Confirming the Price Effects of Private Labels Development

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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), that is positive (89%). We also show that the increase in the prices of national brand products is explained by a strategy of product differentiation. Finally, price reaction of national brands differs with the type of private labels they are facing. This paper confirms, on a larger number of products, previous empirical results.

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

1. Introduction

Private labels are now a key element of the assortment of retailers.[1] In the European food sector, they represent 10% to 40% of the total sales depending on the countries. As a general observation, the level of concentration of the retail industry and the market share of private labels are positively correlated. Moreover, in almost all food categories, private labels now compete with producer brands. Facing this new competition, producer brands need to adapt their strategies both in term of prices and of characteristics of the products.

Berges *et al.*(2004) recently survey the literature dealing with the economic impact of private labels development. In particular, this survey shows that theoretical papers conclude that the threat of a private label entry or its actual introduction will cause a decrease in the price of national brands while recent empirical studies do not support this view. It also shows that there is a limited number of empirical work that studies the impact of private labels development.

The objective of this paper is to estimate the price reaction of national brands to the development of private labels in France. It generalizes to a larger number of products and to a longer period the analysis defined in Bontemps *et al.* (2005).[2] The general methodology is similar to the one used by Ward *et al* (2002). However, it extends their analysis in two additional dimensions that were not present in empirical studies. First we distinguish different categories among private labels. 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'). We thus test whether the price reaction of national brands differs across private labels categories. Second we incorporate the changes in the characteristics of the products that are proposed by national brands producers. This is because brand producers can react to private label development not only by changing the prices of their products, but also by modifying the product themselves (for a theoretical analysis, cf. Bontems (2005)).

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 private labels. In Section 2, we briefly summarize the main

[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] The reader will find a more detailed review of literature in this paper. However, for clarity of presentation, we present in this paper the model used.

findings of the empirical literature. Then, Section 3 presents the methodology used to estimate the impact of private labels development on national brands prices in France. In Section 4, we describe the data used. We present the results in Section 5 , and conclude in Section 6.

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. Moreover, they show that the price reaction of national brands differs 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.

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) obtain mixed results. In about half of the cases surveyed, 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. Models

Because there is no single clear view of the impact of private development on the strategies of national brand producers, this paper tests different models in reduced forms. Following Ward *et al.* (2002), the reduced-form specification of the first model we develop is written as:

$$lnP_k = \beta_k \cdot lnMS_k + \sum_s \alpha_s \cdot \delta_s + C \tag{1}$$

with P_k the price of national brands for the product category k, MS_k the private label market share for the product category k, δ_s quarterly dummies, and C a constant.

As explained in Bontemps *et al.* (2005), national brand producers can react to private label development by using a product differentiation strategy, or by developing new products. Product categories used in empirical studies are aggregates of heterogeneous products. Thus, a change in the national brand price in a product category could result in a change in the composition of the aggregate, rather the price of each item of the aggregate. To distinguish between the price reaction with constant characteristics of the national brands and the change in the characteristics of the product, we estimate a more complete model than (1) specified as:

$$lnP_k = \beta_k \cdot lnMS_k + \gamma_k \cdot \frac{Vol^{Spe}_{k,NB}}{Vol_{k,NB}} + \sum_s \alpha_s \cdot \delta_s + C \tag{2}$$

where $Vol^{Spe}_{k,NB}/Vol_{k,NB}$ is an index of differentiation of the national brand, which is the ratio between the national brand sales within a specific subcategory over the national brand total sales for product category k.[3] A high value of this ratio means

[3] A specific subcategory is defined as a set of products that are more 'sophisticated' products (as compared to the category), priced at a higher price and for which national brands have a high market share.

that national brand producers target their production to the specific subcategory that supports higher prices.

In order to analyze the impact of the different private labels on the price of national brands, we test two additional models that are more complete than (1) and (2). They are specified as follows:

$$lnP_k = \sum_j \beta_{k,j} \cdot lnMS_{k,j} + \sum_s \alpha_s \cdot \delta_s + C \quad (3)$$

$$lnP_k = \sum_j \beta_{k,j} \cdot lnMS_{k,j} + \gamma_k \cdot \frac{Vol_{k,NB}^{Spe}}{Vol_{k,NB}} + \sum_s \alpha_s \cdot \delta_s + C \quad (4)$$

where $MS_{k,j}$ are the market shares of the j^{th} private label type for product category k.

4. Data

We conduct our tests using data from a panel of French consumers (SECODIP panel). The dataset covers 218 product categories. Among them, we select 21 product categories, for which we apply models 1 to 4.[4] To estimate models 2 and 4, the definition of a specific subcategory is required. It is based on the analysis of the characteristics of the goods that composed a product category and cannot be done automatically. However, in order to extend the analysis to a larger number of product categories, we run the models 1 and 3 on all product categories.

We consider 5 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:

- Hard Discount products (HD) are sold exclusively by hard discounters.
- Private Labels (*sensu stricto*) (PL) are developed exclusively by retailers.
- First-Price products (FP) correspond to 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

[4] In this sample, we focus on dairy products (including the 6 dairy products used in Bontemps *et al.* (2005)) and on other basic food products. For statistical reasons, we choose the categories having a large number of observations.

of supermarkets and hypermarkets to the development of hard discounters. In this way, one can consider them as private labels.

- National Brand products (NB) are brands that are not private labels (the first three categories), and that are sold in more than 50% of French regions.
- Regional Brand products (RB) are the other brands, that is, brands that are not private labels, and that are sold in less than 50% of French regions.

For each product category, we build a time series of market shares and prices for the five different types of brands. Thus, for each product category, we design different subcategories and build the corresponding time-series. The dataset covers four years: 1998-2001. We define 52 periods of 4 weeks over the whole period.

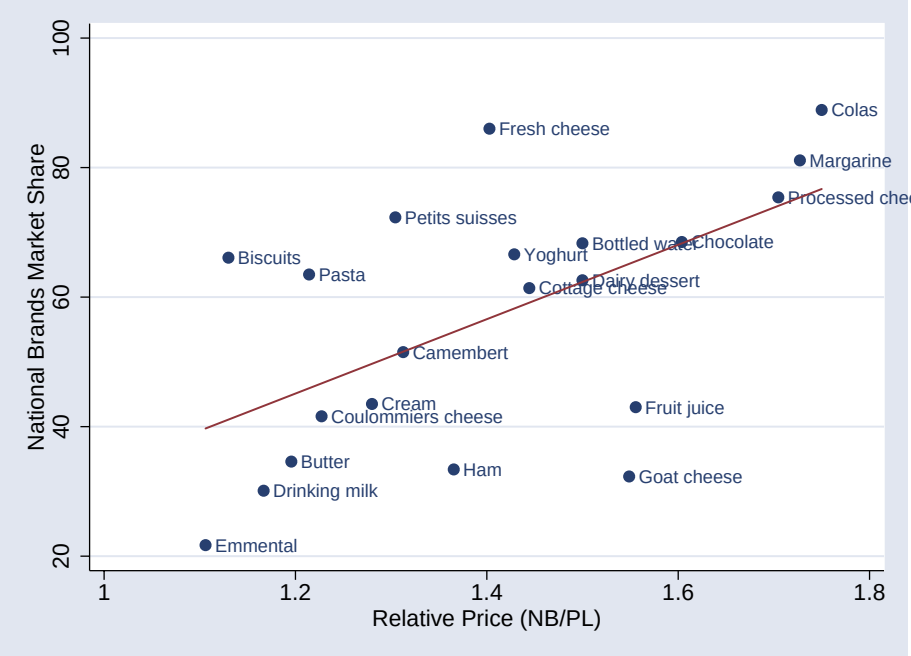

Figure 1: *National Brands Market Share vs Relative Price*

In Figure 1, national brands market shares are plotted against relative prices, defined as P_{NB}/P_{PL}, for the 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 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 inversely with* Δ_p *(difference in national brand and private label prices)*".[5] 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.

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 clear development of private label over the period. For all the product categories but two, when the trend coefficient of private labels (PL+HD) is significant, it is positive.[6] The average growth of private label market share is greater than 0.1% per period on several markets and is even close to 0.3% for some products. Conversely, national brand market share decreases in most cases. Only two sectors exhibit an increase in market share (margarine and cream).

[5] Here we report the national brands market share explaining our positive relationship.

[6] 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 the evolution of 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. 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 0.1% up to 0.4% per period of 4 weeks.[7]

5. Results

We first report the results from models 1 to 4 for the 21 product categories. Then, we extend the analysis using models 1 and 3 for all the product categories (218).

5.1 Results on the 21 product categories sample

We report in Table 2 the main results for the four regression models defined in section 3. In model 1, the private labels market share is the sum of PL and HD market shares. Model 2 is identical, except that we add the differentiation index. In model 3, we separately consider the three types of private labels (HD, PL and FP). Model 4 is identical to model 3, except that we introduce the differentiation index as an additional explanatory variable.

For each model, we test for autocorrelation and correct it using the Cochrane-Orcutt method. Since the private labels market share may be endogeneous, we conduct the Hausman test of endogeneity using appropriate instruments.[8] For each dairy product category, we first test relevance and validity of the instruments.[9] Then, using a Hausman test, we compare the parameters estimated in the regressions performed with and without instruments. In most cases, the parameters estimated with instrumental variables are not significantly different from the parameters estimated without instrumental variables.

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

[8] 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 PL market shares for other products, and other caracteristics of the market (number of producers, number of brands, etc.).

[9] 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.

Table 2: National brands price reaction to the development of private labels for 21 product categories

	Model 1	Model 2		Model 3			Model 4				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.
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.
"true" means that the inequalities hold (for significant β's) or that the equality is verified (Wald test).

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). Consequently, we report only the regression results obtained without instrumental variables in table 2.

Model 1, which is very close to the one estimated by Ward *et al.* (2002), leads to the conclusion that, private labels development has a significant and positive impact on national brands prices (except for one product category).

The index of differentiation defined for national brands (model 2) has a very significant and positive impact on national brands prices. The index is highly significant in 18 cases out of 21. Moreover, model 2 is considered better than model 1 in most cases. Finally, in model 2, when significant (15 cases out of 21) the private label market share has a positive impact on national brands prices. This confirms the results of Bontemps *et al.* (2005).

While Bontemps *et al.* show that an increase in hard discount (and first-price) products has a negative impact in almost half of the cases studied, here the impact of each of the three types of private labels is almost always positive when significant (models 3 and 4). 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 (17 cases out of 21), we obtain :

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

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 4. Indeed, in 17 cases out of 21, the best model includes the differentiation index.[10] The relevance to introduce different private

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

label categories is also confirmed as models 3 and 4 are considered as the best models in 13 cases out of 21.

5.2 Results on all the product categories

In order to test the robustness of our previous findings, we extend the analysis to all the product categories available in the database.[11] In Table 3 we provide some results about significance and signs of coefficients estimated in models 1 and 3.

Table 3: Positive and significant β's on Models 1 and 3

		Significant	Positive	
Model 1	β_{PL+HD}	116	103	(89%)
	β_{PL}	108	99	(91%)
Model 3	β_{HD}	89	79	(89%)
	β_{FP}	73	57	(78%)

Positive β in models 1 and 3 on the 218 product categories

We confirm that the private label (PL+HD) effect on national brands prices is positive when significant (103 positive β_{PL+HD} within 116 significant in Model 1). Private labels (*stricto sensu*) effect on national brands prices is confirmed by the same analysis with Model 3's results.

The question of the relative effect of each of the different types of private labels is also addressed here using model 3 on these 218 product categories. We report in Table 4, test results on this issue for 144 products having at least one significant β in the regression model 3. In 2/3 of the cases, private labels (*sensu stricto*) have the largest impact.

[11] As explained above, we only estimate models 1 and 3 as the other models require to define a specific subcategory for each product, a task that requires a case by case study.

Table 4: A comparison of the β's on Model 3

		$\beta_{HD} \leq \beta_{PL}$			
		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 3

5.3 An analysis of private labels impact among products

In this section, we use the 144 products, having at least one significant β in the regression model 3, to investigate the differences existing among product categories (if any) with respect to the impact of private label development.

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.[12] Group 1 includes 73 products categories for which market is concentrated (higher Herfindahl index), households are "loyal" to national brands, variation coefficient of the average price and interval between two purchases are higher.[13] Group 2 includes 71 products. The number of sales is higher in this group, there are more 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.

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

[12] We use the Calinski and Harabasz index.

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

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

		Group 1		Group 2		
		Mean	(Standard Error)	Mean	(Standard Error)	Equality Test
Model 1	β_{PL+HD}	.077	(.0126)	.174	(.0289)	rejected
Model 3	β_{PL}	.078	(.0115)	.189	(.0284)	rejected
	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

prices, namely β_{PL+HD} in model 1, β_{PL}, β_{HD} and β_{FP} in model 3. We report in Table 5 the results of these tests as well as statistics on the β's on Models 1 and 3 within each cluster.

Besides some products characteristics, the β_{PL+HD} of model 1 and the β_{PL} of model 3 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.

6. Concluding Remarks

The results we 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.

Moreover, results give also support to both ideas developed in this paper.

First, the impact of the different private labels is not identical. Increase in the national brands prices vis a vis a development of hard discount products or first-price products is lower than vis a vis a development of private labels.

Second, we find a significant effect of the product differentiation index. It means that the increase in national brands prices is also explained by a strategy of product differentiation by manufacturers.

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