Market valuation of health claims' types and strength: the Italian yogurt market.

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Abstract

While consumer's demand for foods delivering health benefits, or functional foods, increases, Reg.No.1924/2006, imposes to food manufacturers in the European market stringent criteria for health claims approval. Facing this trade-off, manufacturers need to assess which claim is more likely to lead to market success. We investigate the market value of different health claims, and their efficacy in Italy, using a large database of yogurt sales and a hedonic price framework. Our results indicate large variation in the marginal price of a health claim depending upon the type of health benefits delivered and the claim's strength.

Keywords: health claims, yogurt, hedonic price.

1. Introduction

Functional foods can be defined as any modified foods or food ingredients which may provide a health benefit beyond traditional nutrients they contain (Thomas and Earl, 1994; Diplock et al., 1999). Functional foods appeared in the European market in the mid-90s, and their sales have been growing ever since (Menard, 2003; Granato et al., 2010) thanks to people's interest in self-care treatment and on the prevention of diet related diseases such as heart disease, hypertension, high blood pressure, diabetes and osteoporosis (WHO, 2003; McCarthy et al., 2012). The functional food market represents one of the fastest growing food markets worldwide, with annual growth rate of 8.6% in the 10 year-period to 2012 (Khan, 2013). The European market, sized at 6.4 billion of Euros (Stein and Rodríguez-Cerezo, 2008) amounts to a large portion of the global functional foods market, valued at 25-60 billion Euros (Stein and Rodríguez-Cerezo, 2008).

One of the hurdles in the success of these products is that a health benefit delivered by a functional food is a credence attribute, since it cannot easily recognized by consumers even after repeated consumption. In market characterized by credence attributes, where quality level may not be evaluated in full by consumers, asymmetric information may be present which may result in welfare losses (Roe and Sheldon, 2007) . Therefore, the European Union has created Regulation (EC) No.1924/2006 aiming to reducing asymmetric information between manufacturers and consumers, and to guarantee that the claims are truthful and understandable by the average consumer. Reg. (EC) No.1924/2006 sets the criteria for products' health claims approval and mainly classifies them in two different categories: "Reduction disease risk" claims and "General Function" claims. The former require to undergo a rigorous authorization procedure based on case-by-case dossier review process by the European Food Safety Authority (EFSA). Additionally, the dossier must present scientific evidence supporting the health claim and a causal relationship between the active principle and its claimed effect. While the approval of "General Function" claims is based upon existing knowledge or links between food and health.

Compliance with a health claim labeling policy can be costly for food manufacturers, as suggested by Blandford and Fulponi (1999), since it requires a third party independent certification that guarantees product content and performance as expected by the market. In the case of "general function" claims, the estimated average cost to develop and market a product carrying such claims ranges from €980 to €1,663, while the cost of a "reduction disease risk" claim is over 10 times larger. Even without considering the costs associated with clinical trials required to produce the scientific evidence needed to support applications, requiring €0.25 million to €1 million of additional investments (Brookes G., 2010).

Previous research shows that consumers use health claims in their evaluation of different product alternatives as quality signals as they create expectations regarding the product's quality (Deliza and MacFie, 1996; Ares et al., 2010; Aschemann-Witzel and Hamm, 2010). The presence of a health claim on foods, in fact, increases consumer's willingness to try it as well as its perceived healthiness (Ares et al., 2009). In fact, consumers choose products with health claims more often than those without a claim (Aschemann-Witzel and Hamm, 2010). However, the existing literature provides some evidence there can be considerable variation in how consumers perceive a functional product, their attitude towards it and their wiliness to pay for it (Van Kleff et al., 2002; Peng et al., 2006; Verbeke et al., 2009; Lusk and Parker; 2009) .

First, contrasting findings emerge from research exploring whether "reduction disease risk" or "general function" claims are preferred by consumers. In fact, while several studies found that consumers seem to prefer food products with "health risk threat reduction" claims rather than "health enhancing function" claims (Van Kleef et al., 2005a; Hailu et al., 2009, Siegrist et al., 2008) others suggest the opposite (Verbeke et al.,2009; Szathvary and Trestini, 2013).[1] Evidence on whether consumers are willing to pay a premium price for functional food products is also mixed: while some authors find consumers having a higher willingness to pay for these products (West et al. 2002; Larue et al. 2004; Markosyan et al. 2009; Carlucci et al, 2013), others indicate that only a limited price premium is achievable (Menrad, 2003; Siro' et al., 2008).

Second, the literature shows that different claims can lead to different market performances. The presence of nutrition and health claims on fruit beverage products contribute to explain product's price in a measure of +5.7 and +20.6%, respectively for nutritional claims associated with the presence of vitamins, minerals, fibre and an unspecified "General Function" claim, respectively (Szathvary and Trestini, 2013). Carlucci et al. (2013), decomposed the impact of health attributes on yogurt's price according to the presence of fibre, probiotics or calcium. The premium price attached to yogurt with fibre, probiotic and calcium was +32.33%, +24.45% and +27.18%, respectively. Little has been done so far to evaluating the market preference towards multiple health claims available on the market.

Third, consumers' acceptance of products carrying health attributes may vary in function of the brand-name associated with it. In general terms, brands play a third-party role in the food marketing system as they may act as a signal for the quality of food products (Caswell and Padberg, 1992) and they can contribute reducing the expected risk prior to purchase (Lassar et al., 1995; Ares et al., 2010). Thus, the value attached to functional claims may differ conditionally on brand image (Ares et al. 2007, 2010; Ares and Delizia, 2010; Annunziata and Vecchio, 2013) as well-known brands represent a guarantee for consumers regarding the trustworthiness of the information on the package (Ares and Deliza 2010). The importance of brand in functional food choices seems particularly relevant especially for south European consumers (Messina et al., 2008).

In this paper we measure whether, and to what extent, the price of a functional product depends upon: 1) the type of functionality presented on the labels (cholesterol reducing effect, supporting immunity system, reducing stress and maintain healthy bone); 2) the strength of

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[1] Urala et al., (2003) also show that consumers derive have higher utility from choosing food products with a claim that links a functional ingredient with a reduced risk or with the prevention of an illness or a disease, rather than products with claims simply indicating the presence of a functional ingredient.

the health-related message (reduction disease risk vs. general function activity); and 3) whether it belongs to a well-known brand. To achieve these goals, we use a hedonic price model applied to two years of monthly data of yogurt sales encompassing all the Italian regions. Our data includes sales from hyper- and supermarkets located in 17 Italian IRI regions, augmented with information on the health-related attributes of these products, gathered from food manufactures' websites. We focus on the Italian yogurt market for two reasons. First, yogurt represents an interesting product category to investigate: yogurt is considered intrinsically healthy and it is one of the most credible carriers of functional attributes (Sirò et al., 2008; Ozer and Kirmaci, 2010); as a result yogurt and fermented functional dairy account for nearly 43% of the total functional products' market (Ozer and Kirmaci, 2010). Second, the Italian yogurt market is characterized by a high level of differentiation in terms of health attributes as Italian yogurt manufacturers have invested largely in the development of functional products to reviving a market which was once considered mature (Bonanno 2012, 2013).

2. The model

Our model borrows from the standard hedonic price model proposed by Rosen (1974). According to this framework, each consumer chooses an optimal attributes bundle which maximizes her utility (subject to a budget constraint); thus, additional product characteristic added to a product, will impact consumers' utility while also affecting the firms' marginal cost of providing the characteristic. If each product in the market represents a unique bundle of attributes, at the equilibrium, marginal bids of buyers and marginal offer of sellers match (Ladd and Suvannunt, 1976; Rosen, 1974). The price of product *j* in market *m* at time *t*, P_{jmt}, can be described by:

$$P_{jmt} = f(X_{jmt}) \qquad (1)$$

where *X* is a vector of product attributes and *f*(.) is an unspecified (unless structure to the problem is imposed) functional forms. Equation (1) is a reduced form equation implying that the price consumers in market *m* at time *t* pay for *j* is equal to the sum of the marginal monetary values of *j*'s attributes (Ladd and Suvannunt,1976) which can be obtained by partially differentiating (1) with respect to each attribute.

In our case, *X* is partitioned into seven vectors: X^{HC}, X^{SC}, X^{WB}, X^{OC}, X^{P}, X^{R} and X^{B}. X^{HC} represents a vector of product characteristics capturing health claims (HC) indexed by *h* (*h=1,…,H*), indicating whether or not products containing a heath claim and which type of functionality (cholesterol reducing effect, supporting immunity system, reducing stress and maintain healthy bone). X^{SC}, indexed by a (*a=1,...,A*), is a vector that captures the strengthens of health-related claim, whether it is "reduction disease risk" or a "general function" claim. X^{WB} collects whether a health claim belongs to a well-known brand or not and it is indexed by s (*s=1,...,S*). Our hypothesis is that health claims contribute positively to yogurt prices and their contribution will increase with the level of efficacy guaranteed, as well as with the level of familiarity of the brand. The vector X^{OC} includes other product characteristics, indexed by *l* (*l=1,…,L*), while the vectors X^{P} and X^{R} include package and retail characteristics, indexed by *p* (*p=1,...,P*) and *r* (*r=1,...,R*), respectively. X^{B} is a vector of indicator variables indexed by *b* (*b=1,…,B*) capturing the role of brand image/loyalty on yogurt prices.

Following previous literature, we estimate equation (1) using a single equation approach (Costanigro et al., 2007; Panzone, 2011; Carlucci et al., 2013). We choose the most appropriate functional form from ten different transformations of the dependent variable.

Following Constanigro et al. 2010, a grid search involving 10 discrete choice of the dependent variable, 8 in the form P^{α}, where α varies from –2 to +2 with increments of 0.5 (α=0 is eliminated), the natural log transformation, and the box-cox transformation. We select the best model specification using several criteria: Ramsey's RESET test , Breusch-Pagan / Cook-Weisberg statistics, Skewness and Kurtosis tests as well as monitoring the goodness of fit (R^2) of the models.

3. Data, data manipulation, and estimation

The main database used in the estimation of equation (2) comes from SymphonyIRI Group and contains information on monthly sales in the Italian market (17 IRI regions)[2] encompassing a 25-month period between November 29, 2010, and December 31, 2012. The data contains information on volume sold and value of sales, price (€/L), percentage of store selling each product, number of items in the shelves.

The IRI data allows to identify functional yogurts (under the general umbrella term of "*sante* " – health), and also provides detailed information on manufacturers , brands, flavors, fat content, drinkability, presence of fruit in pieces, whether a yogurt is sold as smoothie or if it presents an additional compartment with cereals, chocolate etc…. Given the broad definition of functionality in our data, the scanner database was augmented with information retrieved from manufacturers' websites and cross-validated using front-of-package and nutritional labels. The health claims reported on the labels were classified according to whether a claim was a "reduction disease risk" or "general function" claims.

An example of how health claims are classified follows: products with the statement "*reduces LDL-cholesterol by ... % in ... weeks*" (or similar) on the label, were classified as carrying a reduction disease risk claim (as it is connected with the reduction of risk factors in the development of coronary heart diseases); this "Cholesterol Reduction" claims, are classified by the indicator *Chol_Red_risk.*[3] Using the same logic, a *Chol_Red_general* attribute indicates a "weaker" cholesterol reduction claim supported by a statement indicating "*it contributes to the maintenance of normal blood cholesterol levels*" or similar. Overall1 in 10 products in our sample carries a health claim. The health claim most represented in our data is "supporting the immune system" (*Immunity_general*) carried by 37.3% of functional yogurts. Yogurts which reduce (*Chol_Res_risk*) or contribute to reduce (*Chol_Res_general*) blood cholesterol, account for 24.7% of the functional products in out our data, while those promoting bowel regularity (*Regularity _general*) and contributing to health bone (*HealthBone_general*) jointly account for 38% (25.3% and 12.7% respectively). Health claims were further divided to capture whether they were supported by a well-known brand, thus reporting the suffix *_Large* or be a less known one, indicated with the suffix *_Small.* [4]

Additionally, we collected information on whether a product was sold as "organic" or "natural," since consumers seems to perceive products with those features as healthier (Rozin et al., 2004). Lastly, we control for variables capturing the market diffusion of the products: these variables are the number of product items of each manufacturers (*Number Items*), the percentage of stores selling the product *(%_Stores_Selling*) and the average weighted

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[2] Although the Italian regions are 20, SymphonyIRI groups data from Piedmont and Aosta Valley, Abruzzo and Molise, and Basilicata and Calabria, resulting in 17 "IRI regions".

[3] Our data contains only one product carrying a risk reduction claim and it refers to lowering the risk of coronary diseases from high cholesterol blood level.

[4] In our database we identify over 200 small brands which accounted for less than 5% of the entire yogurt market; these brands are referred to as *small* brands.

distribution (*AWD*), or the percentage of outlets selling the product, conditional on the manufacturer's products being available in a given store.

Combining the product characteristics in both the original scanner data with t hose obtained from the manufactures' website, we identified 327 products[5] representing unique combinations of attributes, encompassing 77 brands sold by 21 manufacturers for a total of 60,011 observations. Summary statistics of products attributes are reported in Table 1.

The different model specifications are estimated via OLS and the "best" model selected using different metrics: 1) goodness of fit, assessed through the value of an *F* statistic for a test of the joint significance of the parameters in the model, and the adjusted R^2; 2) model specification, via Ramsey's RESET test to detect omitted variables bias (Ramsey, 1969); 3) heteroskedasticity, using the Breusch-Pagan / Cook-Weisberg statistic (Breusch and Pagan, 1979; Cook and Weisberg, 1983); and 4) normality of the residuals, using Skewness and Kurtosis test for normality of the error terms (D'Agostino et al., 1990).

In Table 2 we provide a summary of the test statistics discussed above for the 10 model specifications, each using a different transformation of the dependent variable. Based on the Ramsey's RESET test the semi-logarithmic specification emerged as the most suitable since it does not suffer of omitted variables bias. Also this specification performed the best in terms of data fit (it shows the largest adjusted R^2 of 0.7694 and the largest values of the *F* statistic for the coefficients' joint significance). Although the Skewness and Kurtosis tests formally reject the hypothesis of the errors'being normally distributed, the residuals of the semi-logarithmic specification were the closest to be normally distributed among those of the different model specifications.[6] Misspecification was still present in the model specification and as a measure of caution we re-estimated the model using a White's heteroskedastic consistent covariance matrix; no substantial changes were observed in the estimates. Thus, given the vectors of variables in *X* and the semi-logarithmic functional form, the chosen empirical specification of equation (1) is:

$$lnP_{jmt} = \sum_{h=1}^{H}\sum_{s=1}^{S}\sum_{a=1}^{A} \alpha_{hsa}\, X_{hmt}^{HC} X_{amt}^{SC} X_{smt}^{WB} + \sum_{l=1}^{L} \beta_l X_{lmt}^{OC} + \sum_{p=1}^{P} \beta_p X_{pmt}^{P} + \sum_{r=1}^{R} \beta_r X_{lmt}^{R} \sum_{g=1}^{77} \gamma_g\, X_{gmt}^{B} + \sum_{m=1}^{17} \lambda_m d_m + \sum_{t=1}^{25} \theta_t d_t + \epsilon_{jmt} \qquad (2)$$

where we also control for a vector of *M* market-level (region) and *T* time (month) indicators, d_m and d_t, respectively to capture for regional and monthly average variation in yogurt prices in the data. The α_s, β_s, are parameters to be estimated capturing, respectively, the implicit values associated with health-claims and other product characteristics. The γ_s λ_s, θ_s capture, respectively, brand, regional and time fixed effects while ϵ_{jmt} is an idiosyncratic error term.

[5] Private labels, whose attributes could not be verified, were excluded from the analysis along with products classified as having "other functionality". Yogurts made with milk other than cow milk, and yogurts for kids were also excluded.

[6] We also use a Box Cox transformation of dependent variable as support of model specification decision according with Szathvary and Trestini (2014), Loureiro and McCluskey, (2000), Huang and Lin (2007). Box Cox has been used to choose between linear (λ = 1), log-linear (λ = 0) or inverse (λ = 1) functional forms. The likelihood function is maximised when λ = 0 and the log-linear function is preferred over linear and inverse.

4. Empirical Results and Discussion

The estimated parameters of equation (2) are presented in Table 3. The baseline product is a *RegularFat*, *Plain*, *Non-drinkable* yogurt sold in *Regular* plastic packaging (<300ml) with an average price of 4.30 €/L. The first finding worth highlighting is that all health claims indicators have a positive and significant effect on yogurt price in Italy. The cholesterol risk reduction claim *Chol_Red_risk*, outperforms all other claims. The premium attached to *Chol_Red_risk* is +209.8% compared the baseline alternative and 2.5 times larger than that attached to blood cholesterol management products (*Chol_Red_general*). Other functional claims delivered by well-known brands have also a positive on prices: products carrying "support bone health", "bowel regularity", and "support the immune system" have an impact on yogurt prices of +44.9%, +18.6% and +12.4%, respectively.

These estimates confirm that, among functional yogurts in Italy, the market values more highly those products carrying a "risk reduction" claim than other functional claims, in particular those related to hearth health, as Van Kleef et al. (2005a) study on consumers acceptance of functional product suggests. Also, these higher prices may be justified by consumers showing a strong preference for functional dairy products which prevent or reduce the risk of cardiovascular diseases by lowering the cholesterol level in blood (Ares and Gambaro, 2007; Landström et al., 2007). Scholars have pointed out that, at least for dairy functional category, consumers value the most products with disease risk reduction claim (Van Kleef et al., 2005a; Verbeke et al., 2009). However, as market valuation may depend upon the type of benefit being claimed as well as the carrier delivering the health benefit, a case-by-case assessment may be necessary. Also, existing literature shows that "support bone health" is a highly demanded feature in dairy products. In particular, female consumers prefer functional dairy products added with calcium as they help preventing/reducing the risk of osteoporosis, to which they are more exposed to (Siegrist et al., 2008; Williams, 2008; Ares and Gámbaro, 2007).

Our results show also that claims supported by well-known brands generally outperform those supported by small ones: in 2 out of 3 cases the results confirm that brand image and consumers' brand awareness are strong determinants for functional foods market success (Messina et al., 2008; Ares et al., 2010). The only exception is *Immunity_general_Small*, which shows a positive impact on price 4 times larger than analogue claims supported by a popular or familiar brand. Therefore, our estimates confirm previous findings suggesting that consumer choice of functional products is highly affected by the brand they are sold with, since it represents a promise of quality and a guarantee of the truthfulness of what declared on the package by the manufacturers (Ares et al. 2007, 2010; Annunziata and Vecchio, 2013).

With respect to the estimated impact of other product characteristics on yogurt price, fruit and other flavours show a positive effect of +3.0% and +6.5% compared to the baseline (plain yogurt), while fat content affects yogurt prices negatively. The coefficients for the *Low_Fat* and *Zero_Fat* variables, have a negative and significant impact on price (-4.8% and -2.1%, respectively) partially in line with Carlucci et al. (2013) who found a negative but not significant relationship between the "low-fat" attribute and yogurt's price. The *Drinkable* attribute shows a positive and significant effect :on price (+18.7% compared to the baseline product), in line with Bonanno (2012, 2013) findings which, in the Italian market, consumers seem to prefer drinkable yogurts over regular ones, in particular with regard to the functional alternatives. Also, the premium price attached to drinkable attribute could be justified by the higher level of convenience that drinkable products have compared to regular products. The *Smoothie* and *Lactose_Free* attributes show a positive premium price of +2.5% and +6.1%, respectively, while the presence of added fiber (*Fiber*) leads to a -5.5% lower price compared to the baseline product. However, our finding of the existence of a discount for the presence of fibers in yogurt contrasts with Carlucci et al.'s , (2013) but is supported by other studies highlighting consumers' skepticism for attributes which are "unnatural" or artificially added to a product (Bech-Larsen and Grunert, 2002; Krutulyte et al., 2010; Annunziata and Vecchio, 2013).[7] *Organic* and *Natural* attributes have a positive and significant impact on yogurt price in Italy of, respectively, +44.2% and +94.2% above the baseline product. The high market valuation of these attributes is likely to be the result of consumers' higher willingness to pay for characteristics having a "halo effect" (Schuldt and Schwarz, 2010; Schuldt, 2013). Products labeled as "Organic" and "Natural", are in fact often perceived as healthier than regular ones [8] and supporting the human health is the primary reason for consumers buying organic foods (Ekelund et al., 2003; Hughner et al., 2007).

The other parameter estimates are consistent with previous findings (Carlucci, 2013; Szathvary and Trestini, 2014) and show a higher prices for yogurts sold in glass packaging (*Glass*) and those with two compartments (*Compart_Pack*), for price premiums of +126% and +53.6%, respectively (over the baseline product). This is in line with previous research that finds non-sensory characteristics, such as products packaging, to affect strongly consumer purchase decisions of yogurt (Ares et al., 2010) as consumers associate different levels of product quality to different types of packaging materials. For example packaging in bottles (instead of vase) seems to be used by consumers to infer yogurt wholesomeness (Grunert et al., 2005). However, the existence of a price premium associate with glass packaging may also reflect the higher cost of the material, as suggested by Silayoi and Speece (2004). Last, the estimated coefficients associated with indicators capturing *package size* differences are negative, suggesting that yogurt price declines with size (by -10.1% and -24.3%, respectively, for package size between 300ml-500ml and more than 500ml). Such effects are consistent with the results of Carlucci (2013) and Szathvary and Trestini (2014).

5. Conclusions

In spite of the growing market and the increased consumer interest for foods delivering health benefits, food manufacturers operating in Europe face the challenge to develop new functional food products as well as to have their health claims approved according to Reg.(EC)No.1924/2006. Therefore, functional food developing process has often described as complex, expensive and risky (Van Kleef et al.,2002; Siro et al., 2008) especially if it involves the development of functional food with "reduction disease risk" claims since they require higher level of investment (Brookes G., 2010). However, our results indicate that, in spite of the high investment required to obtain a "reduction disease risk" claim, the market attached to them an higher price compared to "generic function" claims. This results may incentivize firms to apply for "reduction disease risk".

Also, products which claim to reduce or contribute to reduce the cholesterol level in blood, and those which help to maintain health bone, are more valued in the Italian yogurt

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[7] For example, consumers show a positive attitude towards milk with calcium and bread with fibers, since these combinations are perceived naturally health. In both examples the bioactive component is inherent to the carrier (Bech-Larsen and Grunert, 2002; Krutulyte et al., 2010; Annunziata and Vecchio, 2013). Whereas, negative attitudes were expressed in the case of yogurt with omega 3 since the match between carrier and ingredient was considered unnatural (Krutulyte et al. 2011).

[8] Terms as "sustainable", "organic" "genetically-modified free" "unprocessed", "natural" and "home-made" are usually used by consumers to describe healthy products (Rozin, 1994; Schuldt and Schwarz, 2010; Schuldt, 2013).

market. Further, products supported by well-known brands have higher market value, except for helping the immune system functionality. These results suggest also the importance of brands in supporting health claims as brands represents a guarantee of the truthfulness of the information reported on the package (Ares and Deliza 2010; Annunziata and Vecchio, 2013). Additionally, other product characteristics such as organic and natural have a positive and significant impact on yogurt price. Food manufacturers may differentiate their products, not only on the basis of health enhancing features, but also on that of other attributes such as organic, or natural, especially since it encompass consumer's interest towards multiples attributes ranging from food safety, nutrition aspects, ethic values, health and environmental concern (Ernqvist and Ekelund, 2014).

Our results may give a more accurate picture about market preference toward functional claims since estimates are based on real purchasing data collected across the Italian country. Also, our findings allow to evaluate and compare the market value of multiple health claims present on actual products already in the market rather than using fictional products as it is largely done in the literature. Our approach, using a large database of actual purchase allows, in a certain way, to overcome the limits of focus groups and survey based methods, whose findings often indicate conflicting results mainly due to the use of limited sample size. Therefore, making marketing decisions by employing of those techniques is considered to be one of the reasons for the relatively low new product success rates (van Kleef et al., 2005b; Wind and Mahajan,1997).

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Table 1. Descriptive statistic (60,011 observation)

Variable	Mean	Std. Dev.	Min	Max
Price	4.305	1.480	0.889	15.450
Claims variable				
Chol_Red_risk	0.016	0.128	0	1
Chol_Red_general	0.014	0.117	0	1
Chol_Red_general_Small	0.009	0.095	0	1
Immunity_general	0.050	0.219	0	1
Immunity_general_Small	0.009	0.096	0	1
Regularity _general	0.028	0.167	0	1
Regularity _general_Small	0.012	0.112	0	1
HealthBone_general	0.020	0.142	0	1
Product characteristics				
Plain	0.301	0.458	0	1
Fruit	0.488	0.499	0	1
Others_flavour	0.209	0.407	0	1
RegularFat	0.301	0.458	0	1
Low_Fat	0.259	0.438	0	1
Zero_Fat	0.248	0.432	0	1
Lactose_Free	0.017	0.132	0	1
Drinkable	0.231	0.421	0	1
Fiber	0.065	0.247	0	1
Natural	0.013	0.114	0	1
Organic	0.068	0.252	0	1
Smoothie	0.002	0.0482	0	1
Packaging type and size				
Glass	0.019	0.1390	0	1
Compart_Pack	0.097	0.2972	0	1
Regular	0.750	0.4327	0	1
Medium	0.249	0.4327	0	1
Large	0.001	0.0343	0	1
Retailing variables				
Number of Items	3.182	3.513	0	55
%_Stores_Selling	0.147	1.398	0	100
AWD	30.184	28.216	0	100

Table 2. Model Diagnostics used for model selection

	Model Fit		Specification	Heteroskedasticity	Normality
	Adj R^2	*F*-stat	Ramsey's RESET	Breusch-Pagan / Cook-Weisberg	Skewness and Kurtosis
Transf.			F(3, 59883)	$chi^2(1)$	$chi^2(2)$
-2	0.7254	1279.70	1824.44	78477.70	48759.70
			(0.0000)	(0.0000)	(0.0000)
-1.5	0.7490	1444.86	963.71	29592.58	30673.02
			(0.0000)	(0.0000)	(0.0000)
-1	0.7629	1557.96	408.74	9917.71	18175.36
			(0.0000)	(0.0000)	(0.0000)
-0.5	0.7693	1615.20	101.85	2131.61	10069.09
			(0.0000)	(0.0000)	(0.0000)
Box-Cox	0.7684	1606.89	10.95	119.71	**4530.75**
(0.138)			(0.0000)	(0.0000)	**(0.0000)**
Log	**0.7694**	**1616.00**	**1.52**	**0.53**	5190.24
			(0.2072)	**(0.4668)**	(0.0000)
0.5	0.7634	1562.22	123.57	1892.97	4832.17
			(0.0000)	(0.0000)	(0.0000)
1	0.7629	1459.27	494.19	8141.35	12113.60
			(0.0000)	(0.0000)	(0.0000)
1.5	0.7310	1316.45	1107.08	19902.38	26893.00
			(0.0000)	(0.0000)	(0.0000)
2	0.7029	1145.83	1846.18	38613.02	45968.89
			(0.0000)	(0.0000)	(0.0000)

Note: Probability values in parenthesis below the test statistics.

Table 3. Estimated parameters and marginal effects

Variable	β	S.E.	Significance	Percentage premium price‡
Claims variables				
Chol_Red_risk	1.172	0.040	***	+209.8
Chol_Red_general	0.618	0.009	***	+83.8
Chol_Red_general_Small	0.125	0.009	***	+12.3
Immunity_general	0.127	0.009	***	+12.4
Immunity_general_Small	0.417	0.009	***	+50.2
Regularity _general	0.178	0.007	***	+18.6
Regularity _general_Small	0.060	0.008	***	+5.3
HealthBone_general	0.412	0.041	***	+44.9
Product characteristics				
Fruit	0.032	0.001	***	+3.0
Others_flavour	0.065	0.002	***	+6.5
Low_Fat	-0.044	0.005	***	-4.8
Zero_Fat	-0.019	0.002	***	-2.1
Lactose_Free	0.072	0.012	***	+6.1
Drinkable	0.177	0.005	***	+18.7
Fibre	-0.052	0.004	***	-5.5
Natural	0.704	0.040	***	+94.2
Organic	0.383	0.017	***	+44.2
Smoothie	0.044	0.019	*	+2.5
Packaging and size				
Glass	0.860	0.040	***	+126.9
Compart_Pack	0.434	0.005	***	+53.6
Medium	-0.103	0.003	***	-10.1
Large	-0.249	0.029	***	-24.3
Retailing variables				
Number of Items	-0.006	0.000	***	-0.6§
%_Stores_Selling	-0.002	0.000	***	-0.2§
AWD	-0.001	0.000	***	-0.1§
Constant	0.7709	0.041	***	

*Note: *, ** and *** are 10, 5 and 1% significance levels.*
‡ The marginal effect of binary variables are calculated using the adjustment by Kennedy (1981).
§ For continuous variables we present average elasticity values.
The estimated coefficients for regional fixed effects, brand and monthly indicators are omitted for brevity.