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Two-Part Tariffs versus Linear Pricing Between Manufacturers and Retailers: Empirical Tests on Differentiated Products Markets

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Résumé

We present a methodology allowing to introduce manufacturers and retailers vertical contracting in their pricing strategies on a differentiated product market. We consider in particular two types of non linear pricing relationships, one where resale price maintenance is used with two part tariffs contracts and one where no resale price maintenance is allowed in two part tariffs contracts. Our contribution allows to recover price-cost margins from estimates of demand parameters both under linear pricing models and two part tariffs. The methodology allows then to test between different hypothesis on the contracting and pricing relationships between manufacturers and retailers in the supermarket industry using exogenous variables supposed to shift the marginal costs of production and distribution. We apply empirically this method to study the market for retailing bottled water in France. Our empirical evidence shows that manufacturers and retailers use non linear pricing contracts and in particular two part tariffs contracts with resale price maintenance. At last, thanks to the estimation of the our structural model, we present some simulations of counterfactual policy experiments like the change of pricing policies from two part tariffs to linear pricing between manufacturers and retailers, or the change of ownership of some products between manufacturers.

Key words : vertical contracts, two part tariffs, double marginalization, collusion, competition, manufacturers, retailers, differentiated products, water, non nested tests.

JEL codes : L13, L81, C12, C33

1 Introduction

Vertical relationships between manufacturers and retailers seem to be more and more important in the supermarket industry and in particular in food retailing. Competition analysis and issues related to market power on some consumption goods markets should involve the analysis of competition between producers but also between retailers and the whole structure of the industry. Consumer welfare depends crucially on these strategic vertical relationships and the competition or collusion degree of manufacturers and retailers. The aim of this paper is thus to develop a methodology allowing to estimate alternative structural models where the role of manufacturers and retailers is explicit in the horizontal and vertical strategic behaviors. Previous work on these issues

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generally does not account for the behavior of retailers in the manufacturers pricing strategies. One of the reasons is that information on wholesale prices and marginal costs of production or distribution are generally difficult to obtain and methods relying on demand side data, where only retail prices are observed, require the structural modelling of vertical contracts between manufacturers and retailers in an oligopoly model. Following Rosse (1970), researchers have thus tried to develop methodologies allowing to estimate price-cost margins that are necessary for market power analysis and policy simulations, using only data on the demand side, i.e. sales quantities, market shares and retail prices. Empirical industrial organization methods propose to address this question with the estimation of structural models of competition on differentiated products markets (see, for example, Berry, 1994, Berry, Levinsohn and Pakes, 1995, and Nevo, 1998, 2000, 2001, Ivaldi and Verboven, 2001 on markets such as cars, computers, and breakfast cereals). Until recently, most papers in this literature assume that manufacturers set prices and that retailers act as neutral pass-through intermediaries or that they charge exogenous constant margins. However, it seems unlikely that retailers do not use some strategic pricing. Chevalier, Kashyap and Rossi (2003) show the important role of distributors on prices through the use of data on wholesale and retail prices. Actually, the strategic role of retailers has been emphasized only recently in the empirical economics and marketing literatures. Goldberg and Verboven (2001), Mortimer (2004), Sudhir (2001), Berto Villas Boas (2004) or Villas-Boas and Zhao (2004) introduce retailers' strategic behavior. For instance, Sudhir (2001) considers the strategic interactions between manufacturers and a single retailer on a local market and focuses exclusively on a linear pricing model leading to double marginalization. These recent developments introducing retailers' strategic behavior consider mostly cases where competition between producers and/or retailers remains under linear pricing. Berto Villas-Boas (2004) extends the Sudhir's framework to multiple retailers and considers the possibility that vertical contracts between manufacturers and retailers make pricing strategies depart from double marginalization by setting alternatively wholesale margins or retail margins to zero. Using recent theoretical developments due to Rey and Vergé (2004) that characterize pricing equilibria in the case of competition under non linear pricing between manufacturers and retailers (namely two part tariffs with or without resale price maintenance), we extend the analysis taking explicitly into account vertical contracts between manufacturers and retailers.

We then present how to test across different hypothesis on the strategic relationships between manufacturers and retailers in the supermarket industry competing on a differentiated products market. In particular, we consider two types of non linear pricing relationships, one where resale price maintenance is used with two part tariffs contracts and one where no resale price maintenance is allowed in two part tariffs (Rey and Vergé, 2004). Modelling explicitly optimal two part tariffs contracts (with or without resale price maintenance) allows to recover the pricing strategy of manufacturers and retailers and thus the total price-cost margins as functions of demand parameters without observing wholesale prices. Using non nested test procedures, we show how to test between the different models using exogenous variables that shift the marginal costs of production and distribution.

We apply this methodology to study the market for retailing bottled water in France and present the first formal empirical tests of such a model including non linear contracts between manufacturers and retailers. This market presents a high degree of concentration both at the manufacturer and retailer levels. It is to be noted that it is actually even more concentrated at the manufacturer level.

Our empirical evidence shows that, in the French bottled water market, manufacturers and retailers use non linear pricing contracts and in particular two part tariffs contracts with resale price maintenance that allow to implement the pricing equilibrium maximizing the total profits of the vertical chain. Note that more general non linear contracts would not allow to do better for manufacturers, although the same equilibrium could probably be reached by more complex non linear contracts without resale price maintenance.

In section 2, we first present some stylized facts on the market for bottled water in France, an industry where the questions of vertical relationships and competition of manufacturers and retailers seem worth studying. Section 3 presents the main methodological contribution on the supply side. We show how price-cost margins can be recovered with demand parameters, in particular when taking explicitly into account two part tariffs contracts. Section 4 presents the demand model, its identification and the estimation method proposed as well as the testing method between the different models. Section 5 presents the empirical results and tests. A conclusion with future research directions is in section 6.

2 Stylized Facts on the Market for Bottled Water in France

The French market for bottled water is one of the more dynamic sector of the French food processing industry : the total production of bottled water has increased by 4% in 2000, and its turnover by 8%. Some 85% of French consumers drink bottled water, and over two thirds of French bottled water drinkers drink it more than once a day, a proportion exceeded only in Germany. The French bottled water sector is a highly concentrated sector, the first three main manufacturers (Nestlé Waters, Danone, and Castel) sharing 90% of the total production of the sector. This sector can be divided in two major segments : mineral water and spring water. Natural mineral water benefits some properties favorable to health, which are officially recognized. Composition must be guaranteed as well as the consistency of a set of qualitative criteria : mineral content, visual aspects, and taste. The differences between the quality requirements involved in the certification of the two kinds of bottled water may explain part of the large difference that exists between the shelf prices of the national mineral water brands and the local spring water brands. Moreover, national mineral water brands are highly advertised. Actually, thanks to data at the aggregate level (Agreste, 1999, 2000, 2002) on food industries and the bottled water industry, one can remark (see the following Table) that this industry uses much more advertising than other food industries. Friberg and Ganslandt (2003) report an advertising to revenue ratio for the same industry in Sweden, i.e., 6.8% over the 1998-2001 period. For comparison, the highest advertising to revenue ratio in the US food processing industry corresponds to the ready-to-eat breakfast cereal industry and is of 10.8%. These figures may be interpreted as showing the importance of horizontal differentiation of products for bottled water.

Year	Bottled Water		All Food Industries	
	PCM	Advertising/Revenue	PCM	Advertising/Revenue
1998	17.38%	12.09%	6.32%	5.57%
1999	16.70%	14.91%	6.29%	6.81%
2000	13.61%	15.89%	3.40%	8.76%

Table 1 : Aggregate Estimates of Margins and Advertising to Sales Ratios.

These aggregate data also allow to compute some accounting price-cost margins defined as value added (VA) minus payroll (PR) and advertising expenses (AD) divided by the value of shipments (TR). As emphasized by Nevo (2001), these accounting estimates can be considered as an upper bound to the true price-cost margins.

Households buy bottled water mostly in supermarkets : some 80% of the total sales of bottled water comes from supermarkets. Moreover, on average, these sales represent 1.7% of the total turnover of supermarkets, the bottled water shelf being one of the most productive. French bottled water manufacturers thus deal mainly their brands through retailing chains. These chains are also highly concentrated, the market share of the first five accounting for 80.7% of total food product sales. Moreover, these late years, like other processed food products, these chains have developed private labels to attract consumers. The increase in the number of private labels tends to be accompanied by a reduction of the market shares of the main national brands.

We thus face a relatively concentrated market for which the questions of whether or not producers may exert bargaining power in their strategic relationships with retailers is important. The study of competition issues and evaluation of markups, which is crucial for consumer welfare, has then to take into account the possibility that non linear pricing may be used between manufacturers and retailers. Two part tariffs are typically relatively simple contracts that may allow manufacturers to benefit from their bargaining position in selling national brands. Therefore, we study in the next section different alternative models of strategic relationships between multiple manufacturers and multiple retailers that are worth considering.

3 Two-Part Tariffs Contracts Between Manufacturers and Retailers

Before presenting our demand model, we present now the modelling of the competition and vertical relationships between manufacturers and retailers. We show how each supply model can be solved to obtain an expression for both the retailer's and manufacturer's price-cost margins just as a function of demand side parameters. Then using estimates of a differentiated products demand model, we will be able to estimate empirically these price-cost margins and we will show how we can test between these competing scenarios. A similar methodology has been used already for double marginalization scenarios considered below by Sudhir (2001) or Brenkers and Verboven (2004) or Berto Villas-Boas (2004) but none of the papers in this literature already considered the particular case of competition in two part tariffs using the recent theoretical insights of Rey and Vergé (2004).

Let's first introduce the notations. There are J differentiated products defined by the couple product-retailer corresponding to J' national brands and $J - J'$ private labels. We suppose there are R retailers competing in the retail market and F manufacturers competing in the wholesale market. We denote by S_r the set of products sold by retailer r and by F_f the set of products produced by firm f. In the following we present successively the different oligopoly models that we want to study. We consider the case where manufacturers and retailers can sign two-part tariffs contracts. We assume that manufacturers have all the bargaining power. In the case of these two part tariffs contracts, the profit function of retailer r is :

$$\Pi^r = \sum_{s \in S_r} [M(p_s - w_s - c_s)s_s(p) - F_s] \tag{1}$$

where F_s is the franchise fee paid by the retailer for selling product s, p_j is the retail price of product j sold by retailer r, w_j is the wholesale price paid by retailer r for product j, c_j is the retailer's (constant) marginal cost of distribution for product j, $s_j(p)$ is the market share of product j, p is the vector of all products retail prices and M is the size of the market.

Manufacturers set their wholesale prices to w_k and the franchise fees F_k and choose the retail's prices in order to maximize profits which is for firm f equal to

$$\Pi^f = \sum_{k \in F_f} [M(w_k - \mu_k)s_k(p) + F_k] \tag{2}$$

subject to the retailers' participation constraints $\Pi^r \geq 0$, for all $r = 1, .., R$, where μ_j is the manufacturer's (constant) marginal cost of production of product j.

Since the participation constraints are clearly binding (Rey and Vergé, 2004) and manufacturers choose the fixed fees F_k given the ones of the other manufacturers, one can replace the expressions of the franchise fee F_k of the binding participation constraint (1) into the manufacturer's profit

(2) and obtain the following profit for firm f (see details in appendix ??)

$$\sum_{k\in F_f}(p_k-\mu_k-c_k)s_k(p)+\sum_{k\notin F_f}(p_k-w_k-c_k)s_k(p)$$

Then, the maximization of this objective function depends on whether resale price maintenance is used or not by manufacturers.

Two part tariffs with resale price maintenance :

Since manufacturers can capture retail profits through the franchise fees and moreover set retail prices, the wholesale prices have no direct effect on profit. Rey and Vergé (2004) showed however that the wholesale prices influence the strategic behavior of competitors. They show that there exists a continuum of equilibria, one for each wholesale price vector. For each wholesale price vector w^*, there exists a unique symmetric subgame perfect equilibrium in which retailers earn zero profit and manufacturers set retail prices to $p^*(w^*)$, where $p^*(w^*)$ is a decreasing function of w^* equal to the monopoly price when the wholesale prices are equal to the marginal cost of production. For our purpose, we choose some possible equilibria among this multiplicity of equilibria. For a given equilibrium $p^*(w^*)$, the first order conditions of manufacturer f are

$$\sum_{k\in F_f}(p_k-\mu_k-c_k)\frac{\partial s_k(p)}{\partial p_j}+s_j(p)+\sum_{k\notin F_f}(p_k^*-w_k^*-c_k)\frac{\partial s_k(p)}{\partial p_j}=0 \quad \text{for all } j\in F_f \tag{3}$$

Then, depending on the wholesale prices, several cases can be considered. We will consider two cases of interest : first when wholesale prices are equal to the marginal cost of production ($w_k^*=\mu_k$), second, when wholesale prices are such that the retailer's price cost margins are zero ($p_k^*(w_k^*)-w_k^*-c_k=0$).

First, when $w_k^*=\mu_k$, the first order condition (3) writes

$$\sum_k(p_k-\mu_k-c_k)\frac{\partial s_k(p)}{\partial p_j}+s_j(p)=0 \quad \text{for all } j\in F_f$$

Now, we define I_r (of size $(J\times J)$) as the ownership matrix of the retailer r that is diagonal and whose elements $I_r(j,j)$ are equal to 1 if the retailer r sells products j and zero otherwise. Let S_p be the market shares response matrix to retailer prices, containing the first derivatives of all market shares with respect to all retail prices, i.e. $\frac{\partial s_i}{\partial p_j}$ on row j and column i.

Consider I_f the ownership matrix of manufacturer f that is diagonal and whose element $I_f(j,j)$ is equal to one if j is produced by the manufacturer f and zero otherwise. This gives in matrix notation for manufacturer f

$$\gamma_f+\Gamma_f=(p-\mu-c)=-(I_f\times S_p)^{-1}I_f\times s(p) \tag{4}$$

Second, when wholesale prices w_k^* are such that $p_k^*(w_k^*)-w_k^*-c_k=0$, then (3) implies that in matrix notations, for all $f=1,..,F$

$$\gamma_f+\Gamma_f=(p-w-c)=(p-\mu-c)=-(I_f\times S_p\times I_f)^{-1}\times I_f\times s(p)$$

However, among the continuum of possible equilibria, Rey and Vergé (2004) showed that the case where wholesale prices are equal to the marginal costs of production is the equilibrium that would be selected if retailers can provide a retailing effort that increases demand. Actually, in this case it is worth for the manufacturer to make the retailer residual claimant of his retailing effort which leads to select this equilibrium wholesale price.

Two part tariffs without resale price maintenance :

Let's consider now that resale price maintenance cannot be used by manufacturers. Since they cannot choose retail prices, they only set wholesale prices in the following maximization program. Then the first order conditions are for all $i \in F_f$

$$\sum_k \frac{\partial p_k}{\partial w_i} s_k(p) + \sum_{k \in F_f} \left[(p_k - \mu_k - c_k) \sum_j \frac{\partial s_k}{\partial p_j} \frac{\partial p_j}{\partial w_i} \right] + \sum_{k \notin F_f} \left[(p_k - w_k - c_k) \sum_j \frac{\partial s_k}{\partial p_j} \frac{\partial p_j}{\partial w_i} \right] = 0$$

We introduce P_w the $(J \times J)$ matrix of retail prices responses to wholesale prices, containing the first derivatives of the J retail prices p with respect to the J' wholesale prices w. This implies that the total price cost margin $\gamma + \Gamma = p - \mu - c$ is such that for all $j = 1, .., J$:

$$\gamma + \Gamma = (I_f \times P_w \times S_p \times I_f)^{-1} \times [-I_f \times P_w \times s(p) - I_f \times P_w \times S_p \times I_{-f} \times (p - w - c)] \quad (5)$$

that allows us to estimate the price-cost margins with demand parameters using (**??**) to replace $(p - w - c)$ and (**??**) for P_w. Remark again that the formula (**??**) provides directly the total price-cost margin obtained by each retailer on its private label.

4 Differentiated Products Demand

4.1 The Random Utility Demand Model

We now describe our model of differentiated product demand. We use a standard random utility model. Actually, denoting V_{ijt} the utility for consumer i of buying good j at period t, we assume that it can be represented by

$$V_{ijt} = \theta_{jt} + u_{jt} + \varepsilon_{ijt} = \delta_j + \gamma_t - \alpha p_{jt} + u_{jt} + \varepsilon_{ijt} \text{ for } j = 1, ., J$$

where θ_{jt} is the mean utility of good j at period t, u_{jt} a product-time specific unobserved utility term and ε_{ijt} a (mean zero) individual-product-period-specific utility term representing the deviation of individual's preferences from the mean θ_{jt}.

Moreover, we assume that θ_{jt} is the sum of a mean utility δ_j of product j common to all consumers, a mean utility γ_t common to all consumers and products at period t (due to unobserved preference shocks to period t) and an income disutility αp_{jt} where p_{jt} is the price of product j at period t. Consumers may decide not to purchase any of the products. In this case they choose an outside good for which the mean part of the indirect utility is normalized to 0, so that $V_{i0t} = \varepsilon_{i0t}$. Remark that the specification used for θ_{jt} is such that one could also consider that the mean utility of the outside good depends also on its time varying price p_{0t} without changing the identification of the other demand parameters. Actually, adding $-\alpha p_{0t}$ to the outside good mean utility is equivalent to adding αp_{0t} to all other goods mean utility, which would amount to replace γ_t by $\gamma_t + \alpha p_{0t}$.

In the bottled water market in France, it seems that customers make a clear difference between two groups of bottled water : Mineral water and spring water, such that it makes sense to allow customers to have correlated preferences over such groups. Our demand model incorporates this observation. Indeed, we model the distribution of the individual-specific utility term ε_{ijt} according to the assumptions of a Generalized Extreme Value (GEV) model (McFadden, 1978). We assume that the bottled water market can be partitioned into 2 different groups, each sub-group g containing J_g products ($J_1+J_2 = J$). Since products belonging to the same subgroup share a common set of unobserved features, consumers may have correlated preferences over these features. Assuming that consumers choose one unit of the good that maximizes utility, the distributional assumptions yield the following choice probabilities or market shares for each product j, as a function of the price vector $p_t = (p_{1t}, p_{2t}, ..., p_{Jt})$

$$s_{jt}(p_t) = P\left(V_{ijt} = \max_{l=0,1,.,J}(V_{ilt})\right) = \frac{\exp\frac{\theta_{jt}+u_{jt}}{1-\sigma_g}}{\sum_{j\in J_g}\exp\frac{\theta_{jt}+u_{jt}}{1-\sigma_g}} \frac{\left(\sum_{j\in J_g}\exp\frac{\theta_{jt}+u_{jt}}{1-\sigma_g}\right)^{1-\sigma_g}}{\sum_{g=0}^{G}\left(\sum_{j\in J_g}\exp\frac{\theta_{jt}+u_{jt}}{1-\sigma_g}\right)^{1-\sigma_g}}$$

At the aggregate demand level, the parameter σ_g allows to assess to which extent competition is localized between products from the same subgroup.

4.2 Identification and Estimation of the Econometric Model

Our method relies on two structural estimations, first, on the demand model and then on the cost equation. Following Berry (1994) and Verboven (1996), the random utility model introduced in the previous section leads to the following equations on the aggregate market shares of good j at time t

$$\ln s_{jt} - \ln s_{0t} = \theta_{jt} + \sigma_g \ln s_{jt|g} + u_{jt} = \delta_j + \gamma_t - \alpha p_{jt} + \sigma_g \ln s_{jt|g} + u_{jt} \tag{6}$$

where $s_{jt|g}$ is the relative market share of product j at period t in its group g and s_{0t} is the market share of the outside good at time t. Remark that the full set of time fixed effects γ_t captures preferences for bottled water relative to the outside good, and can thus be thought of as accounting for macro-economic fluctuations (like the weather) that affect the decision to buy bottled water but also as accounting for the outside good price variation across periods. The error term u_{jt} captures the remaining unobserved product valuations varying across products and time, e.g. due to unobserved variations in advertising.

The usual problem of endogeneity of price p_{jt} and relative market shares $s_{jt|g}$ has to be handled correctly in order to identify and estimate the parameters of these models. We construct instruments for prices p_{jt} that are interactions between characteristics of bottled water and the prices of inputs (the vector of these instruments is denoted z_{jt}). The identification then relies on the fact that these input prices affect the product prices because they are correlated with input costs but are not correlated with the idiosyncratic unobserved shocks to preferences u_{jt}. For the relative market shares, our strategy relies on the fact that the contemporaneous correlation between $\ln s_{jt|g}$ and unobserved shocks u_{jt}, which is the source of the endogeneity problem, can be controlled for with some suitable projection of the relative market shares on the hyperplane generated by some observed lagged variables. In order to take into account this endogeneity problem, we denote $Z_{jt} = (1_{j=1}, .., 1_{j=J}, \varsigma_{jt-1}, z_{jt})$ the vector of variables on which we project the right hand side endogenous variables (including dummy variables for products), where ς_{jt-1} results form the projection of the lagged variable $\ln s_{jt-1|g}$ on the hyperplane orthogonal to the space spanned by a set of product fixed effects and the variable $\ln s_{jt-2|g}$. ς_{jt-1} is thus the residual of the regression

$$\ln s_{jt-1|g} = \pi_j + \beta \ln s_{jt-2|g} + \varsigma_{jt-1}$$

Then, the identification of the coefficients of (6) relies on the orthogonality condition

$$E\left(Z_{jt}u_{jt}\right) = 0$$

The identification and estimation of these demand models then permits to evaluate own and cross price elasticities in this differentiated product demand model.

4.3 Testing Between Alternative Models

We now present how to test between the alternative models once we have estimated the demand model and obtained the different price-cost margins estimates according to their expressions obtained in the previous section.

Denoting by h the different models considered, for product j at time t under model h, we denote γ_{jt}^h the retailer price cost margin and Γ_{jt}^h the manufacturer price cost margin. Using C_{jt}^h for the sum of the marginal cost of production and distribution ($C_{jt}^h = \mu_{jt}^h + c_{jt}^h$) we can estimate this marginal cost using prices and price cost margins with

$$C_{jt}^h = p_{jt} - \Gamma_{jt}^h - \gamma_{jt}^h \tag{7}$$

Let's now assume that these marginal costs are affected by some exogenous shocks W_{jt}, we use the following specification

$$C_{jt}^h = p_{jt} - \Gamma_{jt}^h - \gamma_{jt}^h = \left[\exp(\omega_j^h + W_{jt}'\lambda_h)\right]\eta_{jt}^h$$

where ω_j^h is an unknown product specific parameter, W_{jt} are observable random shock to the marginal cost of product j at time t and η_{jt}^h is an unobservable random shock to the cost. Assuming that $corr(\ln \eta_{jt}^h, W_{jt}) = corr(\ln \eta_{jt}^h, \omega_j^h) = 0$, one can identify and estimate consistently ω_j^h, λ_g, and η_{jt}^h.

Now, for any two models h and h', one would like to test one model against the other. We use non nested tests (Vuong, 1989, and Rivers and Vuong, 2002) to infer which model h is statistically the best. The tests we use consist in testing models one against another. The test of Vuong (1989) applies in the context of maximum likelihood estimation and thus would apply in our case if one assumes log-normality of η_{jt}^h. Rivers and Vuong (2002) generalized this kind of test to a broad class of estimation methods including non linear least squares.

5 Econometric Estimation and Test Results

5.1 Data and Variables

Our data were collected by the company SECODIP (*Société d'Étude de la Consommation, Distribution et Publicité*) that conducts surveys about households' consumption in France. We have access to a representative survey for the years 1998, 1999, and 2000. These data contain information on a panel of nearly 11000 French households and on their purchases of mostly food products. This survey provides a description of the main characteristics of the goods and records over the whole year the quantity bought, the price, the date of purchase and the store where it is purchased. In particular, this survey contains information on all bottled water purchased by these French households during the three years of study. We consider purchases of the seven most important retailers which represent 70.7% of the total purchases of the sample. We take into account the most important brands, that is five national brands of mineral water, one national brand of spring water, one retailer private label brand of mineral water and one retailer private label spring water. The purchases of these eight brands represent 71.3% of the purchases of the seven retailers. The national brands are produced by three different manufacturers : *Danone*, *Nestlé* and *Castel*. The market share of the outside good is defined as the difference between the total size of the market and the shares of the inside goods. We consider all other non-alcoholic refreshing drinks as the outside good. Therefore, the market size consists in all non-alcoholic refreshing drinks such as bottled water (including sparkling and flavored water), tea drinks, colas, tonics, fruit drinks, sodas lime. We consider eight brands sold in seven distributors, which gives more than 50 differentiated products in this national market. The number of products in our study thus varies between 51 and 54 during the 3 years considered. Considering the monthly market shares of all of these differentiated products, we get a total of 2041 observations in our sample. We also use data from the French National Institute for Statistics and Economic Studies (INSEE) on the plastic price, on a wage salary index for France, on oil and diesel prices and on an index for packaging material cost. Over the time period considered (1998-2000), the wage salary index always raised while the plastic price index first declined during 1998 and the beginning of 1999 before raising again and reaching the 1998 level at the end of 2000. Concerning the diesel price index, it shows quite an important volatility with a first general decline during 1998 before a sharp increase until a new decline at the end of 2000. Also, the packaging material cost index shows important variations with a sharp growth in 1998, a decline at the beginning of 1999 and again an important growth until the end of 2000. Interactions of these prices with the dummies for the type of water (spring versus mineral) will serve as instrumental variables as they are supposed to affect the marginal cost of production and distribution of bottled water. Actually, it is likely that labor cost is not the same for the production of mineral or spring water but it is also known in this industry that the plastic quality used for mineral or spring water is usually not the same which is also likely to affect their bottling and packaging costs. Also, the relatively important variations of all these price indices during the period of study suggests a potentially good identification of our cost equations.

5.2 Demand Results

We estimate the demand model (6) which is the following

$$\ln s_{jt} - \ln s_{0t} = \delta_j + \gamma_t - \alpha p_{jt} + \sigma_g \ln s_{jt|g} + u_{jt}$$

using two stage least squares in order to instrument the endogenous variables p_{jt} and $\ln s_{jt|g}$. Results are in Table 2. F tests of the first stage regressions show that our instrumental variables are well correlated with the endogenous variables. Moreover, the Sargan test of overidentification validates the exclusion of excluded instruments from the main equation. The price coefficient has the expected sign in both specifications and in the case of the nested logit model, the coefficients σ_g actually belongs to the $[0, 1]$ interval as required by the theory.

Variable	Multinomial Logit	Nested Logit
Price (α) (Std. error)	5.47 (0.44)	4.11 (0.077)
Mineral water σ_g (Std. error)		0.68 (0.025)
Spring water σ_g (Std. error)		0.59 (0.018)
Coefficients δ_j, γ_t not shown		
F test that all $\delta_j = 0$ (p value)	219.74 (0.000)	55.84 (0.000)
Wald test that all $\gamma_t = 0$ (p value)	89.89 (0.0000)	64.50 (0.0034)
Sargan Test of overidentification (p value)	6.30 (0.18)	8.38 (0.08)

Table 2 : Estimation Results of Demand Models

Once we obtained our structural demand estimates, we can compute price elasticities of demand for our differentiated products. These elasticities are quite large but it seems consistent with the fact that our model considers a very precise degree of differentiation. Actually, even for non sparkling spring and natural water, we end up with 56 products as we consider that the brand and the supermarket chain distributor are differentiation characteristics of a bottle of water. It is not surprising to find that these products are importantly substitutable. However, if one looks at some group level elasticities, one finds much lower absolute values for these elasticities. It appears that the total price elasticity of the group of mineral water goes down to -7.40 instead of an average of -23.16 at the product level and that for spring water it goes down from -11.14 to -3.41.

5.3 Price-Cost Margins and Non Nested Tests

Once one has estimated the demand parameters, we can use the formulas obtained in section 3 to compute the price cost margins at the retailer and manufacturer levels, or the total price cost margins, for all products, under the various scenarios considered. We presented several models that seem worth of consideration with some variants on manufacturers or retailers behavior. Among the different models with double marginalization or two part tariffs, we consider the models described in the following table. Each scenario can be described according to the assumptions made on the manufacturers behavior (collusive or Nash), the retailers behavior (collusive or Nash) and the vertical interaction which can be Stackelberg or Nash under double marginalization or with RPM or not under two part tariffs contracts :

Models	**Retailers Behavior**	**Manufacturers Behavior**	**Vertical Interaction**
Double marginalization			
Model 1	Collusion	Nash	Nash
Model 2	Collusion	Nash	Stackelberg
Model 3	Collusion	Collusion	Nash
Model 4	Collusion	Collusion	Stackelberg
Model 5	Nash	Nash	Nash
Model 6	Nash	Nash	Stackelberg
Model 7	Nash	Collusion	Nash
Model 8	Nash	Collusion	Stackelberg
Two Part Tariffs			
Model 9	Nash	Nash	RPM ($w = \mu$)
Model 10	Collusion	Collusion	RPM ($w = \mu$)
Model 11	Nash	Nash	RPM ($p = w + c$)
Model 12	Collusion	Collusion	RPM ($p = w + c$)
Model 13	Nash	Nash	no RPM
Model 14 : joint profit maximization	Collusion	Collusion	Collusion

Table 7 then presents the averages of product level price cost margins estimates under the different models with the nested logit demand. It is worth noting that price cost margins are generally lower for mineral water than for spring water. As done by Nevo (2001), one could then compare price cost margins with accounting data to evaluate their empirical validity and also eventually test which model provides the most realistic result. However, the lack of data both on retailers or manufacturers margins prevents such analysis. Moreover accounting data only provide an upper bound for price-cost margins.

Price-Cost Margins (% of retail price p)		Mineral Water		Spring Water	
		Mean	Std.	Mean	Std.
Double Marginalization					
Model 1	Retailers	15.47	3.14	35.26	12.71
	Manufacturers	6.29	0.76	22.43	2.25
	Total	**21.35**	**2.86**	**46.19**	**23.92**
Model 2	Retailers	15.47	3.14	35.26	12.71
	Manufacturers	6.51	1.01	24.52	2.91
	Total	**21.55**	**2.93**	**47.21**	**25.03**
Model 3	Retailers	15.47	3.14	35.26	12.71
	Manufacturers	12.50	1.58	26.32	2.80
	Total	**27.16**	**3.75**	**48.08**	**25.90**
Model 4	Retailers	15.47	3.14	35.26	12.71
	Manufacturers	16.62	4.69	37.19	5.17
	Total	**31.01**	**6.10**	**53.38**	**31.55**
Model 5	Retailers	4.89	0.99	10.97	3.94
	Manufacturers	6.29	0.76	22.43	2.25
	Total	**10.77**	**1.65**	**21.90**	**15.17**
Model 6	Retailers	4.89	0.99	10.97	3.94
	Manufacturers	6.88	2.94	29.91	14.87
	Total	**11.28**	**3.26**	**25.47**	**21.41**
Model 7	Retailers	4.89	0.99	10.97	3.94
	Manufacturers	12.50	1.58	26.32	2.80
	Total	**16.58**	**3.27**	**23.79**	**17.14**
Model 8	Retailers	4.89	0.99	10.97	3.94
	Manufacturers	16.09	3.46	33.88	12.54
	Total	**19.93**	**4.99**	**27.40**	**22.49**
Two part Tariffs with RPM					
Model 9	Nash and $w = \mu$	**4.60**	**0.62**	**17.24**	**1.91**
Model 10	Collusion and $w = \mu$	**10.43**	**1.40**	**10.06**	**2.24**
Model 11	Nash and $p = w + c$	**6.30**	**0.77**	**22.36**	**2.22**
Model 12	Collusion and $p = w + c$	**12.46**	**1.57**	**26.18**	**2.80**
Two-part Tariffs without RPM					
Model 13	Retailers	4.89	0.99	10.97	3.94
	Manufacturers	3.77	4.02	13.26	3.10
	Total	**8.43**	**4.10**	**27.52**	**4.67**
Joint Profit Maximization					
Model 14		**15.47**	**3.14**	**35.26**	**12.71**

Table 7 : Price-Cost Margins (averages by groups) for the Nested Logit Model

After estimating the different price cost margins for the models considered, one can recover the marginal cost C_{jt}^h. We thus performed the non nested tests presented in 4.3. The statistics of test of Rivers and Vuong show that the best model appears to be the model 9, that is the case where two part tariffs contracts with resale price maintenance are used by manufacturers with retailers (for lack of space these statistics are not shown in this version). Finally, the non rejected model tells that manufacturers use two part tariffs with retailers and moreover (as predicted by the theory) that they use resale price maintenance in their contracting relationships although it is in principle not legal in France.

For this model, the estimated total price cost margins (price minus marginal cost of production and distribution), are relatively low with an average of 4.60% for the mineral water and 17.24%

for spring water. These figures are lower than the rough accounting estimates that one can get from aggregate data (see section 2). As Nevo (2001) remarks the accounting margins only provide an upper bound of the true values. Moreover, the accounting estimates do not take into account the marginal cost of distribution while our structural estimates do. Thus, these empirical results seem then quite realistic and consistent with the bounds provided by accounting data. In absolute values, the price-cost margins are on average close for mineral water and for spring water. Actually, the absolute margins are on average of 0.017 € for mineral water and 0.019 € for spring water.

6 Conclusion

In this paper, we presented the first empirical estimation of a structural model taking into account explicitly two part tariffs contracts between manufacturers and retailers. We show how to estimate different structural models embedding the strategic relationships between manufacturers and retailers in the supermarket industry. In particular, we presented how one can test whether manufacturers use two part tariffs contracts with retailers. The method is based on estimates of demand parameters that allow to recover price-cost margins at the manufacturer and retailer levels. We then test between the different models using exogenous variables that are supposed to shift the marginal cost of production and distribution. We apply this methodology to study the market for retailing bottled water in France. Our empirical evidence allows to conclude that manufacturers and retailers use non linear pricing contracts and in particular two part tariffs contracts with resale price maintenance.

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