MARKET VALUATION OF NUTRITIONAL AND HEALTH CLAIMS ON YOGURTS IN SPAIN: A HEDONIC PRICE FUNCTION APPROACH

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**Abstract**

This article investigates price effects of nutritional and health claims (NHC), in addition to other attributes, on yogurts in Spain. Prices and product characteristics were collected from supermarket shelves in the main city of Aragón (Zaragoza) Spain. A hedonic price model is estimated to identify the implicit price from a sample of 508 yogurts. Results show that yogurt is a highly differentiated food product and that health claims outperform nutritional claims leading to higher premium prices.

**Keywords:** Hedonic price, yogurt, nutritional and health claims.

## 1. Introduction

Developing functional food and ingredients with increased health benefits has been one of the main objectives of the food industry lately. Increased awareness in health issues has led to an increase consumption of functional dairy products, and more specifically yoghurts containing nutritional supplements. The consumption of sufficient amounts of yogurt live microorganisms promotes health benefits such as reduced risk of type 2 diabetes (Diaz-Lopez et al., 2015) and prevention of cardiovascular diseases (Astrup, 2014). Commercial yogurt has created a widely segmented market offering a variety of functional products including nutritional claims (NCs) such as sweetened, low-fat, enriched in calcium and other functional yogurts with health claim (HC) properties. One of the hurdles in the success of these products is that a functional food is a credence attribute, meaning that it cannot be easily recognized by consumers even after repeated consumption resulting to asymmetric information. To reduce the asymmetric information, the European Union has created certain regulations presenting NCs[1] and HCs[2] to guarantee better informed food choices. Previous research on consumer acceptance of NHCs has proven that these regulations aim consumers make healthier informed food choices, among others (Bimbo et al., 2016) however, there is a scant literature assessing NHC implicit prices of Spanish yogurts. The main objective of this work is to fill that gap and assess the market valuation of (among other attributes) NHCs of yogurts in Spain.

## 2. Material and Methods

### 2.1 Data collection

To determine the presence of yogurt attributes we created a database that collects information available to the physical stores[3] in Zaragoza - Aragón between July and September 2015. The final sample was 508 with prices depending on quantity with a minimum of €0.89 to a maximum of €6.75 with an average price of €1.69/kg. The most common size found was the plastic Quattro pack of 125g (500g). All NC and/or HC in the packaging were identified based on the official EU regulations.

### 2.2 Hedonic price theory

According to Rosen (1974), the hedonic price function assumes that market goods consist of a set of characteristics that can be represented by a vector $k$ of attributes: $z = (z_1, z_2, \dots, z_k)$. According to economic theory, consumers maximize utility under a budget constraint:

[1] Regulation 1942/2006 defines a nutritional claim as "…any claim which states, suggests or implies that a food has particular beneficial nutritional properties…"
[2] A health claim as defined by the same Regulation (EC) and an update of No 432/2012 is "… any claim that states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health…"
[3] Three food distribution chains (Carrefour, Mercadona and Dia), which account for 40% of the sector's market share (Kantar Worldpanel, 2017)

$$P_j = f(x_{j1}, x_{j2}, \dots, x_{jk}) \quad (1)$$

where, $P_j$ represents the price of the $j^{th}$ market good and the $x_{jk}$ the quantity of the attribute. Expression (1) can adopt different functional forms. The semi-logarithmic (dependent variables is Napierian logarithm of price) form is the one mostly used (Muñoz et al., 2014).

**2.3 Results and conclusions**

In the dependent price model the quantity variable is measured in grams. The rest are dummy variables.

Two likelihood ratio statistics are performed to verify if the semi-logarithmic functional form is significantly preferred to a liner or a double-logarithmic specification, respectively. According to the model comparison results[4] a semi-logarithmic model is estimated as follows:

$$lPrice = \alpha + \beta_1 \times Quantity + \beta_2 \times Brand_{ProcOwn} + \beta_3 \times Ret_{Hyper} + \beta_4 \times Ret_{Disc} + \beta_5 \times Sch_{Drink} + \beta_6 \times Sch_{Bifidus} + \beta_7 \times Sch_{Natural} + \beta_8 \times Sch_{Greek} + \beta_9 \times Sch_{Fruit\_Flav} + \beta_{10} \times N_{Fatfree} + \beta_{11} \times N_{NoSugar} + \beta_{12} \times N_{Fiber} + \beta_{13} \times N_{Protein} + \beta_{14} \times N_{VitB6} + \beta_{15} \times N_{Calcium} + \beta_{16} \times H_{VitB6} + \beta_{17} \times H_{Cholesterol} + \beta_{18} \times H_{Fiber} + \beta_{19} \times H_{Lactose1} + \beta_{20} \times H_{Calcium} + \beta_{21} \times H_{Lactose2} + \varepsilon_i \quad (2)$$

The magnitude of the coefficients is the percentage change of price in view of the change in a unit of the independent variable. In the case of a continuous variable this percentage change can be determined as:

$$(\partial P/\partial Z_i)\,(1/P) = (\partial LnP/\partial Z_i) = (\beta_m) \quad (3)$$

That can be expressed as a percentage $100 \times \beta_m$ (Kennedy, 1981):

$$100 \times (\exp[\beta_m - 0.5Var(\beta_m)] - 1) \quad (4)$$

where $(\beta_m)$ is the estimated variance of parameter *m*. All the percentage variations for each of the attributes used in the estimation model are shown in the fourth column of table 1 (Percentage impact that each dummy variable has on price) - (PIP). Values appearing in the fifth column are the result of applying the percentage impact on a reference price (€1.69 $kg^{-1}$), so implicit prices (IP) were calculated.

The effect of processor "*Brand*" has a negative PIP of -44.11% valued with an IP of €0.57/kg compared to own supermarket brand. Regarding the different types of retail channels, the price decreases by -10.23% for "*Ret_Hyper*" with respect to the "*Ret_Neigh*" stores. "*Sch_Greek*" yogurts are the mostly valued with an IP of €1.25kg/l followed by "*Sch_Drink*" yogurts (€1.18/kg).

Unexpectedly, three NCs with the highest presence in the market ("*N_FatFree*", "*N_NoSugar*", and "*N_Fiber*") do not seem to affect yogurt prices. This result is in contrary to consumers' preference growth for low-caloric food products. However, since these NCs are introduced long time ago, they might be in the maturity stage of the product lifecycle. On contrary, two NCs that were later introduced "*N_Protein*" and "*N_VitB6*" receive IPs of €1.30/kg and €1.83/kg, respectively. This outcome seems understandable since both are considered innovative, are in the growth stage of the product lifecycle and have a limited competition (only Danone). By contrast, HCs better responded yogurt prices. In particular, the highest IP is received by yogurts that bare the "*H_Cholesterol*" claim (€1.77/kg) with a positive PIP of 70%, followed by the "*H_Lactose2*" claim (47% positive PIP and an IP of €1.53/kg). It is worth mentioning that "*N_Calcium*" has negative price effect when comes alone as a NC but when it is accompanied by a HC receives 9% positive PIP with a €1.12/kg IP.

[4] Both models had similar goodness of fit values ($R^2$), similar adjusted $R^2$, and show no problem with the normality of residuals (probability of Jarque-Bera statistic of 0.00). Ramsey's RESET test shows that the specification of double logarithm model is rejected and the values of both Akaike and Schwarz information criterion are higher than those of the semi-logarithmic model. Heteroscedasticity is tested by the Breusch-Pagan-Godfrey and White test statistic. The null hypothesis of the homoscedasticity in the error term is rejected in both contrasts (probability F-statistic 0.00), that indicates homoscedasticity problems. White's robust estimation strategy to obtain the parameter standard errors was used to solve this problem.

Table 1 – estimates of the price hedonic equation

| | Semi-logarithmic (log-lin) | | | |
|---|---|---|---|---|
| | Coefficient[a] | (SE) | Percentage impact on Price (PIP) (%) | Implicit price (IP) (€/Kg)[b] |
| Constant (α) | 1.6396*** | 0.11 | - | - |
| Quantity | -0.0007*** | 0.00 | -0.07 | 0.99 |
| Brand | -0.5576*** | 0.05 | -44.11 | 0.57 |
| Ret_Hyper | -0.0843** | 0.05 | -10.23 | 0.92 |
| Ret_Disc | -0.0581 | 0.05 | -7.97 | 0.94 |
| Sch_Drink | 0.1642*** | 0.06 | 14.60 | 1.18 |
| Sch_Bifidus | 0.0774 | 0.05 | 5.13 | 1.08 |
| Sch_Natural | -0.0724 | 0.05 | -9.13 | 0.93 |
| Sch_Greek | 0.2238*** | 0.05 | 22.25 | 1.25 |
| Sch_Fruit_flav | -0.0295 | 0.06 | -5.64 | 0.97 |
| N_FatFree | -0.0361 | 0.04 | -5.36 | 0.96 |
| N_NoSugar | 0.0071 | 0.05 | -1.84 | 1.01 |
| N_Fiber | 0.0147 | 0.06 | -1.74 | 1.02 |
| N_Protein | 0.2594*** | 0.04 | 26.98 | 1.30 |
| N_VitB6 | 0.6043*** | 0.12 | 72.17 | 1.83 |
| N_Calcium | -0.0820** | 0.04 | -9.87 | 0.92 |
| H_VitB6 | -0.1922 | 0.12 | -22.45 | 0.83 |
| H_Cholesterol | 0.5699*** | 0.07 | 70.35 | 1.77 |
| H_Fiber | 0.0767 | 0.15 | 0.29 | 1.08 |
| H_Lactose1 | 0.0686 | 0.05 | 4.21 | 1.07 |
| H_Calcium | 0.1113** | 0.06 | 8.55 | 1.12 |
| H_ Lactose2 | 0.4229*** | 0.08 | 46.74 | 1.53 |
| $R^2$ | 0.6584 | | | |
| Adjusted $R^2$ | 0.6436 | | | |
| F-test | 14.82 (0.00) | | | |

Notes: [a] p-values calculated with robust HC3 standard errors. *, **, *** Significant at 1%, 5% and 10% level, respectively.
[b]Reference price: €1.69 / kg

Results show that yogurt is a highly differentiated food product. Manufacturers should take into account the growing consumer concerns on healthier food products and heterogeneous preferences and focus on identifying groups of consumers with specific preferences, rather than being focused for the whole marketplace. Our findings show that HCs outperform NCs leading to higher premium prices. These results may be a useful source in a better understanding of the evolution of NHCs in the Spanish market. NCs accompanied by the corresponding HC, which exactly defines the benefits of that nutrient on our health may be a promising strategy for product differentiation.

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