Health Claims Regulation and Welfare

by

Rui Huang and Alessandro Bonanno

Rui Huang
Assistant Professor of Agricultural Economics
Department of Agricultural and Resource Economics
The University of Connecticut
W.B. Young Building Room 314
1376 Storrs Road, Storrs, CT 06269-4021
Tel: (860) 486-1924
Fax: (860) 486-1932
E-Mail: rui.huang@uconn.edu

Alessandro Bonanno
Assistant Professor of Agricultural Economics
Department of Agricultural Economics and Rural Sociology
The Pennsylvania State University
207-D Armsby Building
University Park, PA16802-5600
Tel: (814) 863-8633
Fax: (814) 865 3746
Email: abonanno@psu.edu

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Abstract

Regulation (EC) No 1924/2006, 20 December 2006, requires functional foods manufacturers operating in Europe to provide evidence that the health claims reported on the packaging are truthful. However, most applications reviewed by the European Food Safety Authority (EFSA) have been rejected, leaving food manufacturers with the option of either selling products deprived of their claims or discontinuing their production. This paper analyzes changes in welfare (both producers' and consumers') that would occur if the implementation of Reg. (EC) No 1924/2006 resulted in a large-scale health-claim de-labeling of functional food products. To that end, we use one year (2007) of monthly scanner data of sales of conventional and functional yogurt in the Italian market and a discrete-choice random coefficient logit demand model which accounts for consumers' heterogeneity using the MPEC algorithm developed by Dube *et al.* (2009) to improve numerical efficiency and accuracy, to assess the issue. Preliminary results show that both producers and consumers can be severely impacted if reporting health-claims on functional products is not allowed; as our results indicate that consumers' welfare losses are twice as large than producers' a loosening of EFSA's requirements might be required to avoid such losses.

JEL codes: Q18; L66; M38

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1. Introduction

Among recent trends characterizing the competitive environment of modern food systems, food manufacturers have responded to consumers' interest and policymakers' pressure to improve the nutritional profile of their product and to invest in the development of *functional* foods[1] (Heasman and Mellentin, 200; Nestle, 2002). The forecasted value of the global market for functional foods has been projected to reach $128 billion in 2013 (PricewaterhouseCoopers, 2009), benefitting from large growth rates, particularly in Europe: during the period 2004-2007 such growth rate has exceeded 10% in Western Europe (*The Economist*, 2009) reaching in 2006 a value of approximately US $ 8 billion (Datamonitor, 2007).

This phenomenon has attracted the attention of academics (see Sirò et. al (2008) for a literature review) who have evaluated different aspects of their markets. From the manufacturers' perspective, the introduction of functional attributes comes with substantial costs in R&D, [2] and with the risk of sales cannibalization (Yuan, Capps, and Nayga, 2009). In order to recover the former, and to avoid the latter, food manufacturers need to successfully differentiate their functional products from the pre-existing conventional ones, which could eventually allow them to achieve higher profit margins (Bonanno, 2010). In sum, in spite of the potential hurdles associated with their development, functional products present an opportunity for growth and revitalization of mature markets (Heasman and Mellentin, 2001).

[1] Several definitions exist in merit to when a food product can be said to have functional attributes. See Diplock, et al. 1999, for an overview.
[2] According to Menrad (2003), the development of the functional yogurt Nestlé Lc1 and the proactive margarine Becel®, costed Unilever more than 50 million US$, twenty five times more than the cost of developing a "conventional" food product.

From the consumers' point of view, although there is evidence that some consumers show higher willingness to pay for food with health-enhancing features (see for example West *et al*. 2002; Markosyan *et al*. 2009), the role of knowledge and the reliability of the health claims can make a big difference in the acceptance of these products; in fact consumers' uncertainty regarding functional foods' beneficial properties have been pointed out in previous research (see for example, Verbeke, 2005a, 2005b) as a potential source of mistrust by consumers. In response manufacturers invest in informative advertising campaigns to educate the interested consumers.

As functional products have the characteristic of credence attributes (Grunert, 2005), policymakers have considered taking actions to regulate their market in order to reduce information asymmetry and to protect consumers. A recent development on this front is Regulation (EC) No 1924/2006, of the European Parliament and of the Council of 20 December 2006, which requires functional foods manufacturers operating in European markets to submit evidence (in the form of documented clinical trials) of the truthfulness of the health claims reported on the packaging.[3] Applications are reviewed by a panel of experts of the European Food Safety Authority (EFSA) who decides on their approval. Since November 2009, when the EFSA panel announced its first decisions on 523 submissions, two thirds of which were negative, pundits have suggested that the implementation of the Reg. (EC) No. 1924/2006 can jeopardize innovation and growth of the European food industry, causing job losses and consumers' confusion (Starling, 2009). For products whose submission has been rejected, health claims can no longer appear on the packaging; manufacturers can then either continue selling such products deprived of the health claim or discontinue their production. Both scenarios, likely to result in

[3] As Svederberg and Wendin (2011) point out, the he regulation aims to reduce information asymmetry and to provide consumers with claims that can be better understood. As article 5:2 states: "*The use of nutrition and health claims shall only be permitted if the average consumer can be expected to understand the beneficial effects expressed in the claim*" (Reg. (EC) No 1924/2006: Article 5:2).

lower profits, can discourage investments in functional products and cause welfare losses for consumers. In fact, the absence of health claims on the packaging may lead to confusion becoming less informed on relationship between health and food, an increased in the cost of the information (i.e. an increase in search cost) and, as food manufacturers become discouraged in investing in functional foods, in a decrease in the number of varieties characterized by healthy attributes (let alone a decline of product variety itself).

The fact that more stringent regulation can be a deterrent for the adoption of health-claims is not a novel concept (Parker, 2003)[4] although there is no analysis that quantifies such phenomenon. From a theoretical standpoint, Roe and Sheldon (2007) show that, in the case of vertically differentiated goods, if the government has the exclusive authority to certify the "quality" of the credence good and if the standards (in this case the EFSA protocols) are too strict, firms producing high-quality products (in this case health-enhancing products requiring R&D investments) may not be able to experience positive profits; as firms will avoid unprofitable products, losses in consumers welfare are also possible. There is however evidence that reducing stringency in using health claims as marketing tools, can have an "across the board" benefit.[5] Ippolito and Mathios (1990) for example, analyzing the lift of the ban on health-claim advertising on cereals in the U.S. during the mid-80's, found that in response to the lift of the ban, cereal manufacturers increased the development of fiber cereals, fiber consumption increased and that differences in consumption of cereals with fiber increased across

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[4] Parker (2003) illustrates that, in the U.S. market, the adoption of health claims in food advertising has been limited (among the other factors) by the high level of risk related to the necessity to substantiate health claims, opting for the less stringent procedures necessary to use structure/function claims. Other factors are that, in the U.S., foods with a superior nutritionally profile (i.e. fruits and vegetables), may not be advertised as much as other (less nutritious) categories; and that less nutritious food, also highly advertised, are not as likely to qualify for health claims.

[5] Ippolito and Pappalardo (2002) present a thorough illustration of the effects of changes in health claim regulation in the U.S. during the 10-year period 1987-1997.

consumer-types, suggesting that advertising the health property of fibers, allowed consumers to acquire more information “cheaply”[6].

To understand the severity of the stringency of EFSA’s protocols and the climate of uncertainty that has spread across food companies operating in the EU, an example may help. Danone (who shared its support to the new regulation with other members of the Yoghurt and Live Fermented Milks Association) withdrew in April 2009 two article-13.5 submissions: a digestive health claim for Activia (spoonable) and one immunity claim for Actimel (drinkable), asking the EFSA for more guidance from about scientific requirements. The company re-submitted an article 14 (disease reduction) claim for Actimel in August 2009 and an article 13.5 health claim in November of the same year for Activia which were, once again, denied be the EFSA (Starling, 2010). That has pushed the company to implement a “Zero Claims” policy in most European markets, selling both Actimel and Activia without the possibility of advertising their (alleged, according to the EFSA’s panel) health properties.

Surprisingly, to date, very little attention has been given to understand the welfare implications for both consumers and producers resulting from the existence of functional attributes in a given product category, and, as a consequence, of the changes in welfare that could occur in response to the stringent approach that the EFSA is taking in reviewing health claims. Such an empirical investigation could provide critical information to policy makers in Europe as well as for those considering the implementation of similar regulations elsewhere.

This paper uses the Italian yogurt market as a case study to evaluate welfare changes that both manufacturer and consumers would experience if ALL functional yogurts in this market

[6] Another point that Ippolito and Mathios (1990) make is that, as individual consumers may value health differently, they will be willing to incur different costs to obtain information regarding the health content of foods. Furthermore, the type of information provided to consumer could have unintended consequences. Some evidence exists that, in the U.S. in periods when nutrient content information was readily available to consumers via advertising, awareness of diet-disease relationships declined (Teisl, Levy, and Derby 1999).

were sold without advertising the presence of a health-enhancing functional component, i.e. a "full health-claims de-labeling", as extreme outcome of the stringency of EFSA's review protocols. The Italian yogurt market is chosen as a case study due to the fact that yogurt manufacturers operating in Italy have heavily invested in developing and marketing functional products and that, as illustrated above, their operations have been drastically impacted by the stringency of Reg. (EC) No. 1924/2006.

The data used are one year (Jan 2007 – Dec. 2007) of monthly observations of yogurt sales for 64 products (48 conventional and 16 functional) sold in thirteen Italian regions. The demand model used is discrete-choice random coefficient logit model (Berry, Levisohn, and Pakes, 1995; hereafter BLP; Nevo, 2001, Petrin, 2002), which, by incorporating consumer heterogeneity via random terms, allows for a flexible substitution patterns. The model is estimated via Generalized Method of Moments with the MPEC algorithm, to improve the numerical efficiency and accuracy of the nested fixed point algorithm in obtaining the BLP estimator (Dube *et al.*; 2009), accounting also for endogeneity of prices. The supply-side of the model sees firms deciding prices in the short-run and product formulations in the log-run.

Preliminary results presented show that both Italian yogurt manufacturers and consumers could be severely impacted by the implementation of a full ban on health claims. As consumers may seek additional value in functional yogurts, which is shown through the lower own-price elasticities of demand for these products, and manufactures benefit from higher margins by investing in these products, the losses for both parties can be substantial. While the Italian yogurt industry could have lost, in the year 2007, -114.40 million Euro in profit, if the full de-labeling had been in place, consumer's welfare would have decreased by twice as much, or by -229 million Euros.

2. The Model

2.1 The Demand Side

Consider t markets ($t = 1,\ldots,T$), each with i consumers ($i = 1,\ldots,I_t$), whose utility from consuming the j-th alternative of yogurt ($j = 1,\ldots,J_t$) is represented as

$$u_{ijt} = -\alpha_i p_{jt} + X_j \beta_i + \xi_j + e_{ijt} \quad (1)$$

where p_{jt} is the price of alternative j , faced by all consumers in market t, X_j is a K-dimensional vector of observable characteristics of product j, α_i and β_i are, respectively consumer i's taste parameter for price and a conformable vector of taste parameters for the observable product characteristic; ξ_j is a random term characterizing unobserved product characteristics and and e_{ijt} is a mean-zero stochastic error term.

We characterize consumers' heterogeneity in equation (1) assuming that consumer value all product attributes equally, except in the case of price and of a "functional attribute" (defined as X_j^H). In general terms, X_j^H could either be continuous or discrete, as it could represent both the content of a nutrient whose concentration results in some particular health benefit (i.e. fiber, density of a particular vitamin etc…) or discrete (i.e. presence of a beneficial, probiotic bacteria etc…). Equation (1) can then be rewritten as:

$$u_{ijt} = -\alpha p_{jt} + X_j \beta + \xi_j - \alpha^r \nu_i p_{jt} + \beta^{rH} \nu_i^H X_j^H + e_{ijt} = \delta_{jt} + \mu_{ijt} + e_{ijt} \quad (2)$$

where the term $\delta_{jt} = -\alpha p_{jt} + X_j\beta + \xi_j$ is referred to as the mean utility of alternative *j*, while $\mu_{ijt} + e_{ijt}$ is a deviation from the mean utility which includes random terms to capture consumers taste heterogeneity, or $\mu_{ijt} = -\alpha^r \nu_i p_{jt} + \beta^{rH}\nu_i^H X_j^H$.[7]

As Berry (1994) and BLP (1995) show, the estimation of an econometric model derived from equations similar to (2), cannot be treated with standard econometric techniques. To obtain an estimable form of (2), we first assume that the term e_{ijt} is distributed extreme-value type 1 independently across consumers and products, so that the probability of consumer *i* in market *t* choosing alternative *j*, conditionally on the random terms ν_i and ν_i^H i.e. the market share function is:

$$f_j\left(X, p_t, \delta_t; \theta\right) = \frac{\exp[-\alpha p_{jt} + X_j\beta + \xi_j - \alpha^r \nu_i p_{jt} + \beta^{rH}\nu_i^H X_j^H]}{1 + \sum_{j=1}^{J}\exp[-\alpha p_{jt} + X_j\beta + \xi_j - \alpha^r \nu_i p_{jt} + \beta^{rH}\nu_i^H X_j^H]} \qquad (3)$$

where θ is a vector including all the parameters in the model. Second, one needs to integrate equation (3) over the distribution of the random terms P_ν:

$$s_t\left(X, p_t, \delta_t; \theta, P_\nu\right) = \int f_j\left(\nu_i, \nu_i^H, \delta_{jt}(X, p, \xi_j), X, p, \theta\right) P_\nu(dv) \qquad (4)$$

As Berry (1994), BLP (1995) and Nevo (2001) discuss, such integral has no closed form solution. However, using appropriate assumptions on the form of the unobserved heterogeneity, one can set up an "updating rule" so that the simulated shares form equation (4) will match the ones observed in the data (see Nevo, (2001) for a detailed illustration of the nested fixed point algorithm developed by BLP (1995), or the recent MPEC algorithm, developed by Dube *et al.*

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[7] The role of last term in the mean utility, the product-specific unobservable ξ_j, is crucial as it will become the structural error used in the implementation of the estimation procedure (Generalized Method of Moments; see the "Data and Estimation" section for more details).

(2009)). More details on the estimation procedure are presented in the "Data and Estimation" Section.

2.2 The Supply Side

The supply-side of the model follows a setup consistent with firms adopting a two-stage decision process (a' la Sutton, 1998), where yogurt manufacturers' decide whether or not investing in the formulation of new products (investment stage) and then compete with the other firms in the market in the second stage (competition stage).

For simplicity of exposition, the competition stage will be solved first, and the problem in the investment stage will be solved second. Let J_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 (the market-specific index *t* is dropped for simplicity):

$$\max_{p_j} \pi_n = M \sum_{j \in J_n} S_j (p_j - c_j) - F_j; \tag{5}$$

where *M* is the size of the total market, c_j is product *j*'s (constant) short-run marginal cost and F_j is its long-run cost of product development (or reformulation), which, in this stage is assumed to be fixed. Following Nevo (2001), and assuming that prices are the outcome of a Nash-Bertrand equilibrium, the optimization problem in (5) leads to a vector of FOCs which can be expressed as:

$$p - c = -\Omega^{-1} S(.) \tag{6}$$

Where $p - c$ is a vector of price-cost margins, *S*(.) is a vector of market shares, and each element of the matrix Ω is defined as

$$\Omega_{jk} = \Omega^{*}{}_{jk} \Delta_{jk}, \text{ where } \Omega^{*}_{jk} = \begin{cases} 1 & if \;\; k, j \in J_n \\ 0 & otherwise \end{cases}; \quad \text{and} \quad \Delta_{jk} = \frac{\partial S_j(.)}{\partial p_k}. \tag{7}$$

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 (6) defines implicitly the Price Cost Margin (PCM) of each product $j \in J_n$. Following Nevo (2001), one can obtain different values of the PCMs combining the estimated parameters from equation (4) with different structures of Ω^*. The structure of the ownership matrix chosen is such to impose product –line pricing (following Draganska and Jain's (2006) result), and assuming the existence of two broad product-lines, conventional and functional ($\Omega^*_{jk} = 1 \ \forall j,k \in J_n, \ X_j^H - X_k^H = 0$).

In the long-run food manufacturers invest in revising or updating the formulation of their products by means of investments in R&D (the inclusion of advertising cost to promote the improvement of the products is a simple extension of the model and it will not be explicitly considered). Let h_j, an unspecified, general measure of product quality (obtained through R&D investment) of product *j* be the decision variable in this stage. The long-run optimization problem of manufacturer *n* is:

$$\max_{h_j} \pi_n = M \sum_{j \in J_n} S_j (p_j - c_j) - F_j; \qquad (8)$$

which leads to the following FOC

$$\frac{\partial \pi_j}{\partial h_k} = \sum_j \frac{\partial S_j}{\partial h_k}(p_j - c_j) + \sum_j \frac{\partial S_j}{\partial p_k}\frac{\partial p_k}{\partial h_k}(p_j - c_j) + \sum_j S_j \left(\frac{\partial p_j}{\partial h_k} - \frac{\partial c_j}{\partial h_k} \right) - \sum_j \frac{\partial F_j}{\partial h_k} = 0 \qquad (9)$$

where $\frac{\partial p_j}{\partial h_k}; \frac{\partial c_j}{\partial h_k}; \frac{\partial F_j}{\partial h_k} = 0, \forall j \neq k,$ i.e. where the cost structure and the ability to raise price above costs will be impacted only for those products whose formulation is actually changing.

Using the notation above, the system of *Jn* FOCs can be rewritten in matrix form as:

$$(p-c)'\widetilde{\Omega} + (p-c)'\Omega\Lambda + S(.)\Lambda - S(.)\nabla c - i\nabla F = 0 \qquad (10)$$

where $\Lambda_{jk} = \begin{cases} \dfrac{\partial p_j}{\partial h_k} & if \;\; k, j \in J_n \\ 0 & otherwise \end{cases}$; $\widetilde{\Omega}_{jk} = \Omega^*_{jk}\Xi_{jk}$, $\Xi_{jk} = \dfrac{\partial S_j}{\partial h_k}$, $\nabla(.)_{jk} = \begin{cases} \dfrac{\partial(.)_j}{\partial h_k} & if \;\; k = j \\ 0 & otherwise \end{cases}$

and i is a conformable row-vector of 1s.

Using the assumption of the existence of a multi-product Nash-Bertrand short-run equilibrium, i.e. equation (6), one has $[p-c]'\Omega\Lambda = [-\Omega^{-1}S(.)]'\Omega\Lambda = -S(.)\Lambda$, which, substituted into equation (10) gives the optimal long-run decision of manufacturers in terms of formulation.

$$[\Omega^{-1}S(.)]'\widetilde{\Omega} = S(.)\nabla c + i\nabla F \qquad (11)$$

Equation (11) depicts the long-run optimal condition for a manufacturer to change the formulation of their products. Equation (11) will not be estimated, however the optimality he matrix of the own- and cross-price demand derivatives can be estimated from equation (3) and the Ξ_{jk} can be simulated imposing manufacturers to change their formulation and then recalculating equilibrium prices and shares, one can obtain an estimate of the shadow value of including functionality in a product.

2.3 Simulating the impact of Reg. (EC) No. 1924/2006.

In order to calculate the effect of full de-labeling on producers and consumers, we follow an approach similar to those used by Petrin (2002) and Ackerberg and Rysman (2005). In the first place, once all the parameters of the demand equation in (3) are obtained, we artificially set $X_j^H = 0$ across all functional products; i.e. consumers will no longer be able to obtain the necessary information on the health content of the products. This scenario simulates the rejection by EFSA of all health claims' submission presented.

In order to simulate such scenario, we first invert equation (6) and solve for the vector of short-run marginal cost of production and calculate a new value of market shares S^{del}. Thus, using the artificial shares, we solve the non-linear system of equation in (6) to obtain a new vector of equilibrium prices p^{del}; both $S^{del\ a}$ and p^{del} are obtained considering a manipulated choice set where all functional yogurts in the market are deprived of the possibility to advertise their health claims.

Let S^0 and p^0 be, respectively, the equilibrium price and share's vector that one observers before perturbing the equilibrium; for each of the *n* yogurt manufacturer we calculate

$$\Delta\pi_n^{\ del}(SR) = M\left\{\sum_{j\in J_n} S_j^{del}(p_j^{del} - c_j) - S_j^0(p_j^0 - c_j)\right\} \quad (12)$$

which represents the Short-Run total changes in producers' profits due to the full enforcement of health-claims' de-labeling as consequence of implementation of Reg. (EC) No. 1924/2006. The long-run equilibrium considered in equation (11) could also be used to obtain the shadow price of investing in functional attributes. That would be useful if simulating changes in profits under another extreme outcome of the implementation of Reg. (EC) No. 1924/2006, i.e. the disappearance of all functional alternatives from the marketplace, which would leave manufacturers unable to recover pre-existing investments in R&D and advertisement, analysis which is not developed here.

To complete the evaluation of the effects of full de-labeling we also simulate changes in consumers' surplus under. Having obtained estimates of the demand parameters, we can calculate the level of unconditional utility for consumer *i* as $V_{ijt} = \exp(\delta_{jt} + \mu_{ijt})$. Following McFadden (1981), one could obtain a value of equivalent variation (EV) by dividing the difference of baseline indirect utility minus that of the de-labeling scenario for each individual by the estimated price coefficient from the demand model. Averaging over all consumers (i.e. using the sample analog of integrating over the random parameter's distributions) and using similar notation of that in equation (12), the average equivalent variation for a consumer after full de-labeling occurs is:

$$\overline{EV}_i^{del} = m^{-1} \sum_{i=1}^{m} \frac{V_i^{del} - V_i^0}{\alpha + \alpha^r v_i} \tag{13}$$

where α is the mean of the estimated price parameter from equation (3), α^r is the coefficient of the random component associated with it and *m* is the number of random draws of v_i from its distribution *Pv*.

3. Data and Estimation

3.1 Data and Variables Description

We estimate the random coefficient discrete choice demand model using a proprietary scanner dataset provided by the Food Marketing Policy Centre at the University of Connecticut[8] supplied originally by Information Resources Incorporated (IRI). The database includes 12 monthly observations of yogurt sales (quantities and values) for the period January 2007 – December 2007 in Hyper- and Super-markets located in thirteen Italian IRI regions covering most of the national territory.[9] The data contains yogurt sales for 64 products (48 conventional and 16 functional), for major leading vendors of yogurts operating in the Italian market (Danone, Granarolo/Yomo, Nestle, Mila, Muller, Parmalat, Vipiteno, Private Label, referred below as brands), discriminating for flavor (plain, fruit, and other flavors), fat content (skim and whole),

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

[9] Some of the regions were excluded as their market is characterized by prevalence of local brands, suggesting that the choice set for consumers in those regions could be substantially different than in the rest of the Italian territory. The regions excluded are Sicilia, Sardinia, Calabria+Basilicata and Trentino Alto Adige.

consistency (drinkable versus non-drinkable) and the presence of functional attributes, for a total of 9,800 observations. Volume and value of sales are used to calculate prices in €/Kg. Following Di Giacomo (2008), the size of the potential yogurt market is calculated assuming that each consumer in each region consumes one serving – i.e. 125 grams – of yogurt daily. The total number of resident population in each region is obtained from the Annuario Statistico Italiano of the Istituto Nazionale di Statistica (ISTAT), which is then multiplied by 0.125 and by the number of days in each IRI "month." The total (potential) market is then used to calculate each product market share of each alternative, along with the outside share for each market.

The product characteristics other than price and the functional indicator included in the demand equation are an indicator of fat content (whole), one of "plain" flavor, one for drinkable yogurts, two for fruit flavors (with pieces of fruit and with pulp) and brand indicators (the excluded one being Private Labels).

Table 1 presents average prices (€/serving) and market shares for the 64 products used in the estimation. From the data in Table 1 it emerges that Danone is, the leader in the Italian yogurt market. However, although its position is clear among functional yogurts, among conventional ones, the situation is more mixed. For example Private Labels and Granarolo compete for the predominance among the "Fruit with pulp" yogurt, Private Labels and Danone compete for that in "fruit with pieces" ones, while Granarolo seems to dominate that of flavored ones. With respect to prices, yogurt manufacturer seem to use substantially similar prices across flavors (with the exception of Muller and Nestle). Also, while the market leaders seem to benefit from their position by charging higher prices (on average 0.59 €/serving Danone, 0.39 €/serving Parmalat, 0.49 €/serving Granarolo, 0.44 €/serving Muller), the other vendors price their products at levels that are close to the PLs' prices (average price of Mila's product 0.34

€/serving; Vipiteno's 0.32 €/serving; PLs' ranging from 0.29 to 0.37 € /serving) or that, vice versa, PLs could perhaps compete more heavily with those brands. Lastly, Danone and Parmalat, price their functional alternatives at higher than their conventional ones (average price of Danone's functional is 0.64 €/serving; Parmalat's 0.58 €/serving) while both Nestle's and Granarolo's (Yomo) conventional fruit flavored alternatives (and drinkable in the case of Nestle) show similar prices across product lines.

3.2 Estimation and Identification Strategy

Following Berry (1994) and BLP (1995) we estimate the demand using Generalized Method of Moments (GMM). The population moment condition exploited in the GMM is that the product of exogenous instrument variables with the structural error term in equation (2) is zero. Following Nevo (2001) let's define the vector of exogenous instruments as $Z = [z_1, \dots z_M]$. This vector satisfies $E[Z'\omega(\theta^*)] = 0$ where $\omega(\theta^*)$ is a function of the true values of the parameters of the model θ^* which, in our case is equivalent to the product-specific unobservable ξ_j. The vector of GMM estimates $\hat{\theta}$ solves:

$$\hat{\theta} = \arg\min_{\theta} \omega(\theta)' Z A^{-1} Z' \omega(\theta) \tag{14}$$

where A is a consistent estimate of $E = [Z'\omega\omega' Z]$. In order to solve equation (14) one needs to calculate the vector of unobserved characteristics ξ_j by means of obtaining values of the mean utility δ_t so that the market share functions, as described in equation (4), and the observed market shares are equal or that $s_t\left(X, p_t, \delta_t; \theta\right) = S_t(.)$, which requires numerical methods.[10]

[10] Simpler specifications of how consumers' heterogeneity enters equation (1) lead to closed form solutions of the market share function in equation (4). That is if the only source of heterogeneity was the extreme-value type I

The estimation of the demand equation is performed using the MPEC algorithm developed by Dube *et al.* (2009) using the optimization package TOMLAB-KNITRO. Dube et al. (2009) show that the nested fixed point algorithm (also known as nested contracting mapping algorithm) to solve for the market share function, developed by Berry (1994) and BLP (1995) is susceptible to numerical issues due to nested calls to an inner loop, such as inefficiency and failure to navigate to global minimum. They propose MPEC as a new computational algorithm for implementing the BLP estimator. This new algorithm recasts BLP's GMM objective function as a mathematical program with equality constraint (thus the name MPEC), and hence circumventing the need of nested inner loops and their associated numerical issues. They show through numerical theory and Monte Carlo simulations that MPEC could significantly improve numerical efficiency and accuracy.

The GMM estimator explicitly accounts for the potential price endogeneity by the uses of instrumental variables. To this end, we use cost-variables related to manufacturing and retailing costs of yogurt. Variations in these cost variables are correlated with variations in prices but uncorrelated with unobserved demand shocks. Since all the vendors considered in the analysis operate on a national scale, part of our identification strategy aims to use variation in yogurt prices that is unlikely to be correlated with regional shocks which could, in principle, impact both demand and supply. To that end we use the following input prices as instruments for retail yogurt prices: farm-level milk price (national, monthly, €/l), price of nuts the origin (national, monthly, €/kg), farm-level, national price of fruit (national, monthly, €/kg), from the DATIMA database of the Istituto per lo Studio dei Mercati Agricoli (ISMEA) and the European import price (CIF) of sugar (national, monthly, US $/lb), by Index Mundi. Additionally we control for

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random component e_{ijt} , the mean utility δ_{ijt} will be equal to $\ln(S_{jt})$ - $\ln(S_{0t})$ which results in the multi-nomial logit demand model.

differences in retailing costs, by means of retail workers' per capita earnings (regional, annual, € .000) by the Ministero dello Sviluppo Economico, Osservatorio Italiano del Commercio.

4. Empirical Results and Discussion

4.1 Estimated Parameters and Elasticitities

The results of the estimation of equation (4) are presented in Table 2. Along with the estimates of the Radom Coefficient Logit, reported in the last column on the right, the results of two Multi-Nomial Logits (MNL) are also reported: a "naïve" model where endogeneity of prices is not accounted for (column "OLS") and one where endogeneity is instead controlled for (column "2SLS"). In spite of the low R-squared, the coefficients are jointly significant at the 1% level (statistic not reported); also, the p-value of the Sargan test is close to 0.1, suggesting orthogonality of the overidentifying instruments; lastly, the value of the *F*-statistics for the joint significance of the instruments in the first state regression exceeds the "rule-of-thumb" value of 10 indicated by Stagier and Stock (1997), ruling out the presence of weak instruments problems.

The most considerable differences in estimated coefficients across models are in the coefficients of price and functional indicators.[11] The mean of the estimated price parameter in the random coefficient model is approximately -8.62, while the random component of the price coefficient (i.e. variation from the mean) is 4.03; both coefficients being significant at the 1% level. This result indicates that taste heterogeneity does in fact play a considerable role in impacting consumers' price sensitivity in the Italian yogurt market. The empirical distribution of the random price coefficient is reported in the left panel of Figure1; from such distribution

[11] It should be noted that the results discussed are obtained from a model including a random coefficient for the "Fruit with pulp" attribute. We experimented with different specifications of the model, including different random parameters for different attributes, obtaining, in most cases qualitatively similar results. Allowing for random coefficients for all the product attributes was unfeasible due to the excessive computation time and power required.

(centered at -8.6), it can be noted that, although most of the values are in the negative range, the left tail of the distribution includes some positive values of the price coefficients.

The mean of the estimated coefficient of the functional indicator is approximately 0.43 (statistically significant at the 1% level), while the coefficient of the random component associated with it is small (-0.055), and not statistically significant, indicating that consumers' taste for the functional attribute, is not characterized by substantial heterogeneity. Given the narrow distribution of this parameter, as illustrated in the right panel in Figure 1, no consumers will be likely to show a negative attitude towards functionality.

With respect to the coefficients of the other attributes the "plain" indicator shows negative and statistically significant coefficients in all estimated models, suggesting that, on average Italian yogurt consumers appreciate flavored yogurts more than others. In fact the fruit indicators are both positive, similar to the coefficient of the drinkable attribute. In terms of the estimated coefficients for the vendor indicators, those of Danone and Muller are positive and significant across models, while those of Parmalat, Mila, Parmalat, Granarolo, and Vipiteno show negative and statistically significant sign.

The median of the distributions of the estimated own-price elasticities obtained using the estimated parameters of the random coefficient logit are reported in Table 3. The values range from -0.79 (Danone Plain Functional whole) to -2.94 (Parmalat, Fruit with Pulp, Conventional Skim) for an average value of -1.64. These values are reasonable and are consistent with the values reported by Di Giacomo (2008) in her analysis of the demand for yogurt in the Italian market, ranging from -0.88 to -2.66.

Overall, five patterns emerge from the values in Table 3:

1 *Functional vs. conventional*: Functional yogurts show lower values of own-price elasticities than their conventional counterparts, across brands, flavors, and fat content. This result corroborates previous findings that consumers show higher willingness to pay for products with health enhancing features (see for example West *et al*. 2002; Markosyan *et al*. 2009) and that the demand for functional products tends to be less elastic than for conventional ones (Bonanno, 2010).

2 *Drinkable*: the demand for drinkable conventional products appears to be more inelastic than that for other conventional alternatives, while it is not clear whether this holds as well for functional products, given the very small values of estimated elasticities for Danone's spoonable functional yogurts.

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 the drinkable whole functional alternatives, where the demand for Danone's products appear the most elastic, perhaps due to its high prices.

3 *Flavors*: the demand for fruit flavored yogurts shows (on average) higher values of elasticity than that for other flavors (at times comparable) and plain, in particular that of "fruit with pulp" alternatives, which show the largest values of elasticity.

4 *Fat content*: no unique trend emerges with respect to fat content and; while the demand for whole alternatives seems to be more elastic than for light ones, among plain, fruit flavored (with the exception of the functional alternatives), and drinkable ones, the demand for the light alternatives appear more elastic among some Private Labels.

A summary of the elasticities by brand and by presence of functional attributes, along with profit margins calculated as in equation (6) is presented in table 4. Besides corroborating what illustrated above – Danone's products benefiting from lower values of elasticity of demand, and that functional products dhow less elastic demand than conventional ones – the results illustrate also that the price cost margins for the functional products are 9 % (in the case of Granarolo) to 32 % (in the case of Parmalat) higher than for their conventional counterparts. Although the estimated average margins appear large (as large as 90%), the reader should keep in mind that these are short-run margins and that they do not take into account the presence of fixed costs. Interestingly the profit margins of all manufacturers that have not ventured in the production of functional products show similar PCMs, the lowest of which is registered for Private Labels (55.15%), which may perhaps indicate a lack of brand image for those manufacturers that appear "less-differentiated" resulting in lower margins.

In sum, the results illustrated so far indicate that, as Italian consumers appear less price sensitive for functional yogurts, food manufacturers may see the development of functional alternatives as an opportunity to differentiate their products and benefit from higher margins. If that is the case, the potential losses that they could incur if de-labeling is enforced could be severe. The results discussed in the next section provide evidence to support this intuition.

4.2 Impact of De-labeling on Firms' Performance and Consumers' Welfare

Table 5 presents the results of the counterfactual analysis simulating the impact of full de-labeling enforced by the EFSA on yogurt manufacturers operating in Italy.[12] In the first place, the market leader of functional yogurts, Danone, would experience a loss of 19% in shares of functional products and only a 1.19% of that of conventional ones. The outcome of full de-labeling would therefore be that of the company having to lower considerably the prices of the

[12] The results presented in Table 5 are obtained excluding counterfactual price and shares measure for some of the drinkable alternatives, as the measures resulting from the simulation of de-labeling for these products were too large and therefore unrealistic.

conventional products to avoid losing market shares, since the new equilibrium price of conventional yogurts will drop more than those of conventional one). Overall, Danone's short-run profits in 2007 would have decreased by approximately 64 million Euros, or almost one fourth of its total profitability, if full de-labeling had been in place.

Other yogurt manufacturers would have fared better than Danone. Granarolo, who would have been forced to exit the market of functional yogurts, could have more than compensated the losses from that front thanks to higher profits in the conventional segment, and overall, increase its profits, while Parmalat, would have been able to replenish the losses from the functional segment with some gains from the conventional one. Nestle (who could have benefited from higher prices in the conventional segment) would have also incurred a substantial loss, in the order of approximately 20 million Euros. Interestingly, our counterfactual predicts losses also for manufacturers who do not produce functional yogurts, in particular for Vipiteno and Private Labels. This result comes from the higher equilibrium prices and lower shares, which are perhaps the result of changes in the composition of their consumer base. As some consumers attracted by functional product may lose interest in de-labeled products, manufacturers of functional alternatives will lower their price with the result of price sensitive consumers perceiving the un-labeled functional products now more appealing to them. This could result in the same less price sensitive consumers to lower their consumption of conventional product which could, in turn impact the profits of manufacturers who avoided investing in functional alternatives.

The overall losses in producers' profit due to a full enforcement of de-labeling are estimated in 114 million Euros, or approximately 14%. More than half of this loss would come from Danone, approximately 20% from Nestle, and 23 percent from Vipiteno and Private Labels combined, which would see their position of low-priced alternative being jeopardized by the lower prices of the de-labeled functional alternatives.

The estimated impact of full health-claim de-labeling on consumers' welfare is calculated using equation (13), whose values are reported in table 6. First, the values of the simulated individual consumers' utility shows that the average difference in indirect utility would on average be 0.072, resulting in cumulative decrease in utility of approximately 27% among consumers. In order to show how these differences in utilities differ across heterogeneous consumers, the ratio $\exp(U_i^0)/\exp(U_i^{del})$ was calculated and its distribution plotted in Figure 2. From that histogram, it clearly emerges that most consumers show larger level of utility when they are able to observe health claims of the product they buy (the mean value of the ratio being 1.43).

Table 6. Impact of health-claims de-labeling on consumers – utility and Welfare

Individual utility changes	N draws	Mean	Std. Dev.	Min	Max
$\exp(U_i^{de})-\exp(U_i^0)$	999	-0.0722	1.5413	-43.06	1.4765
Daily Individual Welfare Loss	999	-0.0137	0.2771	-6.0596	1.9586
Annual Average Individual Welfare Loss		-4.9972			
Total Welfare Losses		**-228.797**			

The resulting average welfare loss for each consumer is of approximately -0.0137 € daily, or approximately 5 € per year, which, aggregating over consumers in the 13 regions considered (market size is 45,784,960 people) results of an overall welfare effect of the full de-labeling simulation of approximately -228.8 million €, which would be twice as the losses in profits.

Therefore, if the EFSA was operative in 2007, and if it had rejected all health claims among functional yogurts in the Italian markets, the total deadweight losses would have been of 343 million Euros.

The result that consumers would have been twice as worse off as manufacturers, should however be taken with caution. In fact, our counterfactual assumes that consumers derive zero utility from the presence of a functional attribute once health claims are removed from label and packages. It is likely, especially in the immediate aftermath of the removal, that consumers still know and thus enjoys the presence of functional attributes, even if these are not acknowledged in the labels (that is, there will be some utility associated with the functional attribute). Hence, our welfare estimate should be viewed as an upper bound of consumer welfare loss.

5. Concluding remarks

As the market for health-enhancing food products expands, policymakers have considered updating regulatory schemes about health-claims on food products, so to improve transparency and reduce the risk of asymmetric information between consumers and producers. A recent regulation of the European Union, Regulation (EC) No 1924/2006, of the European Parliament and of the Council of 20 December 2006, dictates the submission of documented clinical trials by food manufacturers that want to have health claims on their products. The European Food Safety Authority (EFSA), in charge of reviewing such submission, has adopted a rather stringent approach, rejecting the majority of application. Some pundits sustain that such approach could jeopardize innovation and growth of the European food industry as a whole. Excessive stringency could also hurt consumers, as search cost to obtain information on health properties of foods will increase, and product variety could also decrease (if manufacturers lose interests in investing in functional products).

As food manufacturers whose application to carry a health-claim are rejected by the EFSA can still sell their products but without reporting the claims on the packaging, we used a case-study approach and analyzed changes in producers' profits and consumers' welfare that could occur if all functional yogurts present in the Italian market were to be sold without health-claims on their packaging. In this preliminary work we illustrate the results of a counterfactual analysis for a "full de-labeling" scenario using demand estimates for conventional and functional alternatives yogurts in Italy obtained via a model which accounts for consumers' taste heterogeneity (mixed logit). The estimated losses from health-claims de-labeling could be substantial, which, for the year 2007, could have results in potential losses of 114 million Euros of yogurt manufacturers' profits (more than half if it coming from the market leader, Danone) and twice as large losses (229 million Euros circa) in consumers' welfare. Although the latter figure is an upper bound, as consumers may still achieve some satisfaction from the presence of functional attributes, even if not advertised, our results indicate that there is, at least potentially, a concrete risk that both manufacturers and consumers could be substantially hurt – especially the former – by an excessive stringency of the implementation of Reg (EC) No. 1924/2006.

The analysis presented here is preliminary, as it does not account for changes in long-run profitability due to changes in fixed-cost related to R&D and/or advertising which are substantial in the market of health-enhancing food products. Also, a different, more severe outcome of Reg (EC) No. 1924/2006 would be that of food manufacturers discontinuing the production of functional alternatives. In order to simulate changes in producers' profits and consumers' welfare one should account for both the impossibility of recovering pre-existing R&D costs (on the producers' side) and the decrease in the number of varieties in the market (on the consumers' side). Next developments of this analysis will include an investigation of such changes.

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Table 1 – Average Price and Market Shares (%) – Annual Average (2007) across 13 IRI Italian Regions

		Danone		Parmalat		Granarolo		Nestle		Mila		Muller		Vipiteno		PL	
Conventional		Price	*Share*	Price	*Share*	Price	*Share*	Price	*Share*	Price	*Share*	Price	*Share*	Price	*Share*	Price	*Share*
Plain	Skim	0.57	*0.058*			0.50	*0.037*			0.33	*0.015*	0.42	*0.073*	0.31	*0.082*	0.30	*0.188*
	Whole	0.55	*0.030*			0.46	*0.051*					0.36	*0.104*	0.31	*0.086*	0.31	*0.184*
Fruit	Skim	0.68	*0.002*	0.36	*0.069*											0.35	*0.121*
(Pulp)	Whole	0.58	*0.051*	0.38	*0.259*	0.53	*0.551*	0.65	*0.086*	0.31	*0.086*	0.41	*0.030*	0.32	*0.335*	0.32	*0.332*
Fruit	Skim	0.55	*0.532*			0.49	*0.059*	0.38	*0.049*	0.34	*0.112*	0.52	*0.102*	0.32	*0.057*	0.35	*0.210*
(Pieces)	Whole	0.52	*0.004*	0.40	*0.083*	0.41	*0.092*			0.34	*0.069*	0.42	*0.086*	0.32	*0.043*	0.29	*0.207*
Other	Skim	0.60	*0.069*													0.37	*0.027*
	Whole			0.43	*0.026*	0.57	*0.327*			0.33	*0.063*	0.45	*0.004*	0.33	*0.127*	0.32	*0.127*
Drink		0.56	*0.074*					0.64	*0.019*	0.41	*0.104*	0.49	*0.242*				
Functional																	
Plain	Skim	0.63	*0.068*														
	Whole	0.60	*0.119*														
	Unsp			0.58	*0.016*												
Fruit	Skim	0.62	*0.106*														
	Whole	0.62	*0.403*	0.56	*0.006*												
Other	Skim	0.66	*0.027*			0.54	*0.006*										
	Whole	0.64	*0.533*	0.59	*0.072*												
Drink	Skim	0.68	*0.181*					0.60	*0.044*								
	Whole	0.67	*0.696*			0.65	*0.049*	0.61	*0.200*	0.60	*0.026*						

Note: Prices are expressed in (€/serving); Serving size = 125 gr.
Market shares are calculated using an estimated total market resulting from the daily consumption of 125gr of product per person

Table 2 Estimated Demand Parameters

VARIABLES	OLS		2-SLS		Random Coefficient			
					mean		Random Coeff.	
Price	-4.427	***	-7.089	***	-8.618	***	4.031	***
	(0.191)		(1.124)		(0.016)		(0.008)	
Functional	0.696	***	0.968	***	0.429	***	-0.055	
	(0.044)		(0.121)		(0.008)		(0.203)	
Fruit Pulp	0.550	***	0.539	***	-10.647	***	-7.832	***
	(0.044)		(0.045)		(0.036)		(0.019)	
Fruit Pieces	0.167	***	0.051		0.218	***		
	(0.043)		(0.065)		(0.001)			
Whole	0.709	***	0.655	***	0.741	***		
	(0.028)		(0.036)		(0.000)			
Plain	-0.154	***	-0.254	***	-0.113	***		
	(0.040)		(0.058)		(0.000)			
Drink	0.633	***	0.740	***	0.512	***		
	(0.048)		(0.066)		(0.001)			
Danone	0.581	***	1.252	***	0.404	***		
	(0.068)		(0.287)		(0.001)			
Granarolo	-0.056		0.452	**	-0.106	**		
	(0.063)		(0.221)		(0.001)			
Parmalat	-0.972	***	-0.661	***	-0.992	***		
	(0.059)		(0.142)		(0.001)			
Nestle	-0.247	**	0.300		-0.275			
	(0.074)		(0.239)		(0.001)			
Muller	0.638	***	0.976	***	0.634	***		
	(0.058)		(0.152)		(0.001)			
Mila	-0.941	***	-0.867	***	-0.920	***		
	(0.054)		(0.062)		(0.001)			
Vipiteno	-0.679	***	-0.681	***	-0.682	***		
	(0.055)		(0.055)		(0.001)			
Constant	-5.436	***	-4.356	***	-4.722	***		
	(0.091)		(0.458)		(0.004)			
Observations	9,800		9,800					
R-squared	0.231		0.216					
Partial-F (P-value)			49.605 (0.000)					
Sargan (P-value)			9.381 (0.095)					

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Instruments for price: farm-level milk price, FOB sugar price, farm-level fruit price; average nut prices; retail earnings.

Table 3 – Median estimated own-price elasticities (*t*-statistics in parenthesis)

		Danone		Parmalat		Granarolo		Nestle		Mila		Muller		Vipiteno		PL	
Conventional		Elast	(*t*-stat)	Elast	(t-stat)	Elast	(*t*-stat)	Elast	(*t*- stat)	Elast	(*t*-stat)	Elast	(*t*-stat)	Elast	(t- stat)	Elast	(*t*-stat)
Plain	Skim	-1.32	(3.11)			-1.54	(5.53)			-1.70	(15.32)	-1.70	(9.51)	-1.68	(15.99)	-1.67	(16.86)
	Whole	-1.40	(5.37)			-1.64	(7.98)					-1.70	(12.43)	-1.68	(15.65)	-1.67	(15.40)
Fruit -	Skim	-1.98	(4.83)	-2.94	(19.03)											-2.91	(19.80)
Pulp	Whole	-2.51	(10.71)	-2.83	(10.08)	-2.37	(28.11)	-2.15	(7.62)	-2.78	(14.85)	-2.89	(23.90)	-2.56	(13.26)	-2.56	(17.49)
Fruit -	Skim	-1.40	(4.22)			-1.57	(7.45)	-1.71	(12.32)	-1.70	(14.13)	-1.53	(5.25)	-1.69	(14.04)	-1.71	(13.52)
Pieces	Whole	-1.47	(4.79)	-1.71	(13.52)	-1.71	(9.76)			-1.70	(13.91)	-1.69	(9.74)	-1.69	(12.73)	-1.63	(15.37)
Other	Skim	-1.19	(2.69)													-1.72	(12.11)
	Whole			-1.68	(10.10)	-1.31	(5.46)			-1.70	(14.02)	-1.65	(8.46)	-1.70	(14.42)	-1.58	(6.66)
Drink		-1.04	(1.95)					-1.71	(10.72)	-1.17	(2.95)	-1.58	(6.66)				
Functional																	
Plain	Skim	-0.79	(1.76)														
	Whole	-1.04	(2.31)														
	Unsp			-1.27	(3.50)												
Fruit	Skim	-1.36	(4.11)														
	Whole	-0.90	(2.28)	-1.36	(3.89)												
Other	Skim	-1.16	(2.52)			-1.50	(4.07)										
	Whole	-0.93	(1.64)	-1.26	(3.46)												
Drink	Skim	-0.90	(2.28)					-0.94	(2.11)								
	Whole	-1.58	(6.66)			-0.87	(2.13)	-1.13	(3.18)	-1.17	(2.79)						

Table 4 – Summary of Elasticities and Price Cost Margins (PCM) across brands and functional attributes

Vendor	Attribute	Elasticity	PCM	%PCM
Danone	Conventional	-1.54	0.43	64.75
	Functional	-1.07	0.64	88.33
Granarolo	Conventional	-1.69	0.35	62.22
	Functional	-1.50	0.44	71.30
Mila	Conventional	-1.88	0.22	55.81
	Functional	-1.50	0.50	72.95
Nestle	Conventional	-1.68	0.47	71.94
	Functional	-1.04	0.62	89.80
Parmalat	Conventional	-2.29	0.22	48.16
	Functional	-1.30	0.53	80.37
Muller	Conventional	-1.82	0.30	58.92
Vipiteno	Conventional	-1.83	0.21	56.71
PLs	Conventional	-1.93	0.21	55.15

Table 5 – Impact of de-labeling of health claims on functional yogurts on profits and welfare

		Price (€/serving)			Market Share (%)			SR $\Delta\pi^{del}$ (eq.12)		
Vendor	Attribute	P^0	P^{del}	P^0-P^{del} (%)	S^0	S^{del}	S^0-S^{del} (%)	π^0	π^{del}	$\Delta\pi^{del}$
Danone	Conventional	0.66	0.59	-10.61	0.1	0.13	-1.19	59.37	58.66	-0.71
	Functional	0.72	0.65	-9.05	0.21	0.15	-26.24	178.25	117.87	-60.37
Granarolo	Conventional	0.56	0.56	-0.5	0.19	0.21	1.09	87.06	96.15	9.09
	Functional	0.61	0.55	-11.12	0.01	0.00	-100	3.71	0.00	-3.71
Mila	Conventional	0.39	0.59	54.53	0.09	0.05	-45.54	25.28	27.80	2.52
	Functional	0.69	0.63	-9.04	0.02	0.01	-61.43	13.38	7.46	-5.92
Nestle	Conventional	0.64	0.6	-2.25	0.05	0.08	26.07	32.28	45.76	13.48
	Functional	0.69	0.64	-7.9	0.12	0.09	-28.11	101.08	68.08	-33.00
Parmalat	Conventional	0.45	0.48	5.48	0.11	0.12	-4.99	32.06	39.34	7.27
	Functional	0.66	0.6	-8.93	0.03	0.02	-51.12	22.14	14.66	-7.48
Muller	Conventional	0.5	0.52	4.24	0.23	0.2	-2.53	92.07	84.13	-7.94
Vipiteno	Conventional	0.36	0.63	72.81	0.12	0.03	-70.33	33.60	17.83	-15.77
PLs	Conventional	0.37	0.65	74.07	0.17	0.06	-62.17	48.00	36.14	-11.85
TOTAL								***728.34***	***613.94***	***-114.40***

Table 6. Impact of health-claims de-labeling on consumers – utility and Welfare

Individual utility changes	N draws	Mean	Std. Dev.	Min	Max
exp(U_i^{de})-exp(U_i^{0})	999	-0.0722	1.5413	-43.06	1.4765
Daily Individual Welfare Loss	999	-0.0137	0.2771	-6.0596	1.9586
Annual Average Individual Welfare Loss		-4.9972			
Total Welfare Losses		**-228.797**			

Figure 1: Distributions of the coefficients associated with price and functional attribute

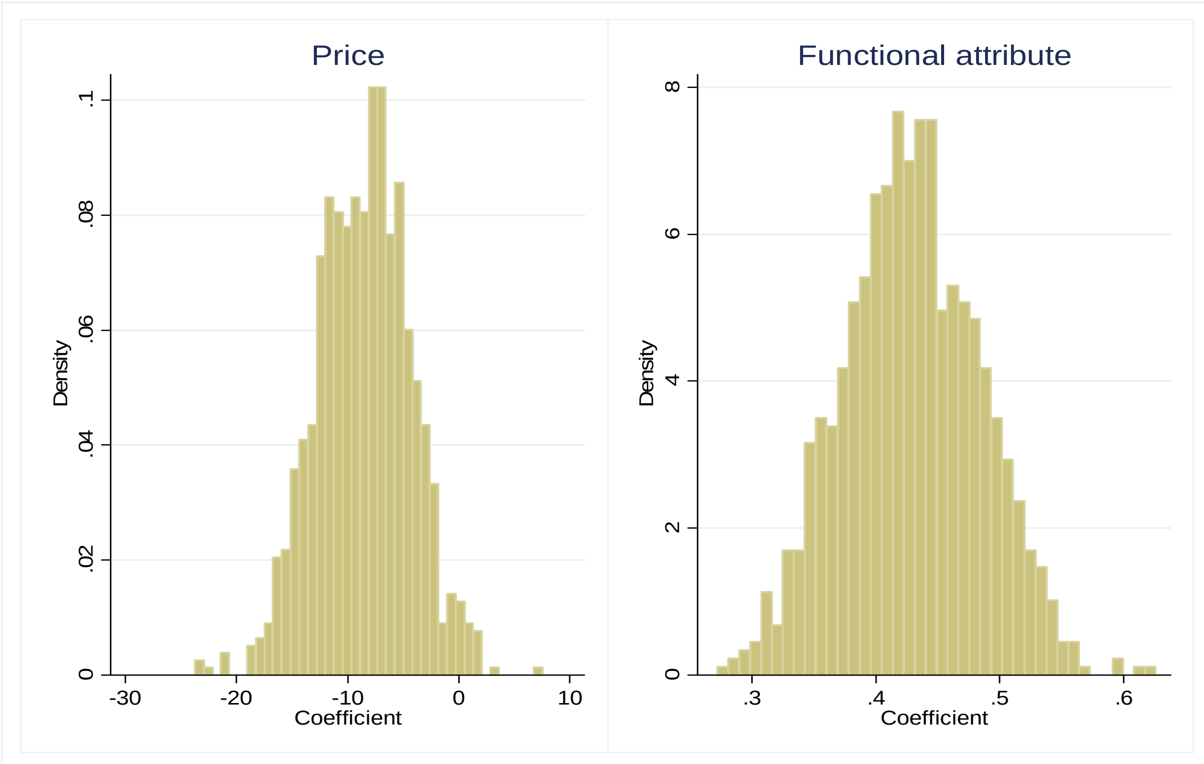

Figure 2: Distributions of $\exp(U_i^{0})/\exp(U_i^{del})$ across consumers