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Market implications of new regulations: impact of health and nutrition information on consumer choice

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Abstract

Consumer concern for health impacts of diet has increased the use of nutritional information and claims by agro-food industry. Under the current European legislation on nutrition and health claims and on nutritional labelling, three type of nutritional information can be provided on food products: nutritional facts panel, nutritional claims and health claims. In this context, the aim of the paper is to assess how much consumers' value the provision of three types of nutritional information in a meat product not precisely perceived as healthy, "pork Frankfurt sausages", using a choice experiment. The data comes from a survey conducted in two Spanish medium size towns (Zaragoza and Córdoba) during 2007. A mixed logit model is used to estimate the effect of the nutrition information attributes on consumers' utility and derive their willingness to pay. Results show that all three nutritional and health information items are valued by consumers, although preferences are heterogeneous. Health claims are significantly higher valued than nutritional attributes (facts panel or claim). Estimated market shares show that the use of any of the available labelling options will obtain significant market success even at prices including premiums above current price levels.

Additional keywords: choice experiments, demand, health claims, nutrition claims, nutrition facts panel, sausages.

Resumen

Implicaciones en el mercado de una nueva regulación: el impacto de la información nutricional y de salud en la elección del consumidor

La preocupación de los consumidores por los impactos de la salud de la dieta ha supuesto que la industria agroalimentaria haya incrementado la presencia de información nutricional y de salud en sus productos. La legislación comunitaria relativa a las alegaciones nutricionales y de salud, así como de etiquetado nutricional, permite la inclusión en los alimentos de tres tipos de información nutricional: composición nutricional, alegaciones nutricionales y alegaciones de salud. En este contexto, el objetivo del presente artículo es evaluar en qué medida los consumidores valoran la presencia de estos tres tipos de información nutricional en un producto cárnico utilizando la metodología de los experimentos de elección. La aplicación empírica se centra en un producto que no es percibido como saludable por los consumidores: las salchichas de cerdo cocidas tipo Frankfurt. Para ello se ha llevado a cabo una encuesta a consumidores en dos ciudades medianas españolas (Zaragoza y Córdoba) en el año 2007. Se han estimado los efectos de los distintos tipos de información sobre la utilidad de los consumidores a partir de un modelo de parámetros aleatorios, así como la disponibilidad a pagar por ellos. Los resultados obtenidos muestran que los tres tipos de información son valorados por los consumidores, aunque las preferencias son heterogéneas. Las alegaciones de salud son significativamente más valoradas que las fuentes de información relacionadas con nutrientes, ya sean como composición nutricional o como alegación. También se han estimado cuotas de mercado para evaluar el éxito potencial de la introducción de nuevas estrategias de etiquetado en este mercado, detectando que cualquiera de las opciones de etiquetado obtendría cuotas de mercado significativas, incluso si éstas llevaran asociados incrementos de precios.

Palabras clave adicionales: alegaciones de propiedades saludables, alegaciones nutricionales, demanda, experimentos de elección, salchichas.

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Abbreviations used: CE (choice experiments), EU (European Union), HCLAIM (health claim), ML (mixed logit), NCLAIM (nutrition claim), NPANEL (nutrition facts panel), RPL (random parameter logit), WTP (willingness to pay).

Introduction

Concern for the health impacts of diet has an increasing importance on consumer food choice, and can now be considered as important as taste when generating an image of product quality (Grunert, 2006). This has lead to an increase in the use of nutritional information and claims by agro-food industry (Cheftel, 2005). Some of the issues consumers associate with "following a healthy diet" are associated with specific nutrient intake[1] (EC, 2006) and therefore, consumers willing to pursuit a healthy diet need to be informed about the nutritional composition of foods. Thus, if the health status of citizens is to be improved through diet, communication regarding nutritional information is a potential strategy which can deliver benefits both from a public (regulation) and a private (business strategy) perspective.

From a public perspective, regulation has been developed regarding two types of labels that can be present on food products: nutrition facts panel and claims. While the former has been regulated at the European Union (EU) level for over a decade, claims (either nutritional and health related) were somehow unregulated. As an answer to the legislative disparities existing among Member States, the EU regulated claims with the objectives of consumer protection and single market assurance (Regulation 1924/2006 on nutrition and health claims made on foods, OJ, 2006). This regulation distinguishes between nutritional and health claims establishing clear-cut requisites for their inclusion on food labels. Claims beyond "specific nutritional profiles" will need to be approved by the relevant food authority based on sound scientific knowledge, thus obtaining permission to include specific claims will be require substantial effort both financial and administrative.

Under this regulatory framework and from a private perspective, food companies will have, at least, three different instruments at their disposal to enhance the communication of health-related benefits of their products. The first is to provide information on the nutritional composition of the product (nutrition facts panel[2]). Second, and if the product has been manufactured to meet nutritional claims requirements as reflected in Regulation 1924/2006, they can introduce one of the wordings reflected in the Annex of the Regulation. For example, if the product has a fat content that implies a reduction of at least 30% when compared with regular products producers can include a nutritional claim label in the form of "reduced fat content". Last, and if approved by the relevant food safety authority, a health claim related to the benefits derived of low fat intake could also be included. As fat consumption is related to coronary diseases, such a health claim could be geared to communicate the potential reduction in this type of illnesses.

Although a great number of empirical studies have been undertaken regarding consumer understanding and use of nutritional labels, there is still not too much research regarding consumer understanding and use of nutrition and health claims and their impact on food choices. Moreover, none of the empirical studies on nutritional labelling found has evaluated consumers' preferences for the simultaneous provision of the different types of nutritional and health labels allowed in the EU legislation (nutrition facts panel, nutrition claim and health claim). This is the aim of the paper, to assess how much consumers value the provision of these three types of nutritional information on food packages when making food choices. Additionally, this paper also estimates the potential market impact derived from the introduction of these nutrition and health related labelling strategies.

Understanding consumers' food choices is an important issue in today's competitive and saturated food markets; however this is a difficult task. This difficulty arises from the increase in consumers' demands for more diversified and high quality food products. The quality concept has also become a complex issue because it comprises several dimensions. Originally, taste, appearance and smell were the attributes of food products consumers valued most. However, in recent decades consumers are demanding other food product attributes; with health, convenience and process as the

[1] *i.e.* "avoid fatty food", "avoid sugar food" and "avoid too much salt" are nutrition based statements identified by more than one out of five European citizens with "eating a healthy diet".

[2] The current regulation on Nutritional Labelling (90/496/ECC) established that nutrition labelling is optional unless a nutrition claim is made, when it becomes compulsory. It also lays down a standardised format in which nutrition labelling must be presented and defines two different label types. The basic label, containing information on the four basic nutrients (energy, proteins, fats and carbohydrates) and detailed label containing information on the four mentioned nutrients plus sugar, type of fat, cholesterol and sodium.

most important ones (Brunso *et al.,* 2002). While taste, appearance and smell are search or experience attributes, the last three attributes mentioned are credence attributes since they are not revealed to consumers even after they buy and use the product, unless additional information is provided (Nelson, 1970). Truthful labelling of credence attributes transforms them into search attributes, allowing consumers to judge products before purchasing (Caswell, 1998) and helping them to make food choices that better reflect their preference (Henneberry and Armbruster, 2003; Martínez-Carrasco *et al*., 2004).

Several empirical studies have examined consumers' preferences for diverse credence attributes. However, although the health attribute has become the most important for many consumers[3], most of the empirical work has focused on analyzing production process attributes (*i.e.* organic, genetically modified, designation of origin) (Umberger *et al.,* 2003). As health is a credence attribute that cannot be revealed to consumer even after purchasing[4], additional credible information on the unobserved characteristics, health and nutrition, must be transmitted. The objective of these credible signals *(i.e.* labels or claims) is to inform and persuade consumers about the healthiness of the food product in order to help them make healthier choices that better reflect their preferences.

A large number of empirical studies have been conducted to analyze the relationship between consumers and the different nutrition labels products on food products. However, most of them have focused on consumer understanding and use of the nutrition facts panel label and health and nutrition claims[5]. Only a minority have been conducted to assess the effect of different nutrition and health labels and/or claims on consumers' food choices. Roe *et al.* (1999), Garrestson and Burton (2001), Kozup *et al.* (2003) and Basil *et al.* (2005) studied the effect on consumers' food product evaluations, attitudes towards purchase intention, of nutrition information presented both as panels and claims. Roe *et al.* (1999) studied the effect of a nutrition or health claim on consumers' health evaluation and intention to purchase three food products (cereal, lasagne and yogurt) and ten different nutrition and health. Results indicate that when a food product carries a health and, to lesser extent, a nutrition claim, consumers view the product as healthier and state they are more likely to purchase it. Garretson and Burton (2001) studied the effects on consumers' attitudes and purchase intention of nutrient information contained in the nutrition facts panel and nutrition and health claims. Results indicate that the effect of the nutrition facts panel on the intention to purchase is stronger than the effect of the claim. Kozup *et al.* (2003) carried out the same type of analysis distinguishing between food products and restaurant menus. Findings indicate that a health claim can have favourable effects on product attitudes and purchase intentions in both cases. The use of heuristics as a mean to understand nutritional information is the subject of the study by Basil *et al.* (2005). They analyze the effect of specific health and nutrition labels on consumers' food choices in Canada concluding that when individuals use a heuristic to read a nutrition label, they make more accurate food choices. In other words, consumers' prefer using shorter nutrition and health information to take the final food choice reducing the time spent making them.

Finally, Bond *et al.* (2007) use a choice experiment to estimate the willingness to pay (WTP) for a number of health and nutrition claims as well as, some production process attributes for a packaged red leaf lettuce. Results showed that specific health claims were more valued by consumers than general health claims. The current paper is in line with the last study, but it expands its objectives measuring consumers' preferences towards three types of labels, including a detailed nutrition facts label, a nutrition claim and a health claim. In other words, it evaluates how much consumers' value the provision of nutritional information from a detailed nutrition label, a nutrition claim and a health claim with respect to the product price. It also expands the type of analysis provided as it evaluates the potential market success of different information dissemination strategies.

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[3] A number of studies indicated that today, the health attribute is as important as taste for consumers when making food purchase decisions (Brunso *et al.*, 2002).

[4] As Roosen *et al.* (2007) point out, nutrition attributes are considered credence attributes because they are only experienced after a very long period of time and experience depends on public and private information policy.

[5] See Cowburn and Stockley (2005), Williams (2005); Drichoutis *et al.* (2006) and Grunert and Wills (2007) for a revision of those papers.

Material and methods

Product selection

Previous research has highlighted the importance of product-specific attributes on the demand for products with nutrition labels. As far as the attribute of perceive healthiness is concerned one could identify three product groups: those which consumers perceive as healthy, as unhealthy and those to which consumers do not attach any pre-defined healthiness level. This paper focuses on a meat product not precisely perceived as healthy, "pork Frankfurt sausages", and particularly on information and claims related to fat reduction. This selection is based both on demand and supply aspects. Considering demand, over 50% of consumers who declare to have changed their eating habits at the EU level have done so to reduce their fat intake (EC, 2006; p. 37). Thus fat seems to be a prominent nutrient consumers would focus their attention on. Second and from a supply-side perspective, sausages are an important source of fat with contents reported to be as high as 20% of total weight (Ruiz *et al.,* 2006). Therefore it would seem logical that the biggest market potential for nutritional and health claims related to fat content is to be developed in products perceived to have high fat content, if producers want to remain in the market. Peng *et al.* (2006) already state that health claims, specially if not counter-intuitive, can increase interest in products perceived as less healthy, a conclusion in line with Bech-Larsen *et al.* (2001) who conclude that enrichment (in our case fat reduction) is found more justified in this type of products. Developments in the sausage market towards the use of other meats with less fat (*i.e.* chicken, turkey etc.) or even functional sausages have been already undertaken, thus promotion of these benefits under the above-mentioned regulation is due to occur in the short-run.

Methodology

To estimate consumer preferences for the three nutritional information strategies mentioned above, the choice experiment methodology (CE) has been selected. CE are applied because this methodology presents choices in a context that explicitly highlights the trade-offs that often have to be made in actual purchasing decisions and it allows obtaining WTP estimates for different attributes if price is included in the choice set design. Moreover, under some assumptions, this tool allows simulating the market potential of new goods which are introduced into a determined market structure. Moreover, CE are used because it allows to value multiple attributes simultaneously, the consistency of CE with random utility theory, and the similarity of the hypothetical choice to real market decisions (Adamowicz *et al.,*1998; Lusk *et al.,* 2003).

Choice modelling is based on Lancastrian consumer theory of utility maximization (Lancaster, 1966) and random utility framework (McFadden, 1974). In the choice modelling approach consumers choose between alternative products that contain a number of attributes with different levels. Individuals select the alternative that provides the greatest utility and the probability of selecting an alternative increases as the utility associated with it increases. The utility function is known by the individual but some of its components are unobserved by the researcher. Thus, utility (U) is taken as a random variable which can be represented as,

$$U_{njt} = v_{njt} + \varepsilon_{njt} \quad [1]$$

Where n is the number of respondents; j the number of alternatives within choice set J, t the number of choice occasions, v_{njt} utility determined by the attributes and their values for alternative j in t choice occasions and ε_{njt} an extreme value error term $(0,\sigma^2)$, *i.i.d.* over alternatives and independent of v_{njt}.

Different choice models can be derived, contingent on the specification of the density of unobserved factors $f(\varepsilon_{njt})$. The selection of this function will depend on the assumptions underling consumer's preferences. If preference heterogeneity across consumers is expected, a general specification such as the random parameters (RPL) or mixed logit (ML) model can be used. Assuming that v_{njt} is linear in parameters ($v_{njt} = \beta_n' x_{njt}$), each consumer has his own vector of parameters β_n[6] which deviates from the population mean β by the deviation parameters η_n. β_n is random across individuals with a density function $f(\beta)$. In the ML model, the conditional probability that individual n chooses alternative j in a particular choice occasion t, is represented as:

[6] β_n does not carry the subscript t as taste is assumed to vary over respondents but not over choices.

$$L_{njt}(\beta_n) = \frac{\exp(\beta'_n x_{njt})}{\sum_i \exp(\beta'_n x_{nit})} \quad [2]$$

For the maximum likelihood estimation, the conditional probability of the sequence of choices made by each respondent is obtained according to the following expression:

$$S_n(\beta_n) = \prod_t L_{nj(n,t)t}(\beta_n) \quad [3]$$

Where *nj(n,t)* represents the alternative chosen by person *n* in choice occasion *t*. The unconditional probability for this sequence is given by:

$$P_n(\theta) = \int S_n(\beta_n) f(\beta_n \mid \theta) d\beta_n \quad [4]$$

Since the integral in [4] does not have a close form, the probabilities have to be simulated by summing over R random draws of β, which are taken from the probability density function $f(\beta_n|\theta)$[7]. For the estimation of the ML, Halton draws rather than random draws are used since they provide a more efficient simulation for the ML.

To estimate the mixed logit model, the researcher has to specify a distribution for the random coefficients which satisfies his expectations about consumer behavior (Train, 2003)[8]. In this case, since consumers may either like or dislike the nutrition and health information attributes considered in the experimental design, a normal distribution is assumed. The estimation of the mixed logit was conducted using NLOGIT 3.0 (Greene, 2002) keeping price as a fixed coefficient and letting those for the other three attributes be random.

Choice experiment design

When designing the choice task for consumers the different products presented were described as combinations of four attributes: price, type of nutrition facts panel, presence of nutrition claim and presence of health claim. These attributes could take different levels, for example, the price vector selected was chosen to reflect the current price levels found in Spanish supermarkets for this product[9]. However, the upper bound was extended to include a 50% premium in order to capture potential higher prices consumers could be willing to pay for the information presented in the new labels. Two levels were considered for the nutrition facts panel attribute. The basic nutrition facts panel option contains only the four nutrients that EU nutritional labelling regulation considers as basic (Directive 90/496/ECC; OJ, 1990), while the detailed one presents additional information consumers could value and that is currently available in some sausages. Values have been calculated from existing data on actual sausages. In order to allow the inclusion of a nutritional claim on "low fat content" as foreseen in the annex of the new EU regulation on nutrition and health claims made on foods (Regulation 1924/2006; OJ, 2006) fat content was reduced by 30% based on the data provided by Ruiz *et al.* (2006). The health claim used is related to cardiovascular diseases. There is sufficient scientific evidence relating the relationship between fat intake and this type of diseases as to consider that this claim could be approved by the European Food Safety Authority (Hooper *et al.,* 2001). A summary of the attributes and levels can be found in Table 1.

The optimal design consists of a choice set in which the number of attributes that differ between any pair of profiles in the choice set is $(k/2)+1$ where k is the number of attributes (Burguess and Street, 2004). The choice set design used in this application was created following Street *et al.* (2005). The procedure to generate it starts with a full factorial design which in this case is comprised of 32 product profiles (4·2·2·2), which are then used to obtain suitable pairs. As the number of attributes is four, the optimal design consisted of all pairs with three different attributes, and the levels of three attributes in each element of the choice set are changed and the level of fourth attribute is left unchanged. Repeating this task three times, results in 96 pairs. After removing repeated choice sets we obtain the final choice set design which is comprised of 80 pairs of products. This design is 97.5% efficient and all attribute main effects can be estimated independently of each other. Because 80 choices were too many for a respondent to complete, the 80 choice sets were randomly split into 20 blocks and each respondent was asked to choice one block of four choice sets[10].

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[7] Further details on the simulation procedure can be found in Train (2003).

[8] The most commonly distributions considered are normal, lognormal, triangular and uniform.

[9] Different food outlets were surveyed both in Zaragoza and Córdoba on March 2007 to obtain a sample of existing prices for 5 piece Frankfurt pork sausages. A total of 40 prices were obtained, with mean price 0.45 € and S.D. 0.15,

[10] In the survey additional choice questions were included for other products, thus four choices per product was the limit fatigue aroused.

Table 1. Attributes and levels used in the experimental design

Attribute	Levels
Price	€0.20, 0.40, 0.60 or 0.80 per pack
Nutrition facts panel	Basic (energy, fat, protein, carbohydrates) Detailed (basic plus sugar, type of fat, cholesterol and sodium)
Nutrition claim	None Low fat content
Health claim	None Reduces the risk of cardiovascular diseases

Figure 1. Sample choice card.

In each of the four choice sets, consumers were asked to choose between two alternatives, each representing a different type of pork Frankfurt sausages packages (5-pieces), and a third alternative which represented a no-buy scenario. Inclusion of this "opt-out" clause is significant in product evaluation as in "real purchase decisions" consumers can defer purchase or purchase elsewhere (Enneking, 2004; Hu *et al.*, 2004). Prior to the choice question, the functioning of the experiment was explained to participants, indicating the pork Frankfurt sausages attributes included in the experimental design and their levels as well as the existence of a no-buy option for each choice. To get consumers stimuli to the product, they were shown a colour picture with both product choices, while a sample choice card is included as Figure 1.

Survey design and sample characteristics

Data were collected from a survey conducted in two medium-sized Spanish towns, Cordoba and Zaragoza, during March and April 2007. These towns, one from the North and the other from the South of Spain were selected to reflect northern and southern diet patterns in Spain. Moreover, Zaragoza was chosen because it is a town widely used by food marketers and consulting companies since the socio-demographics of this town are representative of the Spanish Census of Population (INE, 2004), a requirement partly fulfilled by Córdoba (see Appendix). The questionnaire was designed to analyse the relationship between consumers' health and diet concerns and food consumption. In particular, consumers were asked questions related to health, diet and food safety attitudes, nutritional knowledge, food label use and pork Frankfurt sausages consumption patterns. The questionnaire also contained questions on socio-demographic characteristics (i.e. sex, family size and composition, age, education level, income). Prior to the main survey, this questionnaire was validated using a pilot survey of 20 consumers in each town to test for understanding and interview length.

Sample size in both towns was set at 400, thus, assuming a confidence level of 95.5% (k=2) and p=0.5, the error is ±5% as both populations can be considered infinite. A stratified random sample of consumers was made on the basis of town district[11] and age. A number of representative grocery stores and supermarkets were selected in each town district, and food shoppers were randomly approached outside these food outlets. Target respondents were the primary food buyers in the household and interviews carried out face to face. Interviewers contacted the randomly selected individuals asking them two screening questions, whether they were the main household food shopper and whether they consumed pork Frankfurt sausages. In the case of a negative response to either the first or the second screening questions, the interviewer selected randomly another customer belonging to a given age group, and asked the screening questions until a participant matching both requirements were found. The average survey length was approximately 15 minutes.

Summary statistics for the characteristics of the full sample are presented in Table 2. The majority of respondents were female (72%), something common when targeting persons responsible for food purchases. The

[11] Sampling according to town district is chosen in order to capture the different socio-economic consumer profiles that exist in each district.

Table 2. Socio-demographic characteristics of the sample (% unless stated)

Gender	
- Male	28
- Female	72
Age (average from total sample)	45.54
Education of respondent	
- Elementary School	29.5
- High School	34.0
- University	36.5
Average household income[a]	
- < €600	2.1
- Between €600 and 1,500	15.5
- Between €1,501 and 2,500	32.5
- Between €2,501 and 3,500	19.5
- Between €3,501 and 4,500	10.1
- > €4,500	6.3
Household size (average from total sample)	3.13
Households with children less than 6 years old	19

[a] 14% of respondents do not provide information on the income level

respondent's average age was about 45 years, living in a household with an average of 3 members. Around 52% of respondents state that they have a net household monthly income between €1,500 and 3,500 and approximately one third of the sample belongs to the different education levels. Finally, the percentage of households with children less than 6 years old is 19%.

Results

The final specification of the utility function includes an alternative-specific constant representing the A and B choice option (β) and the four attributes considered: price (Price), nutrition facts panel (NPanel), nutrition claim (NClaim) and health claim (HClaim). Thus, the final mixed logit model estimated is the following:

$$U_{njt} = \beta_0 + \beta_1 Price_{njt} + \beta_2 NPanel_{njt} + \beta_3 NClaim_{njt} + \\ + \beta_4 HClaim_{njt} + \varepsilon_{njt} \quad [5]$$

where *j*= option A, B, C. Attributes *NPanel*, *NClaim* and *HClaim* have been coded using value +1 if the product carries a detailed nutrition facts panel (nutritional claim or health claim) and -1 if the product carries a basic nutrition facts panel (no nutritional claim or no health claim). β_0 is expected to be positive and significant, indicating that consumers will get higher utility from alternative A and B than from the remaining option C (no buy option). The results of the RPL estimation are presented in Table 3.

The model fit is overall statistically significant ($\chi^2_{8d.f.}$ = 2,550.95) which suggests that the attributes included in the final estimation are jointly significant, affecting consumers' utility, while the pseudo R^2 is 0.36. As expected, the alternative specific constant is positive and statistically significant, indicating that consumer utility for alternative A and B is higher than for the no buy option. The Wald test for the estimated mean of the coefficients associated with the attributes indicates that they are statistically significant as the null hypotheses of individual insignificance are rejected at the 5% significant level, and their relationship with the utility function is, as expected, positive.

With respect to preference heterogeneity, the derived standard deviations for all random attributes are statistically significant according to the Wald tests indicating that consumers' valuation for the nutrition and health attributes differs between consumers. Analyzing the dispersion of the estimated coefficient distributions (mean and standard deviation), nearly 28% of the sample has negative values for the nutrition facts panel coefficient and close to one fourth has negative coefficient values associated with any of the claims.

In order to interpret the results, one must recall that in the mixed logit model, the coefficients represent the direct effects associated with each of the explanatory

Table 3. Mixed logit model results for pork Frankfurt sausages choice

Variable	Coefficient	Stand. error	*t*-statistic
Mean values			
β_0	3.6815	0.1454	25.321
Price	-1.3321	0.1466	-9.086
NPanel	0.2037	0.0351	5.807
NClaim	0.2094	0.354	5.923
HClaim	0.3491	0.312	44.198
Standard deviations			
NPanel	0.3425	0.0791	4.331
NClaim	0.3092	0.0756	4.092
HClaim	0.5060	0.0453	11.181
Number of observations			9,600
Chi-square			2,550.95
Log likelihood			-2,240.1
Pseudo R^2			0.361

Source: own calculations

variables on the (unobservable) utility function. Thus, price increments decrease the associated utility level provided by the choice. As all remaining variables are effect-coded with two levels, positive values mean that utility for the package of pork Frankfurt sausage increases with the presence of detailed nutrition facts panel label, nutrition claims and health claims. The highest utility increment occurs with the presence of a health claim, followed by the presence of a detailed nutrition facts panel and a nutrition claim. Then, including a health claim indicating that the product might reduce the risk of cardiovascular disease, increases to a larger extent the consumer utility derived by the product. Including nutritional information related attributes (be it extended facts panel or a claim) also rises consumer's utility but to lesser extent, moreover both coefficients cannot be considered significantly different, while their difference with the health claim coefficient can.

Market implications

Using the results obtained estimating Eq. [5], mean WTP estimates for each of the attributes are calculated as the ratio of the partial derivative of the utility function with respect to the attribute of interest, over the derivative of the utility function with respect to the variable Price (Burton *et al.,* 2001; James and Burton, 2003). Each of these estimated ratios is understood as a price change associated with a unit increase in a given attribute. Thus, mean WTP values for each attributed are calculated by taking the ratio of mean attributes, parameters with respect to the price one multiplied by minus one (Table 4). Results indicate that all the considered attributes carry a positive premium with the highest WTP corresponding with the health claim attribute (€0.26 per package). This result means that, on average, €0.26 per package is the premium that makes consumers indifferent between the two levels of utility, associated with the presence and absence of a health claim indicating that the product might reduce the risk of cardiovascular disease. Considering that the average price per package in the design is €0.50 this premium means a 50% price increase. Second, and with no significant differences between them, consumers value information attributes, either additional facts or claim, with consumers WTP about €0.16 extra for either additional label.

Additionally, and following Train (2003), mixed logit model results have been used to simulate market shares for different products. Probabilities for any given attribute combination can be approximated for any given value of θ by averaging the results of product probabilities following expression [4] using multiple draws for each random parameter. Simulations reported are based in 10,000 draws. As the simulated probability sums one over alternatives, it can be used for forecasting. In order to forecast market shares, the researcher must assume that only a determined set of products (alternatives) is available in the market. Estimated market shares only reflect real market shares if the assortment in the experiment is comprised of all, or nearly all, products offered in this product category. Although this assumption can be restrictive in some settings, for pork Frankfurt sausages as described in our application it is not. Considering a base market where no detailed nutritional facts panel and claims exist, the four products varying only in price would resemble actual product choice consumer face when purchasing pork Frankfurt sausages.

Table 4. Willingness to pay (WTP) estimates for individual attributes considered

Attribute	Mean	Standard deviation
NPanel	0.1540	0.0886
NClaim	0.1585	0.0734
HClaim	0.2636	0.2278

Source: own calculations

Thus, setting this market as a base line, market shares simulations have been undertaken to assess potential success of different labelling strategies. Three alternative market settings are considered, in each of them two new products enter the market reflecting the introduction of one of the three labelling options, at the two higher price values. Table 5 describes the different market settings considered.

The use of the upper tail of the price distribution is justified for two reasons. First, as higher prices are associated with lower utilities, results can be considered lower bounds for real market success in case lower prices were used and second, it can be foreseen that efforts for new labelling (i.e. new analysis for detailed information, claim approval by food authorities) will have additional costs that would be transferred to the consumer through increased prices.

Results of the market shares simulations are presented in Table 6. In all market scenarios, the introduction of the two new products capture at least one third of total market share (last two rows of each simulated market column), with the maximum market share associa-

Table 5. Alternative settings considered for market simulations

Baseline Market	Four products: pork Frankfurt sausages with basic nutrition facts panel and no claims at €0.2, €0.4, €0.6 and €0.8 prices.
Simulated Market I	Six products: Baseline plus two new products presenting detailed nutrition facts panel at €0.6 and €0.8 prices.
Simulated Market II	Six products: Baseline products plus two new products presenting a nutrition claim at €0.6 and €0.8 prices.
Simulated Market III	Six products: Baseline products plus two new products presenting a health claim at €0.6 and €0.8 prices.

ted with the introduction of the health claim (45%). The new market shares are obtained substituting consumption of all pre-existing goods. Combining the results of WTP and market shares, we can conclude that if additional efforts are devoted to develop new products using health and nutrition attributes, these can face both significant price mark-ups and market shares at least for basic, cheap and not so healthy food categories.

Discussion

The use of nutrition and health related attributes is gaining importance in agro-food industry product development and marketing strategies. In this study we have estimated consumers' valuation for different nutrition and health, labels for a product which is perceived as "not too healthy". Results suggest that all three labelling options are positively valued by consumers although preference heterogeneity exists to such an extent that significant percentages of consumers would not value and even value negatively, them. Health related labelling is preferred to nutritional one, either as inclusion of additional ingredients in the facts panel or claims.

This finding seems to contradict those presented by Garretson and Burton (2001), however in their study consumers were only presented with one product and asked to rate their purchase intention while in ours, consumers choose among products and it is from their behaviour that values are derived. Moreover, in their study actual nutrient levels varied while in ours all products had the same nutrition content. The results reported by Bond *et al.* (2007) are more in line with ours as, even though they do not value the type of nutrition facts panel, health claims are more valued than nutrition ones. It seems that products perceived as not healthy are more suited for health claims, as claiming low fat in a product perceived as having high fat content does not seem to be highly valued. The same pattern seems to hold for healthy products which claim high specific nutrient content, as the Bond *et al.* (2007) study shows, using lettuce as study product and a nutrition claim related to high vitamin C content. Of course, our findings are contin-

Table 6. Mean market shares for alternative market compositions (standard deviation in parenthesis)

Detailed nutritional information	Nutritional claim	Health claim	Price (€ per package)	Baseline market	Simulated market I	Simulated market II	Simulated market III
-	-	-	0.2	35.68 (0.36)	24.48 (5.19)	22.54 (4.76)	19.92 (7.41)
-	-	-	0.4	27.33 (0.27)	17.22 (3.98)	17.27 (3.65)	15.26 (5.68)
-	-	-	0.6	20.94 (0.21)	13.19 (3.05)	13.23 (2.80)	11.69 (4.35)
-	-	-	0.8	16.04 (0.16)	10.11 (2.33)	10.14 (2.14)	8.96 (3.33)
+	-	-	0.6		20.95 (8.23)		
+	-	-	0.8		16.05 (6.30)		
-	+	-	0.6			20.85 (7.56)	
-	+		0.8			15.97 (5.79)	
-	-	+	0.6				25.01 (7.56)
-	-	+	0.8				19.06 (5.79)

- attribute not present; + attribute present. Source: Own calculations

gent on claim development costs (both administrative and research costs) and whether these can be covered by additional price premiums and a specific company retains the exclusivity of the claim (for nutrition claims this is not possible, but yes for health claims).

From a public health perspective, the European Commission is preparing a proposal to amend the current nutrition labelling regulation. In particular, it is planning to make the provision of the nutrition label mandatory and it is revising which nutrients to be included in this label. Result from this study indicates that Spanish consumers value the inclusion of information in additional nutrients labels, so the mandatory provision of a nutrition label, including nutrients, would be highly appreciate by consumers. However, utility derived from the nutrient information on nutrition label is heterogeneous among consumers. Then, before enforcing agro-food companies to provide detailed nutrient information on labels, more empirical research on the source of consumer's heterogeneity in preferences should be undertaken. This will provide public health authorities with information on the characteristics of the potential users of the nutritional information.

The extent to which claims will be allowed in "not so healthy" products is also subject to debate. The idea behind this debate is that if a product is not healthy (*i.e.* the level of a specific [not desirable] nutrient is above some pre-established level) it should not be promoted using claims. Levels have still to be determined, but prior results are mixed regarding the effects of this type of bans. Wansink and Chandon (2006) show that nutritional labels can induce less healthy eating through increase in quantities, even when serving size is clearly indicated. On the other hand, analysis of real market data has shown that claims do indeed shift consumption patterns towards healthier diets (Kim *et al.,* 2000) and that a ban on their use in certain products can foster unhealthy habits (Mathios, 1998). The reported results show consumers value health and nutritional claims on "unhealthy" products, and that would shift consumption towards products marketed as more healthy or with less fat. Nevertheless, impact on aggregate consumption patterns or non-consumer behaviour when new labels are allowed, could not be assessed from our dataset and this remains an issue for further research. Of course, an alternative would be to develop a "functional" version of pork sausages which would contain an ingredient that actually reduces the risk of cardiovascular diseases and that would be eligible for the health claim with the provision of sufficient scientific evidence. Functional products are the most fast growing market segment in developed countries and consumers are willing to pay significant price premiums for them, albeit contingent in the provision of information in the form of health claims about them (Barreiro-Hurlé *et al.,* 2008). Additional research along this line could be a promising avenue for agro-food industries willing to compete in saturated market segments.

Further research is also needed in order to understand how interactions between different labels affect consumers' utility and to explain consumer heterogeneity with regards to nutritional information. Nevertheless, it seems that provision of additional information is valued by consumers, and if this information is quality assured (one of the objectives of the afore-mentioned EC regulation), better informed choices could be made.

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Appendix. Population distribution by sex and age in Spain, Córdoba and Zaragoza (%)

	Total	Sex		Age				
		Female	Male	0-19	20-34	35-54	55-64	> 64
Spain	40,084,371	51.00	49.00	20.56	24.64	27.82	9.95	17.04
Córdoba	308,072	51.89	48.11	23.08	24.82	27.61	9.60	14.88
Zaragoza	614,905	51.80	48.20	18.33	24.02	29.07	10.67	17.96

Source: INE (2004)

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