat cheese	-.109	-.001	-.28**	true	.035	.011	.011	true	-.09	-.01	.184*	not true
Fruit juice	.134	.067	.007	true	.023	-.028	-.086**	true	.669***	.198**	-.016	true
Colas	.074***	.053	-.00004	true	.005	.051	.008	true	.022	-.072	-.023	true

Notes : ***, ** and * indicate the significance of the estimated ρ at the 1%, 5% and 10% levels.
"true" means that the inequalities hold or that the equality is verified (Wald test).