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Abstract

In spite of growing consumers' interest for functional foods and strong growth of their markets, limited knowledge of the demand for these products and their profitability is available. Adapting the LA/AIDS model by means of Pinkse, Slade, and Brett's (2002) distance metric method, this article assesses the demand, substitution pattern, and profitability of conventional and functional alternatives inside the yogurt category in the Italian market. Results indicate that functional alternatives' demand is often less elastic than conventional ones', that brand loyalty plays a key role, and that 25% of the profitability of functional yogurts comes from the functional attribute itself.

Key words: Functional Foods, Differentiated Products, Distance Metric, Yogurt

JEL: L15; L25; L66

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Functional Foods as Differentiated Products

Consumers' interest for nutraceutical food products (featuring both *nutr*itional and pharm*aceutical* properties) has recently triggered a strong growth of the market for functional foods (claiming to provide health benefits beyond the traditional nutrients they contain).[1] During the period 2004-2007 the sales of fortified and functional packaged goods have exceeded 10% in Western Europe (*The Economist*, 2009), reaching a value of approximately US $ 8 billion in 2006 (Datamonitor, 2007). The forecasted value of the global market for functional foods is expected to grow by 56% over the period 2007-2013, reaching $128 billion in 2013 (PricewaterhouseCoopers, 2009).

Although a considerable number of survey-based studies have investigated aspects related to the demand for these products, finding that consumers show high willingness to pay for food with health-enhancing features (see for example West *et al*. 2002; Markosyan *et al*. 2009), and a large body of research aims to understand consumers' attitudes toward functional products using survey data rather than market data (see Sirò et. al (2008) for an extensive review of the literature on functional foods),[2] only few analyses have focused on estimating the demand for these products. Two examples are Yuan, Capps, and Nayga (2009), who investigated sales cannibalization due to the presence of a functional alternative in a given

[1] According to the European Commission's Concerted Action on Functional Food Science in Europe (FuFoSE), coordinated by the International Life Science Institute (ILSI) "*a food product can only be considered functional if together with the basic nutritional impact it has beneficial effects on one or more functions of the human organism thus either improving the general and physical conditions or/and decreasing the risk of the evolution of diseases.*" (Diplock *et al.* 1999). Several others definitions exist: see Siró *et al.* (2008) for a summary.

[2] This strand of literature indicates that consumers with a positive attitude towards functional foods also have a clear understanding and a positive perception of the health benefits they provide. For example Verbeke (2005) shows that in the Belgian market believing in the health benefits of functional foods is the main positive determinant of their acceptance. Using samples of MS students living in USA, Canada and France, Labrecque et al. (2006) found that health, health-related benefits' beliefs, and credibility of information are the main positive determinants of the acceptance of these products.

category (orange juice) and Bonanno (2009), who analyzed the role of health-related socio-demographic characteristics on the odds of demanding functional versus conventional yogurts in Italy.

Surprisingly, no study has so far assessed functional foods' profitability and the extent of their differentiation. Functional foods are usually sold by large food manufacturers with the objective to attract new customers and/or to revitalize mature segments through product differentiation (Heasman and Mellentin, 2001). If higher margins are achieved from selling functional products, these are not only needed to revive mature segments, but also necessary to recover 1) the large R&D costs incurred in the development of the functional attributes,[3] 2) high marketing costs, and 3) diseconomies of scope which may arise from the excessive length of the product lines (Draganska and Jain, 2005) and from the failure to support the already existing core products (Herath *et al*. 2008). If functional foods' manufacturers fail their differentiation strategy, consumers may be less likely to purchase the more pricey functional alternatives and more likely to switch to the conventional ones as prices increase. As a result, understanding consumers' purchasing patterns for functional and conventional alternatives is crucial to understand the actual profitability of these products and consumers' characterization of them.

The lack of understanding of the market of functional products and of their performance is surprising, particularly in light of the rapid changes that they are experiencing. For example, the European functional food industry is undergoing major changes as a consequence of Regulation (EC) No. 1924/2006, 20 December 2006, regulating food products' health claims. Food industry pundits are concerned that the lack of transparency of the protocols used by the European Food Safety Agency (EFSA) review panel can create a climate of uncertainty which

[3] Menrad (2003) reports that Unilever invested more than 50 million US$ to develop the functional yogurt Nestlé Lc1 and the proactive margarine Becel®, sum considerably higher than the general estimated cost of developing a new food product (2 million US$).

could jeopardize the future innovation and growth of the European food industry (Starling, 2009). In November 2009, the EFSA announced its first decisions on 523 (out of 4,159) claims, of which about two thirds were negative. Such situation of uncertainty has not spared large companies that have supported the thrust of the EU nutrition and health claims legislation: for example Danone (which shared the support that the Yoghurt and Live Fermented Milks Association gave to the legislation) withdrew in April 2009 two article-13.5 submission: a digestive health claim for Activia (spoonable) and one immunity claim for Actimel (drinkable), seeking further guidance from EFSA about scientific requirements. In August 2009, the company submitted an article 14 (disease reduction) claim for Actimel and in November of the same year an article 13.5 health claim to EFSA for Activia which were, again, denied.

This study aims to improve the understanding and characterization of functional foods' markets and of their profitability by pursuing the following objectives: 1) to characterize the demand for functional and conventional products inside one product category; 2) to investigate the patterns and the determinants of consumers' switching between conventional and functional alternatives and; 3) to provide an empirical assessment of the profitability of these products.

To achieve these goals, Deaton and Muellbauer's (1980) LA/AIDS model is modified following Rojas and Peterson's (2008) adaptation of Pinkse, Slade, and Brett's (2002) Distance Metric (DM) method, and the model applied to a scanner database of yogurt purchases in sixteen Italian regions, encompassing eighteen conventional and twelve functional alternatives.[4] The DM method builds on the concept that products more distant in the characteristics space are less likely to be substitutes to one another. This method allows for a flexible substitution pattern while keeping the analysis tractable (*e.g.*, only one equation needs to be estimated, even

[4] Each product is identified as a combination of brand (vendor), flavor, fat content and the presence (or absence) of the functional attribute.

when a large number of alternatives are considered, and the number of the estimated parameters is heavily reduced). The Italian yogurt market is chosen as a case study since large yogurt manufacturers operating in this market (Danone, Parmalat and Nestle) have heavily invested in adding new lines of functional products. Table 1 contains a list of examples of functional yogurts sold in the Italian market during the period 2004-2007.[5]

The results show that Italian consumers of functional yogurts are on average less price sensitive than those purchasing conventional ones, and that brand loyalty plays a major role in this market. Also, although price does not appear as a strong determinant of switching between conventional and functional yogurts, intra-brand shifting between functional and conventional yogurts is more likely than inter-brand, suggesting that the different functional attributes existing across brands increase switching costs. Lastly, the results suggest that, in most cases, functional yogurts generate higher margins than their conventional counterparts and that the functional attributes themselves contribute, on average to circa 25% of their profitability.

The Model

The demand for yogurts in Italy is modeled following the Linear Approximated–Almost Ideal Demand System developed by Deaton and Muellbauer (1980). Let $j \in (1,...,J)$ and $t \in (1,...,T)$ be product and time indexes, respectively. Let q_{jt} be the retail-level quantity demanded for product j at time t and p_{jt} its price; the total expenditure for yogurt at time t is $x_t = \sum_j q_{jt} p_{jt}$, so that

[5] From this table it can be noted how functional yogurts manufacturers have tried to capitalize on the fact that health benefits are obtained from repeated consumption, trying to increase brand loyalty by offering different active principles in their yogurts and aiming to set high barriers to entry and achieve successful differentiation

(1) $$w_{jt} = a_j + \sum_{k=1}^{J} b_{jk} \log p_{kt} + \beta_j \log \frac{x_t}{P_t^L} + e_{jt},$$

where $w_{jt} = \frac{q_{jt} p_{jt}}{x_t}$ is product j's expenditure share at time t, $\log P_t^L$ is Moschini's (1995) Laspeyers-type Price Index ($\log P_t^L \approx \sum_{j=1}^{J} w_j^0 \log p_{jt}$ where $w_j^0 = T^{-1} \sum_{t=1}^{T} w_{jt}$), the αs, bs and βs are parameters to be estimated and e_{jt} is an error term. After imposing all the restrictions dictated by theory,[6] the estimation of a LA/AIDS demand system will consist of *J*-1 equations producing *J*(*J*-1)/2 cross-price parameters which, for large *J*s, is an unmanageable task.

To circumvent this issue, each cross price parameters b_{jk} can be assumed function of the distance in attribute space between products *j* and *k*. This approach, the Distance Metric (DM) method, originally developed by Pinkse, Slade, and Brett (2002) to analyze spatial price competition in the U.S. wholesale gasoline market, has been applied to demand analysis since Pinkse and Slade's (2004) study of the U.K. beer market, and adapted to the LA/AIDS model by Rojas (2008), and used by Rojas and Peterson (2008) and Pofahl and Richards (2009).

In this application of the DM method (which will be referred to as DM-LA/AIDS), let Z_j^C and Z_j^D be sets of product *j*'s attributes, measured in continuous space (calories, fat content etc…), and in discrete space (brand, flavors, presence of a functional attribute), respectively. Let δ_{jk}^C and δ_{jk}^D be two measures of closeness between products *j* and *k*, function of continuous and discrete attributes, respectively. As in Pinkse and Slade (2004), Rojas (2008), and Pofahl

[6] In order for the AIDS model to be consistent with the primitive preference structure under which it is derived, the following conditions need to hold: symmetry $b_{jk} = b_{kj}, \forall j,k$, homogeneity and adding-up $\sum_{k=1}^{J} a_j = 1; \sum_{k=1}^{J} \beta_j = 0;$ and $\sum_{k=1}^{J} b_{kj} = 0$.

and Richards (2009), δ_{jk}^{C} is specified as a function of the Euclidean distance in characteristics space between product *j* and *k*:[7]

$$(2) \qquad \delta_{jk}^{C} = \frac{1}{1+2\sqrt{\sum_{l}(z_{jl}^{C}-z_{kl}^{C})^2}},$$

where z_{jl}^{C} (z_{kl}^{C}) is the *l*-th continuous attribute of product *j* (*k*).[8] Let z_{jl}^{D} be an indicator variable such that $z_{jl}^{D} = \{1$ if product *j* shows characteristic *l*; 0 otherwise$\}$. The expression for δ_{jk}^{D} is:

$$(3) \qquad \delta_{jk}^{D} = \begin{cases} 1 \text{ if } \left| z_{jl}^{D} - z_{kl}^{D} \right| = 0 \\ 0 \text{ if } \left| z_{jl}^{D} - z_{kl}^{D} \right| = 1. \end{cases}$$

Using the closeness measures δ_{jk}^{C} and δ_{jk}^{D},[9] the cross-price parameter portion of the LA/AIDS is reformulated as follows:

$$(4) \qquad \sum_{k=1}^{J} b_{jk} \log p_{kt} = b_{jj} \log p_j + \lambda_j \sum_{k \neq j}^{J} \delta_{jk}^{C} \log p_{kt} + \varphi_j \sum_{k \neq j}^{J} \delta_{jk}^{D} \log p_{kt} ,$$

which gives $b_{j1} = \lambda_j \delta_{j1}^{C} + \varphi_j \delta_{j1}^{D}, ..., b_{jn} = \lambda_j \delta_{jn}^{C} + \varphi_j \delta_{jn}^{D}$, where φ_j and λ_j are parameters to be estimated. [10] Additionally, following Rojas (2008), symmetry is imposed to the cross-price

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7 Pinkse, Slade and Brett (2002) treat the distance functions as general and the model semi-parametric. Pinkse and Slade (2004) showed that both parametric and semi-parametric specification of the model lead to similar results.

8 Before proceeding, one technical note regarding equation (2) is needed. For continuous attributes measured in different units, their values (or their distances) should be normalized to one to ensure that all the attributes have the same weight in determining closeness. Since in this analysis all continuous attributes will be expressed in the same unit, so no rescaling will be needed.

9 δ_{jk}^{C} and δ_{jk}^{D} play different roles: δ_{jk}^{C} is a global measure of product closeness and it will show small, but non-zero values even for products that are very dissimilar while δ_{jk}^{D} is a local measure of closeness which takes the value of 1 if *j* and *k* have the same attribute (i.e. they are *neighboring* products), 0 otherwise.

10 The reader should notice the mode δ_{jk}^{D} s are used additively in equation (4). Instrumentally to the purposes of this analysis, δ_{jk}^{C} and δ_{jk}^{D} are used additively, not multiplicatively, as in Pofahl and Richards 2009. An additional benefit of using an additive form is the ease of interpretation of the estimated parameters.

parameters by assuming $\lambda_1 = \lambda_2 = ... = \lambda_J = \lambda$ and $\varphi_1 = \varphi_2 = ... = \varphi_J = \varphi$. Since $\delta^C_{jk} = \delta^C_{kj}$ and $\delta^D_{jk} = \delta^D_{kj}$, one has $\lambda\delta^C_{jk} + \varphi\delta^D_{jk} = b_{jk} = b_{kj} = \lambda\delta^C_{kj} + \varphi\delta^D_{kj}$ which reduces the total number of cross-price parameters to be estimated from $J(J\text{-}1)/2$ to 2.

Following Pinkse and Slade (2004), Rojas (2008), and Rojas and Peterson (2008), product attributes are interacted with own-price, intercept, and expenditure coefficients so that only one equation needs to be estimated. Imposing $a_j = a_0 + \sum_n a_n z^a_{jn}$, $b_{jj} = \gamma_0 + \sum_l \gamma_l z^b_{jl}$ and $\beta_j = \beta_0 + \sum_m \beta_m z^\beta_{jm}$, where z^a_j, z^b_j and z^β_j are subsets of product's *j* attributes,[11] the final specification of the DM-LA/AIDS model is:

$$\text{(5)} \quad \begin{aligned} w_{jt} = a_0 + \sum_n a_n z^a_{jn} + \log p_{jt}\left(\gamma_0 + \sum_l \gamma_l z^b_{jl}\right) \\ + \lambda\sum_{k\neq j}^{J}\delta^C_{jk}\log p_{kt} + \sum_D \varphi^D \sum_{k\neq j}^{J}\delta^D_{jk}\log p_{kt} + \log\frac{x_t}{P^L_t}\left(\beta_0 + \sum_m \beta_l z^\beta_{jm}\right) + e_{jt}. \end{aligned}$$

where the discrete closeness measures are indexed as *D*={Brand (*Br*); Flavor (*Fl*); Drinkable (*Dr*); Functional (*H*)}.

The signs and magnitudes of the estimated $\varphi^D s$ characterize the structure of consumers' switching behavior motivated by a price increase. For example, a positive φ^{Br} would suggest consumers would respond to an increase in the price of a product by switching to another product of the same manufacturer, i.e. that brand loyalty plays an important role in this market. Similarly, if the coefficient associated with closeness in the functional attribute φ^H, is greater than 0 consumers will be more likely to switch within either conventional or functional yogurts

[11] Pinkse and Slade (2004) originally proposed the interaction of product characteristics with the own-price, aggregate income and intercept's coefficients, to obtain unique parameters and limit the number of equations to be estimated, with the drawback of increasing the risk of multi-collinearity. In light of this risk and to avoid reducing the flexibility of the model, Pofahl and Richards (2009) estimated the full set of simultaneous equations.

than between them. If instead φ^H <0 consumers will be more likely to switch from a functional to a conventional yogurt (or vice versa). The other coefficients have similar interpretations.

The Marhsallian own- (η_{jj}) and cross- (η_{jk}) price elasticities are calculated as:

(6 - a) $$\eta_{jj} = -1 + \frac{\gamma_0 + \sum_l \gamma_l z_{jl}^b}{\overline{w_j}} - \left(\beta_0 + \sum_m \beta_l z_{jm}^\beta \right) \text{ and}$$

(6 - b) $$\eta_{jk} = \frac{\lambda \delta_{jk}^{SFP} + \sum_d \varphi^D \delta_{jk}^D}{\overline{w_j}} - \left(\beta_0 + \sum_m \beta_l z_{jm}^\beta \right) \frac{\overline{w_k}}{\overline{w_j}},$$

where $\overline{w_j}\left(\overline{w_k}\right)$ is product *j*'s (*k*) expenditure share measured at the sample averages. Comparing the own- and cross- price elasticities for functional and conventional yogurts, will help characterizing the role of price on consumers' acceptance of functional products in presence of conventional alternatives.

In order to assess the profitability of functional yogurts, a supply-side relationship needs to be specified so that the estimated demand parameters can be used to calculate profit margins. Let Y_n be the set of yogurts produced by manufacturer *n*. Assume manufacturer *n* maximizes its profits by jointly setting prices for all the products it produces:

(7) $$\max_{p_j} \pi_n = \sum_{j \in Y_n} q_j (p_j - c_j) - F_j;$$

where c_j is product *j*'s (constant) short-run marginal cost and F_j is fixed cost. Following Nevo (2000), and assuming that prices are the outcome of a Nash-Bertrand equilibrium, the optimization problem in (7) leads to a vector of FOCs which can be expressed as:

(8) $$p - c = \Omega^{-1} q(p, z).$$

Each element of the matrix Ω is defined as

(9) $\Omega_{jk} = \Omega^{*}{}_{jk}\Delta_{jk}$, where $\Omega^{*}_{jk} = \begin{cases} 1 & if \;\; k, j \in Y_n \\ 0 & otherwise \end{cases}$; and $\Delta_{jk} = \dfrac{\partial q_j}{\partial p_k}$.

In the context of a multi-product Nash-Bertrand equilibrium, Ω^{*} represents the ownership matrix, while the elements of Δ are partial derivatives of demand with respect to the vector of prices. Equation (8) defines implicitly the Price Cost Margin (PCM) of each product $j \in Y_n$. Following Rojas and Peterson (2008), one can obtain different values of the PCMs combining the estimated parameters of the DM-LA/AIDS with different structures of Ω^{*}. Two scenarios are considered here; the first assumes that the price of each yogurt is the outcome of a single-product Nash Bertrand equilibrium ($\Omega^{*}_{jk} = 1 \;\forall j = k,\; 0$ otherwise). The second, following Draganska and Jain's (2006) finding that manufacturers tend to choose uniform pricing strategies inside the same product line, assumes three product-lines, conventional spoonable, drinkable functional and spoonable functional ($\Omega^{*}_{jk} = 1 \;\forall j, k \in Y_n$, $z^{H}_{j} - z^{H}_{k} = 0$, and $z^{Dr}_{j} - z^{Dr}_{k} = 0$).

Since introducing a functional component is a long-run strategic decision, one could differentiate (8) w.r.t. z^{H}_{j}, and obtain a comparative static expression determining the marginal variation in (short-run) profitability for a change in product's formulation. However, as z^{H}_{j} is an indicator variable, differentiating (8) w.r.t. z^{H}_{j} would be inappropriate; nonetheless, a measure of such variation can be calculated as follows:

(10) $$\Delta\% PCM^{H}_{j} = \frac{PCM_j - PCM^{*}_{j}}{PCM_j} = -\eta_{jj}\left[-\frac{1}{\eta_{jj}} + \frac{1}{\eta^{*}_{jj}}\right] = -\frac{\eta_{jj} - \eta^{*}_{jj}}{\eta^{*}_{jj}}$$

where η^{*}_{jj} represents the own-price elasticity of demand for a functional yogurt "stripped" of the functional attribute. An example may clarify: assume that own-price and expenditure parameters of the functional alternative *j* are shifted by a continuous characteristic z_C and by the functional indicator z_H, so that $\eta_{jj} = -1 + \frac{\gamma_0 + \gamma_C z_C + \gamma_H z_H}{\overline{w_j}} - \left(\beta_0 + \beta_C z_C + \beta_H z_H\right)$ and

$\eta_{jj}^* = -1 + \frac{\gamma_0 + \gamma_C z_C}{\overline{w_j}} - \left(\beta_0 + \beta_C z_C\right)$; in this case $\Delta\% PCM_j^H = -\frac{\frac{\gamma_H}{\overline{w_j}} - \beta_H}{-1 + \frac{\gamma_0 + \gamma_C z_C}{\overline{w_j}} - \left(\beta_0 + \beta_C z_C\right)}$.

Since consumers of functional products are expected to be less price sensitive than those of conventional ones γ_H is expected to be positive, equation (10) will show positive sign, with the caveat that the simulated elasticity $\eta_{jj}^* < 0$ and $\gamma_H - \beta_H \overline{w_j} > 0$.

Equation (10) measures the percentage of profit margins of a functional yogurt directly attributable to the functional component under the single-product Nash-Bertrand assumption; because of this, it can be interpreted as the lower bound of the increase in margin under any other pricing structure. Alternatively, one could interpret (10) as the profitability that a yogurt manufacturer would renounce to if the *j*-th functional product was stripped of the health attribute, *ceteris paribus*.

Data, Model Specification and Estimation

Equation (5) is estimated using primarily a scanner database provided by the Food Marketing Policy Center at the University of Connecticut[12] supplied originally by Information Resources Incorporated (IRI). The data include twenty-four monthly observations of yogurt sales (quantities and values) for the period January 2004 – December 2005 in Hyper- and Super-markets located in sixteen Italian IRI regional markets covering most of the national

[12] Ronald W. Cotterill, director of the Food Marketing Policy Center is thankfully acknowledged for granting access to the IRI data.

territory,[13] for a total of 384 market combinations. Thirty product combinations[14] are identified by vendor (Danone, Granarolo, Nestle, Muller and Parmalat, referred below as brands), flavor (plain, fruit, and other flavors), fat content (skim and whole), drinkable versus non-drinkable, and by the presence of a functional attribute, for a total of 11,520 observations. Volume and value of sales are used to calculate prices in €/Kg.

The continuous product characteristics used in the analysis are protein, sugar, fat content and calories, referred to 100g of product. Attributes information was collected from the manufacturers' websites or, when not available, form www.ciao.it, a website where Italian consumers share opinions on purchase experiences, often reporting the nutritional content of food products as they appear on the nutritional labels.[15] Table 2 presents summary statistics of the data for the thirty products included in the analysis, including product characteristics, price and expenditure shares. Other product characteristics from the IRI data include average volume per unit (Kilogram/unit) and a proxy for market coverage (average number of items per store). Additionally, monthly and regional dummies are included in the estimation to capture seasonal variations in yogurt consumption, and unobservables across regions, respectively.

One challenge in estimating equation (5) was finding a flexible model specifications, and at the same time trying to reduce the risk of multicollinearity that could arise if one used the same product characteristics to shift intercept, own-price, and expenditure parameters (respectively z_j^a, z_j^b, and z_j^β). In the first place, average volume per unit and market coverage

[13] IRI regions are defined consistently with the political boundaries of the Italian regions except "Piedmont and Val d'Aosta", "Basilicata and Calabria" and "Abruzzo and Molise".Trentino Alto Adige was excluded due to the strong presence of regional brands.
[14] The products chosen belong to firms operating nationally with a "reasonably large" (at least 0.5%) expenditure share in the "national" market. The sub-categories are identified by combination of fat content, flavor and "health" content (functional and conventional).
[15] The accuracy of the postings was evaluated by cross-referring available nutritional information by www.ciao.it and manufacturers' websites which, in the cases considered, resulted to be accurate.

were chosen as intercept shifters (z_j^a) to limit the selection of own-price and expenditure shifters only among physical product characteristics.[16] Fat content and calories were used in a mutually exclusive way as either z_j^b or z_j^β, because of the large correlation of these two variables (0.87). Similarly, as formulations low in fat include often more sugar and/or proteins to stabilize the product's texture, either fat or protein and sugar were used to shift the log-price or the expenditure parameter, resulting in four "full" specifications of the model, where "full" indicates that all the discrete product characteristics enter both z_j^b, and z_j^β. Two restricted versions of each "full" specification were estimated using flavor indicators (fruit, other flavors and plain), and brand indicators as mutually exclusive shifters of own-price and expenditure. In sum, twelve specifications of the model were obtained; model selection was performed monitoring the Variance Inflation Factor (VIF – to exclude the presence of multicollinearity), significance and sign of the estimated parameters, and magnitude, sign and significance of estimated elasticities and price cost margins.

Estimates of equation (5)'s parameters could be biased if prices are correlated with demand shocks unaccounted for by the other variables in the model. Endogeneity was detected in the "full" models using *C* statistics, obtained as difference of two Sargan statistics (Hayashi, 2000, pg. 232). To ensure unbiasedness of the estimates an instrumental variable estimation method (Generalized Method of Moments – GMM) was adopted, using variables relate to yogurt manufacturing and retail activities as instruments for price. Such instruments are: farm-level milk price (national, monthly, €/l), price of cream at the origin (national, monthly, €/kg),

[16] Using product dummies as intercept shifters, as in Rojas and Peterson (2008), was also considered as it could mitigate problems of unobserved heterogeneity. It was ultimately not adopted as it led to non-significant own-price parameters (across model specifications and estimation methods). Furthermore, since most of the product characteristics are included either as part of z_j^b or z_j^β, the use of product dummies as intercept shifters may be redundant.

farm-level, national price of fruit (national, monthly, €/kg), from the DATIMA database of the Istituto per lo Studio dei Mercati Agricoli (ISMEA); the producer price index for the dairy industry (national, monthly) by the Istituto Nazionale di Statistica (ISTAT); the European import price (CIF) of sugar (monthly, US $/lb), by Index Mundi; retail workers' per capita earnings (regional, annual, € .000) [17] by the Ministero dello Sviluppo Economico, Osservatorio Italiano del Commercio; the industrial price of heating oil (national, monthly, €/hl) by the Ministero dello Sviluppo Economico, Statistiche dell'Energia; and the commercial price of electricity at the source (regional, monthly, €/Mw) by the Gestore del Mercato Elettrico Italiano. The orthogonality of the instruments was evaluated using Hansen's (1982) *J*-statistic while problems of weak instruments where ruled out by Staiger and Stock (1997) "rule of thumb" (the value of the *F*-statistics for the joint significance of the instruments in the first stage equation are above 10 in all the models).

Also, following Blundell and Robin (2000) and Dhar, Chavas and Gould (2003) category expenditure is treated as endogenous, and it is instrumented by regressing it on median household income (from the Annuario Statistico Italiano by ISTAT), its squared term, a (monthly) time trend and region dummies.[18] The estimation of the different specification of equation (5) was performed using STATA v. 10.[19]

Empirical Results

[17] This variable refers to the industry classified as: *"G (divisione 52) – Commercio al detteglio, escluso autoveicoli e motocicli, riparazione di beni personali e per la casa"*.

[18] As a time trend is part of the instruments proposed by Dhar, Chavas and Gould (2003) and monthly dummies are used to capture seasonal variations in the demand for yogurt in the estimation of equation (5), the use of a first-stage regression to account for expenditure endogeneity instead of directly using an IV estimation method is a forced choice.

[19] Additionally, given the panel structure of the data, Durbin-Watson tests for first order autocorrelation of the error terms where performed using using Bhargava et al. (1982) critical values of the rejection areas. OIn all the estimated models the errors appeared free from serial correlation.

The empirical results summarized below, and presented in table 3, are for two different specifications of equation (5) where fat content shifts the own-price parameter while protein and sugar content shift the expenditure parameter. Other results are omitted due to space limitation and are available upon request to the corresponding author. The reader should note that using calories in place of fat content generates results extremely close to those discussed below, and that the specifications where protein and sugar content shift the own-price parameters and fat content shifts the expenditure parameter are qualitatively similar to those in table 3. Also, all the estimated models where flavor indicators shift own-price while and brand dummies shift expenditure resulted to be misspecified. As a result, table 3 includes only a "full" model specification (left columns) and that where brand dummies shift the own price parameter and flavor indicators shift expenditure (right columns).

Summary statistics in Table 3 show that the restricted model performs just as well, or outperforms, the full model. The full model presents an R-squared of 0.7833, while the restricted model one of 0.7556; the values of the *p*-values associated with Hansen (1982) *J*-statistic for overidentifying instruments is smaller in the full model then in the restricted model (0.0633 and 0.1321, respectively). The restricted model shows average VIF much smaller than the full model (the average VIFs are, respectively 50.29, and 19.34). The estimated parameters for both specifications are illustrated below; a thorough discussion of the estimated elasticities and Price Cost Margins will focus on those obtained from the restricted model.

Estimated Coefficients

The own-price coefficients are negative and significant at the 5% level in both specifications, although that of the full specification is approximately 25% larger than the restricted (respectively -0.0625 and -0.0443). The coefficients associated with the interaction of log-price with fat content are negative and significant at the 1% level in both models, their coefficients being -0.0024 and -0.0018. The interaction of price with the functional indicator generates positive coefficients in both specifications, although only significant at the 10% level in the full model (estimated coefficient 0.0147), while significant at the 1% level in the restricted model (0.0186). This result indicates that, everything else constant, Italian consumers are less price sensitive for functional yogurts than for conventional ones.

The interactions of price with the vendor indicators (Danone, Granarolo, Muller and Parmalat) show that while consumers seem more price sensitive in the case of Granarolo's product versus Nestle' (Granarolo's estimated coefficients are negative and significant in both specifications), there is no difference between price sensitivity for Danone and Nestle, since Danone's coefficient is not statistically significant in both specifications. Also, consumers show either higher or indifferent price sensitivity when it comes to the difference between Muller and Nestle, while the opposite emerges for Parmalat's products. Lastly, the coefficients of the interactions of price with the flavor indicators are not statistically significant in the full model, supporting the use of the restricted model instead of the full specification.

The behavior of the cross-price closeness measures is similar across specifications, although showing some limited differences. The estimated coefficient associated with δ_{jk}^{C} are positive and significant, being 0.0016 for the full model and 0.0035 for the restricted one, suggesting that consumers respond to price increases by switching to products with similar nutritional profiles. Among discrete closeness measures, closeness in brands emerges as the strongest determinant of substitution, suggesting that, when motivated by a price change, Italian yogurt consumers tend to switch within products of the same manufacturer, or that this market is characterized by a substantial level of brand loyalty (the estimated coefficients are significant and are, respectively, 0.0055 and 0.0030 in the two specifications). The role of closeness in flavor is unclear, as its coefficient is negative and significant in the full model (-0.0028) and positive and significant (0.0038) in the restricted model. Closeness in functional attribute does not appear to be a strong determinant of substitution, as its coefficients are not statistically significant. This suggests that price is not a large motivator of switching between functional and conventional yogurts. Lastly, closeness in drinkable attribute affects the substitution across yogurts only in the restricted model, with a negative and statistically significant parameter (-0.0011) indicating that, as the prices of a non-drinkable yogurts increases, consumers will be more likely to switch to a non-drinkable one (and vice versa).

Concluding the exposition of the estimated parameters, the expenditure coefficient appears negative in both model, but statistically significant only in the restricted one. Most of the other product characteristics used as shifters generate statistically significant parameters whose signs are consistent across specifications. Some exceptions to this underlying trend emerge: protein content and other flavors indicator show different signs in the two models, while the functional indicator coefficient appears statistically significant only in the restricted model. Lastly, the coefficients of the demand intercept's shifters (average volume per unit and coverage) are positive, significant at the 1% level and show similar magnitude in the two models.

Own-Price Elasticities

Estimates of the own-price elasticties obtained using the estimated parameters of the restricted model and equation (6-a) are reported in table 4. The estimated values range from -

8.94 of Nestle'/conventional/other flavors/skim to -1.27, of Danone/functional/drinkable/whole for an average value of -3.78. Although these values, may appear larger than those of other analyses of the yogurt market, are overall reasonable. For example, Di Giacomo (2008), who presents values of elasticities of demand for yogurt in Italy ranging from -0.88 to -2.66, reports also that an alternative specification of her model produced larger values of elasticities, whose average was -3.17, close to the average value of -3.78 obtained here. Bonanno (2009)'s estimated values of elasticity of demand for yogurt subcategories in Italy vary between -2.57 and -6.08, and are estimated at a higher level of aggregation than those discussed in this paper. Lastly, other studies using product categories other than yogurts but at a level of aggregation similar to that of this analysis, present much larger values of elasticity.[20]

Overall, five patterns emerge from the values in Table 4:

1 – *Functional vs. conventional*: Functional plain and "other flavors" yogurts show larger values of own price elasticities than their conventional counterparts, while the opposite emerges for fruit yogurts (for example the value of Danone/fruit/skim/conventional is -1.38 while that for the functional alternative is -3.62). This patter, does not necessarily hold if one considers values across brands: for example, Muller/plain/whole shows an elasticity of -2.32, while Danone's plain/functional ones are -/363 (skim) and -.3.45 (whole).

2 – *Drinkable*: functional drinkable yogurts show own-price elasticities of demand below the average value of -3.78, with the exception of Granarolo.

3 – *Brand* (*vendor*): the demand for Danone's yogurts tends to be less elastic than that for other brands, across flavors, fat content and functional properties, with the exception of

[20] Pofahl and Richars (2009) found brand-level elasticity in the fruit juice market to vary between -3.15 and -14.18.

plain/conventional yogurts, where the “whole” alternative by Muller shows the lowest magnitude of elasticity among plain yogurts.

4 – *Flavors*: the demand for fruit flavored yogurts show (on average) higher values of elasticity than that for other flavors and plain, for both conventional and functional yogurts alike.

5 – *Fat content*: no unique trend emerges with respect to fat content and elasticities; for plain yogurts the values are similar, while for fruit flavored and drinkable yogurts, whole alternatives are less elastic than skim ones.

Cross-price elasticities

The analysis of cross-price elasticities, obtained using equation (6-b) and the estimated parameters of the restricted model is divided in two parts: cross-price elasticities between conventional and functional yogurts are discussed first (both intra- and inter-brand) while those among functional yogurts are discussed in a second moment. It should be mentioned that negative signs emerged for cross-price elasticites between functional and conventional yogurts with different flavor and fat content, produced by different manufacturers. This result suggests that products located far from one another in the characteristic space are not likely to be seen as substitutes, as suggested by Kadiyali, Vilcassim and Chintagunta (1996). An alternative explanation is that, as Betancourt (2006) suggests, households purchase multiple items during each shopping trip and therefore, different household members may prefer different types of yogurt, resulting in some yogurts behaving as complements instead of substitutes.

Intra-brand cross-price elasticities are illustrated using Danone as an example: the values are reported in table 5. The notation η_{FC} (η_{CF}) indicates cross-price elasticity of demand for a functional (conventional) yogurt to a conventional (functional) one. All estimated cross-price elasticities for Danone's yogurts are positive with η_{FC} s and η_{CF} s being of similar magnitude for plain yogurts, while η_{CF} are smaller than η_{FC} s for fruit flavored; the opposite is observed for other flavors yogurts. Also, Danone's plain yogurts' consumers do not see conventional and functional alternatives different enough to justify largely asymmetric patterns of cross-price elasticities. For fruit flavored alternatives instead, differentiation is more marked, while for other flavors appears weak, with consumers being more likely to purchase conventional yogurts if the price of a functional one increases than vice versa. Interestingly, the results show asymmetry in the cross-price elasticities between functional drinkable yogurts and non-drinkable ones (both conventional and functional), showing that consumers are more likely to switch from drinkable to non-drinkable yogurts than the opposite.

A detailed discussion of inter-brand cross-price elasticites is omitted for brevity. However, three trends emerge: first, on average, cross-price elasticities among plain yogurts are larger than those among other flavors and fruit yogurts, whose average values are 0.40, 0.31, and 0.23, respectively. Second, values of cross-price elasticities are rather small for yogurts produced by different manufacturers and with different fat content (particularly η_{FC} s and η_{CF} s). Third, cross-price elasticities for same flavor yogurts produced by the same manufacturers tend to be relatively large (for example the η_{CF} for Granarolo conventional/plain/skim to whole is 0.83; while the η_{CF} of Parmalat fruit/whole to skim is 0.84).

The values of the cross-price elasticites among functional products are reported in table 7. The trends observed are similar to those discussed above. In particular, cross-price elasticites of yogurts produced by the same manufacturers are larger than those of products from different manufacturers. This pattern is particularly marked: Parmalat non-drinkable/fruit/whole to other flavors/whole shows the largest value of cross-price elasticity among all combination of products (0.56). Also, on average, cross-price elasticities for non-drinkable yogurts to drinkable ones have larger values than their counterparts. As health benefits are obtained from repeated consumption of the same product and functional products sold by different vendors carry different functional attributes, (see Table 1), the small values of cross price elasticities across brands may be motivated by increased switching costs.

PCMs and Contribution of the Functional Component to the PCMs

The Price-Cost Margins calculated under the single product Nash-Bertrand and the multi-product portfolio pricing are reported in table 8, along with the contribution of the functional attribute to the PCM, as in equation (10). The values illustrated are for the restricted model only. As the estimated PCMs reach values as large as 80.24 for Danone/drinkable/whole under portfolio pricing, the reader should keep in mind that these are short-run profit margins and that both fixed cost to develop these products and advertising costs are not factored in. As a result, the values presented in table 8 represent upper bounds to these products' actual profitability.

On average, PCMs increase from conventional to non-drinkable functional to drinkable ones; also, as expected, margins calculated under single-product Nash-Bertrand are lower than the portfolio pricing ones. The average PCMs for conventional yogurts are 32.51 under single-product Bertrand and 38.53 under portfolio pricing; while the average PCMs for functional, non-drinkable yogurts are 35.78 and 50.33, respectively under the two different pricing scenarios. Lastly, the average PCMs for drinkable functional products are 51.32 and 54.14 for single product Bertrand and portfolio pricing, respectively. On average Danone is the brand whit the largest profitability. Among the conventional ones, the largest PCMs are obtained for

Danone/fruit/skim (72.16 and 74.17 for the two pricing scenarios); among non-drinkable functional ones, the largest profitability is obtained for Danone other flavors/whole (69.37 and 76.90); and for Danone/whole among drinkable ones (78.76 and 80.24).

The estimated contribution of the functional attribute to the PCM is substantial, ranging from 14.38% of Danone/other flavors/whole to 32.32% of Danone/fruit/skim, for an average value of approximately 25%. This result indicates that, by introducing a functional attribute to their products, yogurt manufacturers can increase the short-run profitability of their products by one fourth. Interestingly enough, on average, the functional attribute seem to impact more non-drinkable functional yogurts than the drinkable ones, their estimated contribution to profitability being 28.1 and 22.6, respectively. This suggests that functional drinkable yogurts' higher margins can be the outcome of other factors, such as convenience.

As the variations in margin illustrated above are obtained under the single-product Nash Bertrand scenario, they represent a lower bound to the actual variations under other pricing scenarios, suggesting that the introduction of a functional attribute can, potentially result in a substantial benefit for functional food manufacturers.

Concluding Remarks

As consumers' interest for nutraceutical food products grows, food manufacturers may see the development of functional products as an opportunity to revive mature markets. Despite many studies focused on understanding consumers' acceptance of functional foods, they have disregarded several dimensions (brand loyalty, switching cost), which may impact their likelihood of success and which can play a major role in complex, increasingly competitive markets.

This article analyzed the demand for functional and conventional products, and their profitability, using the Italian yogurt as a case study via a flexible and parsimonious methodology (the Distance Metric method). Results show that brand loyalty plays an important role in the Italian yogurt market and that the success of functional products is heavily influenced by it. Danone, the market leader, benefits largely from this phenomenon, benefiting for higher margins for its functional products. Results show also that consumers of functional yogurts tend to be less price sensitive than those of conventional ones and that superior performances are associated with the presence of a functional attribute. Furthermore, both intra-brand and inter-brand substitution patterns across functional and conventional yogurts favor in most cases the former, supporting the existing evidence that consumers show remarkable interest for functional products.

As "switching" between functional and conventional products produced by different manufacturers appears unlikely, yogurt manufacturers operating in the Italian market could expand their consumers' base via introducing new functional products, successfully avoiding sales cannibalization. Lastly the results indicate that consumers buying non-drinkable yogurts may not be likely to switch to drinkable ones as price changes (and vice versa). This could suggest that the success of drinkable yogurts may be due to an increase in the consumers' base.

These findings apply however to a scenario which was prior to the implementation of Regulation (EC) No 1924/2006 20, December 2006. As the implementation of this regulation has so far resulted in many health claims being denied, especially in the context of the category in analysis, yogurts, researchers should assess whether there is indeed the risk that depriving this source of profitability among functional foods' manufacturers could result into what pundits have referred to as "innovation wasteland. To this end more research is needed to understand the long-run profitability of food manufacturers' strategic investment decision in functional products. Furthermore, an analytical framework similar to that used in this article could be used to assess the economic impact Reg. (EC) No 1924/2006 for both consumer and producers, and to assess potential welfare losses for both consumers and manufactures.

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Table 1. Examples of functional yogurts sold in the Italian market.

Manufacturer	Brand/Product	Active component	Health claim
Danone	Actimel	*Lactobacillus Casei Immunitass*	*Strengthening the intestinal tract and/or the immune system*
Nestlé	LC1 Protection	*Lactobacillus Jonhsonii LA1*	
Parmalat	Kyr	*Lactobacillus Paracasei*	
Danone	Activia	*Bifidus Actiregularus*	*Helping the functions of the intestinal tract*
Parmalat	Fibresse	*RegoPlus®*	
Danone	Danacol	*Phythosterols*	*Reducing the absorption of cholesterol*
Granarolo	Yomo Abc Equicol		

Source: manufacturers' websites.

Note: the claims refer to products sold during a period prior to the implementation of Regulation (EC) No 1924/2006 20, December 2006.

Table 2. Product Characteristics, Average Price and Expenditure Shares by Brand

Brand	*Flavor*	*Type*	*Calories (Kcal)*	*Proteins*	*Sugar*	*Fat*	*Price (€/kg)*	*Exp. Share* (*w*)
Conventional								
Danone	Plain	Skim	49	6.1	5	0.1	4.41	1.15
Danone	Plain	Whole	99	3.3	12.5	3.7	4.37	1.35
Danone	Fruit	Skim	52	4.1	7.9	0.1	4.4	12.11
Danone	Others[b]	Skim	58	4.4	8.9	0.1	5.24	2.87
Granarolo	Plain	Skim	39	4.7	4	0.1	3.81	0.84
Granarolo	Plain	Whole	68	3.5	3.5	4	3.5	0.94
Granarolo	Fruit	Skim	75	3.9	13.7	0.1	4.02	1.49
Granarolo	Fruit	Whole	103	3.2	12.5	4.1	4.17	9.15
Granarolo	Others	Whole	117	3.7	15.1	4.3	4.38	3.02
Mueller	Plain	Whole	109	5.1	11.3	4.5	2.91	4.08
Mueller	Fruit	Skim	76	4.6	13.4	0.1	3.94	1.08
Mueller	Fruit	Whole	111	2.9	16.1	3.6	3.37	10.1
Mueller	Others	Whole	118	4.4	15.8	4.4	3.45	2.62
Nestle	Fruit	Skim	40	4.2	5.6	0.1	4.05	1.63
Nestle	Others	Skim	73	4.3	13.4	0.2	4.86	0.57
Parmalat	Fruit	Skim	59	5.2	9.4	0.12	3.47	1.68
Parmalat	Fruit	Whole	109	3.4	15.5	3.7	3.19	6.24
Parmalat	Others	Whole	119.2	3.28	15.36	4.72	3.45	0.85
Functional								
Danone	Plain	Skim	48	4.9	6.1	0.1	4.98	1.07
Danone	Plain	Whole	72	4.2	5.1	3.5	4.96	1.4
Danone	Fruit	Skim	52	4.4	7.5	0.1	5.32	1.08
Danone	Fruit	Whole	104	3.7	13.6	3.4	5.32	3.7
Danone	Others	Whole	103	3.8	13.5	3.3	5.31	7.67
Parmalat	Fruit	Whole	103.2	3.12	14	3.84	4.91	0.77
Parmalat	Others	Whole	106	3.1	14	4.2	5.01	1.02
Functional/drinkable								
Danone	Drinkable	Skim	29	2.7	3.7	0.1	5.55	3.79
Danone	Drinkable	Whole	73	2.7	11.8	1.2	5.54	11
Granarolo	Drinkable	Whole	77	3	12	1.9	5.3	1.2
Nestle	Drinkable	Skim	62	2.7	12.7	0.08	5.29	1.55
Nestle	Drinkable	Whole	77	2.6	14.5	0.9	5.21	3.98

Source: Calories, Protein, Sugar and Fat content come from nutritional labels collected from various sources. Price and *w* obtained from IRI Infoscan data: Jan. 2004 – Dec.2005 averages. Note: Product characteristics are measured in g/100g of products. "Others" indicate "other flavors".

Table 3. DM-LAAIDS – Estimated Parameters and related statistics: – price parameters

Variables	Full Model		Restricted Model	
Log p_j	-0.0625	**	-0.0443	**
	(0.0298)		(0.0189)	
Log p_j*Fat	-0.0024	***	-0.0018	***
	(0.0003)		(0.0005)	
Log p_j*Functional	0.0147	*	0.0186	***
	(0.0087)		(0.0052)	
Log p_j*Flavor	0.0338			
	(0.0228)			
Log p_j*Fruit	0.0176			
	(0.0239)			
Log p_j*Plain	-0.0268			
	(0.0225)			
Log p_j*Danone	0.0011		-0.0024	
	(0.0071)		(0.0046)	
Log p_j*Granarolo	-0.0289	***	-0.0019	**
	(0.0072)		(0.0010)	
Log p_j*Muller	0.0038		-0.0095	***
	(0.0080)		(0.0011)	
Log p_j*Parmalat	0.0349	***	-0.0012	
	(0.0062)		(0.0016)	
Closeness	0.0016	***	0.0035	***
Fat/Sugar/Prot	(0.0004)		(0.0012)	
Closeness Brand	0.0055	***	0.0030	***
	(0.0007)		(0.0006)	
Closeness Flavor	-0.0028	***	0.0038	***
	(0.0009)		(0.0008)	
Closeness Functional	0.0011		0.0005	
	(0.0013)		(0.0006)	
Closeness Drink	0.0005		-0.0011	***
	(0.0014)		(0.0002)	

Table 3. DM-LAAIDS – Estimated Parameters and related statistics: expenditure and other parameters

Variables	Full Model		Restricted Model	
Log $(x_t/P^L{}_t)$	-0.0011		-0.0029	***
	(0.0008)		(0.0005)	
Log $(x_t/P^L{}_t)$*Prot	3.29E-05	***	-3.12E-05	***
	(8.08E-06)		(7.98E-06)	
Log $(x_t/P^L{}_t)$*Sugar	5.80E-04	***	4.76E-04	***
	(3.89E-05)		(3.52E-05)	
Log $(x_t/P^L{}_t)$*Functional	-0.0005		-0.0011	***
	(0.0006)		(0.0004)	
Log $(x_t/P^L{}_t)$*Flavor	-0.0036	***	0.0009	***
	(0.0003)		(0.0001)	
Log $(x_t/P^L{}_t)$*Fruit	-0.0050	***	-0.0013	***
	(0.0004)		(0.0004)	
Log $(x_t/P^L{}_t)$*Plain	0.0017	***	0.0016	***
	(0.0001)		(0.0003)	
Log $(x_t/P^L{}_t)$*Danone	-0.0023	***		
	(0.0006)			
Log $(x_t/P^L{}_t)$*Granarolo	0.0017	**		
	(0.0008)			
Log $(x_t/P^L{}_t)$*Muller	-0.0007			
	(0.0009)			
Log $(x_t/P^L{}_t)$*Parmalat	-0.0039	***		
	(0.0007)			
Average Vol. Unit	0.0541	***	0.0431	***
	(0.0030)		(0.0080)	
Coverage	0.0083	***	0.0078	***
	(0.0001)		(0.0001)	
Constant	-0.0037		-0.0208	
	(0.0237)		(0.0243)	
R-squared	0.7833		0.7556	
Hansen *J*-test $[\chi^2{}_{(8)}]$	14.7927 (*p-val*=0.0633)		12.4522 (p-val=0.1321)	
F-test joint significance of instruments	$F_{(9,11463)}$ =53.247 (*p*-val= 0.0000)		$F_{(9,11470)}$=14.1019 (*p*-val= 0.0000)	
Mean VIF	50.29		19.34	

Note: *, **, and *** represent 10, 5 and 1% significance levels. Standard errors in parenthesis

Table 4. Estimated Own-Price Elasticities - Restricted Model

Brand	Flavor	Type	Elasticity	*St. Error*	*t*-ratio
Conventional					
Danone	Plain	Skim	-5.0875	1.5655	-3.2500
Danone	Plain	Whole	-4.9745	1.2307	-4.0400
Danone	Fruit	Skim	-1.3858	0.1489	-9.3000
Danone	Others	Skim	-2.6341	0.6263	-4.2100
Granarolo	Plain	Skim	-7.4274	2.1990	-3.3800
Granarolo	Plain	Whole	-7.4607	1.7881	-4.1700
Granarolo	Fruit	Skim	-4.6212	1.2403	-3.7300
Granarolo	Fruit	Whole	-1.6622	0.1833	-9.0700
Granarolo	Others	Whole	-3.0124	0.5484	-5.4900
Mueller	Plain	Whole	-2.3180	0.4517	-5.1300
Mueller	Fruit	Skim	-5.1895	1.8534	-2.8000
Mueller	Fruit	Whole	-1.5100	0.1853	-8.1500
Mueller	Others	Whole	-3.0256	0.6993	-4.3300
Nestle	Fruit	Skim	-3.7444	1.1663	-3.2100
Nestle	Others	Skim	-8.9363	3.3486	-2.6700
Parmalat	Fruit	Skim	-3.7789	1.1766	-3.2100
Parmalat	Fruit	Whole	-1.8577	0.2959	-6.2800
Parmalat	Others	Whole	-7.3779	2.0710	-3.5600
Functional					
Danone	Plain	Skim	-3.6337	1.2798	-2.8400
Danone	Plain	Whole	-3.4492	0.8850	-3.9000
Danone	Fruit	Skim	-3.6186	1.2745	-2.8400
Danone	Fruit	Whole	-1.9189	0.3362	-5.7100
Danone	Others	Whole	-1.4415	0.1626	-8.8600
Parmalat	Fruit	Whole	-5.4912	1.7849	-3.0800
Parmalat	Others	Whole	-4.4639	1.3366	-3.3400
Functional/drinkable					
Danone	Drinkable	Skim	-1.7408	0.3611	-4.8200
Danone	Drinkable	Whole	-1.2712	0.1203	-10.5700
Granarolo	Drinkable	Whole	-4.2094	1.1095	-3.7900
Nestle	Drinkable	Skim	-2.6779	0.9417	-2.8400
Nestle	Drinkable	Whole	-1.6839	0.3554	-4.7400

Note: “Others” indicates “other flavors”.

Table 5. Selected Own- and Cross- Price Elasticities: Danone

			Conventional				Functional						
			Plain Skim	Plain Whole	Fruit Skim	Others Skim	Plain Skim	Plain Whole	Fruit Skim	Fruit Whole	Others Whole	Drink Skim	Drink Whole
Conventional	Plain	Skim	-5.09	0.60	0.27	0.28	0.58	0.56	0.24	0.22	0.22	0.32	0.31
	Plain	Whole	0.51	-4.97	0.24	0.24	0.48	0.49	0.20	0.24	0.24	0.28	0.30
	Fruit	Skim	0.03	0.03	-1.39	0.03	0.03	0.02	0.06	0.05	0.02	0.03	0.03
	Others	Skim	0.11	0.11	0.14	-2.63	0.11	0.10	0.12	0.10	0.23	0.13	0.14
Functional	Plain	Skim	0.62	0.60	0.29	0.29	-3.63	0.66	0.35	0.30	0.30	0.41	0.40
	Plain	Whole	0.46	0.47	0.20	0.20	0.50	-3.45	0.24	0.24	0.24	0.31	0.31
	Fruit	Skim	0.26	0.26	0.71	0.33	0.35	0.31	-3.62	0.66	0.33	0.42	0.44
	Fruit	Whole	0.07	0.09	0.19	0.08	0.09	0.09	0.19	-1.92	0.13	0.12	0.13
	Others	Whole	0.03	0.04	0.04	0.09	0.04	0.04	0.04	0.06	-1.44	0.06	0.06
	Drink	Skim	0.10	0.10	0.11	0.10	0.12	0.12	0.12	0.12	0.12	-1.74	0.10
	Drink	Whole	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	-1.27

Note: "Others" indicates "other flavors".

Table 6. Selected Own- and Cross-Price Elasticities: Functional Yogurts

				Non-drinkable							Drinkable				
				Dan Plain Skim	Dan Plain Whole	Dan Fruit Skim	Dan Fruit Whole	Dan Others Whole	Parm Fruit Whole	Parm Others Whole	Dan Skim	Dan Whole	Nes Skim	Nes Whole	Gran Whole
Non-Drinkable	Dan	Plain	Skim	-3.63	0.66	0.35	0.30	0.30	0.01	0.01	0.41	0.40	0.12	0.12	0.12
	Dan	Plain	Whole	0.50	-3.45	0.24	0.24	0.24	0.02	0.02	0.31	0.31	0.10	0.09	0.09
	Dan	Fruit	Skim	0.35	0.31	-3.62	0.66	0.33	0.37	0.02	0.42	0.44	0.13	0.13	0.14
	Dan	Fruit	Whole	0.09	0.09	0.19	-1.92	0.13	0.12	0.02	0.12	0.13	0.04	0.04	0.04
	Dan	Others	Whole	0.04	0.04	0.04	0.06	-1.44	0.01	0.06	0.06	0.06	0.02	0.02	0.02
	Parm	Fruit	Whole	0.03	0.04	0.52	0.60	0.13	-5.49	0.56	0.19	0.26	0.22	0.19	0.22
	Parm	Others	Whole	0.02	0.03	0.02	0.07	0.44	0.42	-4.46	0.13	0.17	0.16	0.14	0.15
Drinkable	Dan		Skim	0.12	0.12	0.12	0.12	0.12	0.03	0.03	-1.74	0.10	0.01	0.01	0.01
	Dan		Whole	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.03	-1.27	0.01	0.01	0.01
	Nes		Skim	0.11	0.12	0.12	0.14	0.15	0.14	0.13	0.03	0.10	-4.21	0.05	0.06
	Nes		Whole	0.09	0.09	0.09	0.10	0.11	0.09	0.09	0.03	0.07	0.04	-2.68	0.25
	Gran		Whole	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.01	0.03	0.02	0.10	-1.68

Note: “Others” indicates “other flavors”.

Table 7. Estimated Price-Cost Margins and Variation in Profitability

Brand	*Flavor*	*Type*	*Bertrand*	*Portfolio*	$\Delta\%PCM_j^H$
Conventional					
Danone	Plain	Skim	19.66	29.45	–
Danone	Plain	Whole	20.10	29.95	–
Danone	Fruit	Skim	72.16	74.37	–
Danone	Others	Skim	37.96	43.95	–
Granarolo	Plain	Skim	13.46	21.36	–
Granarolo	Plain	Whole	13.40	21.03	–
Granarolo	Fruit	Skim	21.64	33.12	–
Granarolo	Fruit	Whole	60.16	63.71	–
Granarolo	Others	Whole	33.20	38.19	–
Mueller	Plain	Whole	43.14	48.15	–
Mueller	Fruit	Skim	19.27	32.06	–
Mueller	Fruit	Whole	66.23	69.75	–
Mueller	Others	Whole	33.05	39.60	–
Nestle	Fruit	Skim	26.71	27.43	–
Nestle	Others	Skim	11.19	13.00	–
Parmalat	Fruit	Skim	26.46	33.03	–
Parmalat	Fruit	Whole	53.83	56.72	–
Parmalat	Others	Whole	13.55	18.62	–
Functional					
Danone	Plain	Skim	27.52	54.98	32.32
Danone	Plain	Whole	28.99	50.83	27.76
Danone	Fruit	Skim	27.64	57.34	32.32
Danone	Fruit	Whole	52.11	67.21	20.73
Danone	Others	Whole	69.37	76.90	14.38
Parmalat	Fruit	Whole	18.21	20.82	30.57
Parmalat	Others	Whole	22.40	24.26	29.07
Functional/drinkable					
Danone	Drinkable	Skim	57.45	61.63	21.96
Danone	Drinkable	Whole	78.67	80.24	11.71
Granarolo	Drinkable	Whole	23.76	23.76	26.86
Nestle	Drinkable	Skim	37.34	43.27	31.13
Nestle	Drinkable	Whole	59.39	61.80	21.74

Note: “Others” indicates “other flavors”.

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