Walnut preferences in Spain: is the Spanish consumer ready for new varieties?

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ABSTRACT

Stated consumer preferences for walnuts in Spain are investigated by means of a choice experiment. Conditional heterogeneity is explored, assuming two possible sources: how often walnuts are consumed and how driven by health and nutrition attitudes or convenience the consumer is. In particular, the possibilities for a mostly unknown variety in the Spanish market are investigated. Specific guidelines for the distribution and commercialisation of walnuts are provided.

Key words: logit model, stated preferences, choice experiment, walnuts.

Jel Classification: M31

1. Introduction

This paper focuses on consumer behaviour and preferences towards walnuts in Spain. Nuts in general, and walnuts in particular, are part of the traditional Mediterranean diet. The average per capita consumption of walnuts in Spain is 0.5Kg, 20% higher than in the EU (MERCASA, 2003), what together with an insufficient domestic production, has made of Spain the main importer country in the EU, 21863t in 2001 (MAPA,2002), being USA the main supplier (ICEX, 2002). Nevertheless, consumption in Spain is not as deeply rooted as in other Mediterranean countries, mainly Greece and Italy (Muncharaz, 2001), and it is very seasonal, with peaks of consumption in December as it is traditional to take tree nuts at Christmas. Different studies in the area of health science have highlighted the healthy properties of walnuts in relation to cholesterol (Lavedrine et al., 1999; Muñoz et al., 2001); heart diseases (Feldman, 2002; *inter alia*); and beneficial nutrition components (Chisholm et al., 1998; Savage, 2001; *inter alia*). Nevertheless, there is still a lack of equivalent research in the area of marketing and consumer behaviour (we can mention Gracia et al. (2003) in demand analysis).

Accordingly, a first objective of the paper is to investigate consumer behaviour and attitudes towards walnuts. A second objective is to identify the relevance of a set of attributes or product characteristics in consumer preferences, exploring the influence of possible sources of heterogeneity, such as the nutritional or health benefits searched and the frequency of consumption. Of particular interest is the relevance of variety. Although in the last years there has been an irruption into the market of new varieties, the one mostly spread is still the Hartley, also known as California. Therefore, we wonder to what extent this variety could be displaced by a new imported variety, such as Pecan, which is mainly produced in the USA and Mexico (USDA, 2004). Likewise, new sale packages are appearing, which are putting aside the sale in bulk, with the goal of matching new consumers' needs, such as convenience and fast consumption. Accordingly, we wonder to what extent the Spanish consumer is receptive towards the sale format and new varieties.

To fulfil the objectives, a survey was addressed to consumers, in a medium size Spanish city in 2003. The survey contained three differentiated sections: purchase and consumption habits and attitudes; personal identification; and choice experiment. Choice experiments have received attention in different disciplines, such as environmental valuation (see Bennett and Blamey (2001) and Louvière et al. (2000) for a deep explanation of methods and a review of case studies; Adamowicz et al., 1994; Train (1998, 1999); *inter alia*); transportation (e.g. Ben-Akiva and Bierlaire (1999); Ben-Akiva and Morikawa (1990); and market research in the area of acceptability of GMOs (Burton and Pearse, 2002; James and Burton, 2003) and territorial agrofood products (Scarpa et al., 2004; Quagrainie et al., 1998 *inter alia*).

Stated preferences (SP) methods, such as conjoint analysis, have been used extensively in marketing literature. Choice modelling is an extension of conjoint analysis, also based on trade-off between alternative multi-attribute products and utility maximisation. In choice modelling, however, the respondent faces a choice between alternative products, having the option of choosing none of them, reproducing in this way more closely the actual choice situations. Unlike revealed preference methods (RP), SP allow to investigate commercial possibilities of new products, which is particularly suitable for our objective. Modelling of discrete choices allows incorporate heterogeneity of preferences across individuals, which may be unobserved according to a generic parametric distribution of taste or conditional on some specific individual's characteristics. The first line of research leads to mixed logit models, and has been applied in consumer research by Bonnet and Simioni (2001), Scarpa et al.(2004), Rigby and Burton (2003) *inter alia*. In this paper, however, we focus on preferences heterogeneity conditional on consumer observed characteristics: frequency of consumption and attitudes and beliefs about walnuts[1].

The paper is structured as follows. In Section 2, the analytical framework is summarized. In Section 3, a description of the empirical application is presented. In Section 4, results are shown and in the last section some conclusions are drawn.

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[1] In other paper by the same authors, a mixed logit is applied to check unconditional heterogeneity of preferences on walnuts.

2. The analytical framework

A brief summary of the main elements of choice modelling is explained. Further explanations may be found in the excellent manuals by Train (2003), Bennett and Blamey (2001) and Louviere et al. (2000).

The choice between alternative options is formally explained assuming a utility maximisation behaviour, which leads to the so called Random Utility Models (RUM), which can be summarized as follows. An individual n faces a choice set composed of J alternatives, and from each alternative i, the individual will obtain utility U_{in}, i = 1,..,J. The researcher can not observe this utility, but instead, can observe a set of attributes x_{in} of alternative i. Additionally, the researcher can observe some characteristics s_n of individual n. Utility (U_{in}) is then defined as the sum of two components: $U_{in} = V_{in} + \varepsilon_{in}$. The first component is called representative utility and is a function (V) of characteristics of the alternative (x_{in}) and the individual (s_n): $V_{in} = V(x_{in}, s_n) \forall i$. The function V depends on parameters that are estimated. The second component of utility (ε_{in}) is unobserved and captures all those factors that affect utility but are not included in V_{in}. The unknown component is considered random with a joint density function $f(\varepsilon_n)$., with the random vector $\varepsilon_n = \{\varepsilon_{1n},..., \varepsilon_{Jn}\}$. From this density function, both the behaviour rule of utility maximisation and choice probability can be conjugated: individual n will choose alternative i, if this alternative provides a bigger utility than any other j alternative available in the choice set. In other words, the probability that individual n chooses i, P_{in} is:

$$P_{in} = Prob[U_{in} > U_{jn}] = Prob[V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn} \ \forall \ i \neq j] = Prob[\varepsilon_{jn} - \varepsilon_{in} < V_{in} - V_{jn} \ \forall \ i \neq j] \qquad [1]$$

Expression [1] is the probability that each random term $\varepsilon_{jn} - \varepsilon_{in}$ is smaller than the observed portion of utility $V_{in} - V_{jn}$, namely, a cumulative probability distribution, that can be rewritten in terms of the density function $f(\varepsilon_n)$.

Different discrete choice models are obtained from different specifications of $f(\varepsilon_n)$. The logit model is one of the most widely used, and is based on the assumption that the unobserved portion of utility ε_n is distributed iid (independent and identically) extreme value. From this assumption the probability of choosing alternative i is expressed as (McFadden, 1973):

$$P_{in} = \frac{e^{V_{in}}}{\sum_{j=1}^{J} e^{V_{jn}}} \qquad [2]$$

3. Empirical application

3.1. Design of the choice experiment

The design of the choice experiment starts with the identification of the relevant attributes and levels of alternatives in order to accurate reproduce the real choice conditions at the market. With this purpose, nuts sections in 11 distribution chains, located in Zaragoza, in June 2003, were visited in order to gather information on the different presentation possibilities and the characteristics highlighted in labels.

The final list of attributes (levels) chosen for the design were: Production technique (organic and conventional); Shell (in-shell and kernel); Brand/Presentation (with brand or packaged, and without brand or in bulk); Price (2€, 2.5€, 3€, 3,75€, 4€ and 5€); Variety (California and Pecan). Brand and presentation were found to be highly correlated, such as, when walnuts carry a brand, either the own distributor's (e.g. Consumer, El Corte Inglés) or the producer's (e.g. Borges), the product is usually offered packaged, while when the product is sold in bulk, no brand identification is offered to the consumer. For this reason, both attributes were considered jointly in the experiment. With respect to price, it is important to note that it is not a price per kg, but price per equivalent quantities of in-shell and kernel walnuts, that is to say, either € for 750g of in-shell or € for 250g of kernel walnut. The

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walnuts currently offered in the market are usually local varieties or California, therefore, including the level Pecan we will be able to pursuit one of the objectives of the paper, that is to measure the degree of acceptability of a generally unknown variety and to estimate the willingness to pay, or the discount that a foreign producer should apply in order to introduce the new product in the Spanish market. Both, California and Pecan are imported, although the first one is broadly spread and consolidated in the market. Given that Pecan is unknown, photographs of the varieties were included in the cards, and samples of walnuts were offered to participants.

Two orthogonal designs for "main effects" were applied (SPSS 10.0) to reduce the 96 original possible combinations of attributes and levels ($6x2^4$). From each orthogonal design, 16 alternative combinations were obtained, which were randomly grouped into pairs (after checking that there were not repeated combinations in both designs). In this way, 16 cards or choice sets were obtained, each containing alternative combinations labelled as A and B, and a "no choice" option named C. The procedure described is one of the possible procedures provided for by Louviere et al. (2000), and valid when the labels of each alternative (A and B) have not a specific meaning themselves. The "no choice" option was included in order to reproduce more accurately the actual market conditions, in which the consumer has the option of not buying any of the products offered. An example of one of the choice sets is shown in Table 1.

Table 1. Example of card or choice set.

CARD 1	OPTION A	OPTION B	OPTION C
Production technique	Organic	Organic	
Price	3€ (499 ptas)	3.75 € (624 ptas)	
Brand / Presentation	With brand / packaged	No brand / in bulk	Neither A nor B
Shell	Kernel (250g)	Kernel(250g)	
Variety	Pecan	California	
Which option would you buy? A☐ B☐ C (Neither A nor B)☐			

The 16 choice sets were split in to three blocks of 10 cards or choice sets each, with 6 of the cards in common and the remaining 4 assigned randomly. This procedure is called "blocking" and has become a usual practice (Louviere et al., 2000) as it reduces the complexity of the task faced by the respondent, mitigating the lack of concentration or interest that he can suffer, affecting negatively the quality and reliability of data (Wu, 2002; Adamowicz et al., 1994).

A pilot survey suggested the convenience of dealing with small groups of consumers in order to ease the understanding of the experiment. In addition to choice experiment, the survey included questions about purchase and consumption habits of nuts in general and walnuts in particular; and identification questions. The final survey was carried out in Zaragoza (Spain), in September- October 2003. This city is frequently used in market research by companies as it is considered to be highly representative of the average Spanish consumer. It is also the main urban city in the region, characterised also by a higher consumption of walnuts than the Spanish average (540g versus 500g).

3.2. Model specification

Two models have been estimated with the data provided by the choice experiment, named conditional logit, and hybrid conditional logit.

In the logit model the utility that individual n obtains from alternative i is:

$$U_{in} = \beta_{PR} \bullet PR_i + \beta_{OCO} \bullet OCO_i + \beta_{BNB} \bullet BNB_i + \beta_{SK} \bullet SK_i + \beta_{PECCA} \bullet PECCA + \alpha\_i + \varepsilon_{in}$$

$$i= \text{Option A, B, C} \qquad\qquad [3]$$

where:
PR$_i$ = price of option i;

OCO$_i$ = +1 if production technique in option i is organic; = -1 if production technique in option i is conventional;

BNB$_i$ = +1 if option i has a brand (it is packaged); = -1 if option i has not a brand (it is sold in bulk);

SK$_i$ = +1 if option i is sold in-shell; = -1 if option i is sold in kernel;

PECCA$_i$ = +1 if option i is of Pecan variety; = -1 if option i is of California variety.

α_i = specific constant for alternative i

Price enter the model as linear and the rest of attributes as effect codes. Therefore, each estimated parameter accounts for the utility difference between one level and the reference level (Louviere et al., 2000), which in our case, as only two levels exist, is the only parameter with the sign changed. For instance, β_{SK} measures the impact on utility when walnuts are offered in-shell instead of kernel, and -β_{SK} measures the impact on utility of the product being kernel instead of in-shell.

Each of the attributes in the "no choice" option C, takes a 0 value. Following Haaijer (1999)'s recommendation, a specific constant for each "actual" option (A and B) is included (what is equivalent to include a specific constant for the "no choice" option). This value 0 in option C represents an additional level in each attribute, which may induce to bias in the estimated parameter of the linear attribute (price) as it acts as a real level. This effect is offset if specific constants are included. In effect codes variables (OCO, BNB, SK, PECCA), there is not such a bias, nevertheless, even in this case it is advisable to include specific constants that may improve the fit of the model.

The second model is named hybrid conditional logit, and includes respondent's specific characteristics as additional explanatory variables of utility as a way to explore the existence of heterogeneous preferences across consumers and their possible sources. In particular we have considered the frequency of consumption, distinguishing between occasional and regular consumers; and attitudes towards walnuts. Using frequency of consumption as segmentation criteria, the model is expressed as:

$$U_{in} = \beta_{PR} \bullet PR_i + \beta_{OCO} \bullet OCO_i + \beta_{BNB} \bullet BNB_i + \beta_{SK} \bullet SK_i + \beta_{PECCA} \bullet PECCA_i +$$
$$\beta_{PR\_OCC} \bullet PR_i \bullet OCC_n + \beta_{OCO\_OCC} \bullet OCO_i \bullet OCC_n + \beta_{BNB\_OCC} \bullet BNB_i \bullet OCC_n + \quad [4]$$
$$\beta_{PECCA\_OCC} \bullet PECCA_i \bullet OCC_n + \alpha\_i + \varepsilon_{in}$$

where OCC$_n$ equals 1 when consumer n is occasional, and 0 when consumer n is regular. The parameter of the attribute without interaction is interpreted as the effect on utility of the specific level in the benchmark segment, e.g. β_{PECCA} measures the difference in utility provided by the variety Pecan instead of California in the group of frequent consumers; the parameter of the interaction is the difference in utility provided by a specific level to consumers in that segment in comparison to consumers in the benchmark segment, e.g. β_{PECCA_OCC} is the effect on utility provided by the variety Pecan instead of California in the group of occasional instead of regular consumers; therefore, the utility provided by the Pecan variety instead of California to occasional consumers is β_{PECCA} + β_{PECCA_OCC}.

In any of the models explained above, a monetary value, or willingness to pay (WTP) for each attribute level may be obtained by combination of parameters, dividing the coefficient on an attribute level by the coefficient of price, with changed sign. WTP is the price that consumer should pay to offset the change in utility arising when modifying the level of an attribute. For instance, when changing the production technique from conventional to organic (ΔOCO), WTP is:

$$WTP = \frac{\Delta PR}{\Delta OCO} = -\frac{\beta_{OCO}}{\beta_{PR}} \qquad [5]$$

As explanatory variables are effect codes, WTP is interpreted as the difference in euros that the consumer is willing to pay for a level in comparison with the reference level of the attribute.

Estimation has been done with GAUSS, adapting the programs available in K. Train's web page: http://emlab.berkeley.edu/books/choice.html.

4. Results

4.1. Description of the sample: consumption habits

A sample of 130 consumers of walnuts attended the meetings, split into small groups of no more than 7 persons. With respect to socio-demographic characteristics, there is a predominance of women (54% of respondents); young people (40% are less than 30 years old, and 27% are between 30 and 40 years old); with high level of education (74% have university degrees); and middle class. To obtain representative population samples is difficult when working with focus groups as only a small number of individuals respond to the calls, especially when no reward is offered.

The consumption of walnuts is mainly occasional: 55.3% of respondents consume sporadically along the year; and 9% only at Christmas following tradition; while 14% consume walnuts weekly and 21.4% at least once every month. Therefore, two segments of consumers can be identified: regular consumers (REG), who represent 35.5% of the sample and occasional consumers (OCC), 64.5%. Nevertheless, it is not possible to identify exclusive traits for each group of consumers (bivariate statistics, such as Pearson χ^2 or Anova, did not provide significant differences across segments with respect to an array of personal characteristics).

With respect to varieties, while most of the consumers, 92%, recognize by name the California (or Hartley) walnut, only 26% recognize Pecan nuts. Apart from a minority who actually knows, has seen and tasted Pecan nuts, the majority of that 26% admitted that they only recognise the name because it is a usual ingredient in desserts and therefore the name is written in the compositional labels. It is also noteworthy that most of the respondents highlighted the good properties of local varieties in comparison to California walnuts. About 57% of respondents consume walnuts mainly as snacks and 25% as a dessert, while only a small proportion uses them as an ingredient in cooking.

Respondents were asked to value in a Likert scale of five levels their degree of agreement or disagreement with a set of statements in relation to their beliefs and attitudes towards walnuts. Results are shown in Table 2.

Table 2. Attitudes and beliefs about walnuts: percentage of respondents who agree, disagree or are indifferent with the statements proposed.

Walnuts	Agreement (%)	Indifference (%)	Disagreement (%)
1. have good nutritional properties	93.4	4.1	2.5
2. are beneficial for health	93.4	3.0	3.6
3. are an ideal snack	85.0	10.7	4.3
4. are convenient to eat (easy and fast)	66.9	19.0	13.1
5. in-shell keep properties better	65.0	26.0	9.0
6. are convenient to have available always at home	55.0	34.7	10.3
7. are fattening because of high calories contents	54.0	27.0	19.0
8. are tasty	47.9	36.0	16.1

Consumers mainly consider that walnuts have good nutritional properties and are beneficial for health (93% of respondents), are ideal as a snack (85%) and convenient (67%). Despite other aspects receive high degrees of agreement, they also show high degrees of indifference. For instance, 65% of respondents believe that shell keeps properties better, while 26% do not have an opinion; or around 55% of respondents like having walnuts available at home and think that walnuts are fattening, while 35% and 27% of consumers, respectively, show indifference. The statement which receives the lowest degree of agreement is that walnuts are tasty. In fact, walnuts are quoted as one of the four most preferred nuts, but clearly behind almonds, pistachios and pine nuts.

A factor analysis has been applied to the previous statements in order to condensate information into underlying latent beliefs, which are used then as segmentation basis. Summing up (results are available upon request), three factors are found which explain 62.5% of the total variance, and which can be identified as: convenience food (statements 6, 8, 3, 4); health and nutrition (statements 1,2) and intrinsic properties(5,7). Subsequent cluster analysis classifies consumers into two groups of similar dimensions: one relatively more driven by nutrition and health motivations (HEAL) and the other by

convenience and intrinsic properties (CONV). Nevertheless, not significant differentiated profiles were obtained (Pearson χ^2 and means comparison tests, did not provide significant differences across segments with respect to an array of personal characteristics).

4.2. Results of the logit model

In Table 3, results of the basic conditional logit model are shown. All attributes affect significantly utility, except Shell, where in-shell and kernel walnuts provide the same utility to the consumer. Price affects negatively utility, and therefore, increases in price reduce the probability of an option to be selected, what is consistent with a normal demand. The ecological production technique favours the choice of an option. The brand increases utility for consumers, therefore, the probability of choosing an article with brand is higher than an article sold in bulk, *ceteris paribus* the rest of attributes. Utility decreases for Pecan nuts in comparison to California walnuts. The low degree of familiarity motivates that *ceteris paribus* other attributes consumer is more prone to buy the most known California variety. Finally, the specific constants for real options are positive and significant, meaning that the utility of any of the real options shown to the consumer is higher than the utility provided by the no-choice option.

The addition of individual's frequency of consumption does not improve significantly the overall explanatory power of the model as the log likelihood ratio (LLR1) is 11.58, lower than the critical value $\chi^2_{0.05,7}$ =14.06. Nevertheless, some of the interaction parameters are significant, providing some interesting hints on preferences. In particular, production technique and variety have a different impact on the utility of regular and occasional consumers. The organic production technique increases utility in both groups of consumers, although the impact is relatively higher in the regular consumers group. Both segments of consumers prefer the California variety, although the occasional consumers are not as reluctant as regular consumers. The attributes price, brand and shell, on the other hand, affect utility of both segments of consumers in the same direction and with the same intensity: the higher the price the lower the utility; no utility differences exist between in shell and kernel walnuts; and carrying a brand increases the probability of choosing an option.

Table 3. Results of the Logit models

Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
PR	-0.441*	PR	-0.582*	PR	-0.386*
OCO	0.209*	OCO	0.450*	OCO	0.282*
BNB	0.160*	BNB	0.128**	BNB	0.093
SK	0.049	SK	0.028	SK	0.293*
PECCA	-0.173*	PECCA	-0.276*	PECCA	-0.146*
	---	PR_OCC	0.233	PR_HEAL	-0.172
	---	OCO_OCC	-0.397*	OCO_HEAL	-0.133
	---	BNB_OCC	0.065	BNB_HEAL	0.166**
	---	SK_OCC	0.039	SK_HEAL	-0.523*
	---	PECCA_OCC	0.171*	PECCA_HEAL	-0.078
α_A	2.742*	α_A	32.05*	α_A	2.549*
α_B	2.757*	α_B	32.49*	α_B	2.521*
	---	α_A_OCC	-0.739	α_A_HEAL	0.620
	---	α_B_OCC	-0.788	α_B_HEAL	0.732
LL(θ)$_1$	-1244,61	LL(θ)$_2$	-1238.82	LL(θ)$_2$	-1227.11
LL(0)	-1275,56	LLR	73.47(0.000)	LLR	96.88 (0.000)
LLR	62,14(0.000)	LLR1	11.58(0.115)	LLR1	35.00(0.000)
N.Obs.	1300	N.Obs.	1300	N.Obs.	1300

LL(0): Log likelihood in the model which includes only the specific constants
LL(θ): Log likelihood in the model with all explanatory variables
LLR: Log likelihood ratio which tests the joint significance of a set of parameters: LLR = -2[LL(0)-LL(θ)]; LL(θ) = LL(θ)$_1$ in the conditional logit model; y LL(θ) = LL(θ)$_2$ in hybrid conditional logit.
LLR1: Log likelihood ratio of comparison of both models: -2[LL(θ)$_1$-LL(θ)$_2$].

Individual's beliefs about walnuts have been introduced in the model by interacting the segment of membership defined in the previous section with the attributes. The segment used as reference is CONV (the one relatively more driven by the convenience and intrinsic properties of walnuts), and the interactions relate to the group more driven by health and nutrition beliefs (HEAL). Individual's beliefs or attitudes towards walnuts improve the overall explanatory power of the model (LLR1 is 35.00, higher than the critical value 14.06). Individually, brand and shell have a different impact on the utility of convenience and health driven consumers. Brand and package increases utility of both segments, but the effect is bigger in the case of health driven consumers. In the group of consumers driven by intrinsic properties and convenience, the probability of choosing a product is higher when walnuts are in-shell, while consumers driven by nutrition and health considerations are more prone to kernel walnuts. Additional socio-demographic and attitudinal individuals' characteristics were included as explanatory variables but no significant improvements of the overall explanatory power of the model were obtained, and they provided a very marginal contribution to the explanation of preferences.

In Table 4, the marginal willingness to pay (WTP) or implicit price of each attribute level is shown for both models. In the hybrid model, for each segment, the appropriate set of coefficients must be used. For instance, WTP for Pecan variety instead of California by occasional consumers is:

$$\text{WTP}_{\text{PECCA\_OCC}} = \left(\beta_{\text{PECCA}} + \beta_{\text{PECCA\_OCC}}\right) / \left(\beta_{\text{PR}} + \beta_{\text{PR\_OCC}}\right) \qquad [6]$$

Nevertheless, results in Table 3 indicate that $\beta_{\text{PR\_OCC}}$ is not significant at 5%, and accordingly the same price coefficient (β_{PR}) is used for the calculation of WTP at both segments. Likewise, for those attributes where non-differentiated impact on utility (BNB and SK) was found across segments, the estimated non-significant interaction coefficient has been substituted by zero. The same procedure is applied in the hybrid model defined in terms of segments based on beliefs and attitudes towards walnuts.

Table 4. Willingness to pay (WTP)

Attribute / level	Conditional logit	Conditional hybrid logit			
		Regular	Occasional	Convenience	Health
Organic_ conventional	0.475	0.765	0.090	0.731	0.731
With brand _ without brand	0.381	0.217	0.217	0	0.430
In shell_ kernel	0.112	0	0	0.759	-0.621
Pecan_ California	-0.394	-0.469	-0.178	-0.378	-0.378

The average consumer is willing to pay 0.475€ more for organic walnuts than conventional; 0.381€ more for a product packaged and with brand than for one sold in bulk without brand. As In-shell did not provide additional utility to the consumer in comparison to kernel (Table 3), WTP can be interpreted as zero despite the quotient between estimated parameters gives 0.112€. With respect to the variety, the average consumer should be compensated with a discount of 0.394€ in order to buy Pecan instead of California.

Segmentation with respect to frequency of consumption led to significant differences across segments with respect to the production technique and the variety. The organic technique is more valued by regular consumers while the discount for Pecan variety would not need to be as high for occasional consumers. Thus, a regular consumer is willing to pay 0.765€ more for organically produced walnuts in comparison to conventionally produced ones, while an occasional consumer would be willing to pay 0.090€; and an occasional consumer would require a discount of 0.178€ to buy Pecan variety instead of California, while a regular consumer would demand a discount of 0.469€. In the same way, WTP for brand and shell differs between those consumers who believe relatively more in the health and nutrition properties of walnuts, and those who attach relatively more importance to convenience and intrinsic properties. In this way, health driven consumers are willing to

pay more for brand and package (0.430€ more than for no branded or in bulk) while consumers more driven by convenience beliefs and intrinsic properties (shell and calories), are not ready to pay for this attribute. The latter however, are willing to pay 0.759€ for in-shell product while consumers relatively more driven by health and nutrition considerations, should be compensated by a discount of 60 cents of euro.

Finally, the models estimated are used to calculate the probability of choosing alternative products that differ in some specific characteristic. In particular, we are interested in the chances for Pecan to compete in the Spanish market with the California variety, with the characteristics most commonly found in the marketplace: a price of 3€ per 750g of in-shell walnut, produced with a conventional technique, and sold packaged and with brand (option A). Two alternative scenarios are defined for Pecan(option B): Scenario 1, in which Pecan shares the same characteristics as California option, but with alternative prices; and Scenario 2, in which apart from dealing with alternative prices, an organic production technique is assumed, in order to provide a source of differentiation additional to price. The competing options for each scenario are shown in Table 5.

Table 5. Description of hypothetical products in alternative competing scenarios

Attributes	Reference option Option A	Scenario 1 Option B	Scenario 2 Option B
Variety	California	Pecan	Pecan
Production technique	Conventional	Conventional	Organic
Brand (package)	With brand (package)	With brand (package)	With brand (package)
Shell	In-shell	In-shell	In-shell
Price	3€	From 2 to 5 €	From 2 to 5 €

The simulation is based on the parameters estimated in the conditional hybrid logit model in which frequency of consumption is included, given that the preferences for variety were different between occasional and regular consumers. The calculation of probabilities is made through expression [2], and choosing the appropriate values for each variable. For instance, in Scenario 1, the probabilities to choose option A (California), B (Pecan) and C (no choice) are:

$$P_A = \frac{e^A}{e^A + e^B + 1}; P_B = \frac{e^B}{e^A + e^B + 1}; P_C = \frac{1}{e^A + e^B + 1} \qquad [7]$$

where:

$A = \beta_{PR} \bullet 3 + \beta_{OCO} \bullet (-1) + \beta_{BNB} \bullet 1 + \beta_{SK} \bullet 1 + \beta_{PECCA} \bullet (-1) + \alpha\_A$

$B = \beta_{PR} \bullet PR + \beta_{OCO} \bullet (-1) + \beta_{BNB} \bullet 1 + \beta_{SK} \bullet 1 + \beta_{PECCA} \bullet (-1) + \alpha\_B$ (PR = 2, 2.25, 2.5, 2.75, 3)

$C = 0$

with the corresponding interaction also added for calculation of A and B in each of the segments of consumers.

Results are shown in Table 6. In Scenario 1, for identical characteristics (price of 3€ for 750g of in-shell product, with brand and package) the probability of choosing Pecan is 0.327 among the regular consumers and 0.406 among occasional consumers, in both cases, smaller than the probability of choosing California (0.544 and 0.504, among regular and occasional consumers, respectively). As price goes down, the probability of choosing Pecan increases, but only if the price is under 75 cents of euro cheaper than California, Pecan demand would equalize or pass the demand for California. Thus, at 2.25€, the probability for an occasional consumer to choose Pecan is 0.471, higher than the probability of choosing California, 0.450; while, among the group of regular consumers the price should follow to 2€ to get a market share larger than California (probabilities of 0.465 for Pecan and 0.432 for California).

In Scenario 2, for identical characteristics, including a price of 3€, the probability of choosing organic Pecan nuts would be higher than California but only by the regular consumers group, as this segment also shows a more intense preference for the organic characteristic (with probabilities of

0.545 and 0.368, respectively). Among occasional consumers, on the other hand, the price should fall significantly, to 2.5€ in order for the organic Pecan to get a larger portion of the market. For prices of organic Pecan higher than the competing conventional California (3€), the probability of selecting Pecan diminishes drastically in the occasional consumers' group. For instance, at a price of 4€, the probability of choosing organic Pecan is 0.349 while the probability of choosing conventional California is 0.553. Therefore, in both scenarios, the sensitiveness to price is high, with market shares varying drastically with changes in prices.

Table 5. Probability of choosing competing hypothetical products

| Price in option B | Scenario 1 | | | | Scenario 2 | | | |
| | Regular consumers | | Occasional consumers | | Regular consumers | | Occasional consumers | |
	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B
2	0.432	0.465	0.431	0.492	0.257	0.682	0.409	0.519
2.25	0.462	0.429	0.45	0.471	0.284	0.649	0.427	0.497
2.5	0.49	0.394	0.468	0.449	0.311	0.615	0.446	0.475
2.75	0.518	0.36	0.486	0.428	0.339	0.58	0.464	0.454
3	0.544	0.327	0.504	0.406	0.368	0.545	0.482	0.432
3.25	0.569	0.296	0.522	0.385	0.397	0.508	0.5	0.411
3.5	0.593	0.266	0.54	0.365	0.427	0.472	0.518	0.39
3.75	0.615	0.239	0.556	0.345	0.456	0.436	0.536	0.369
4	0.636	0.213	0.573	0.326	0.485	0.401	0.553	0.349
4.25	0.655	0.19	0.589	0.307	0.512	0.366	0.569	0.33
4.5	0.672	0.169	0.605	0.288	0.539	0.333	0.586	0.311
4.75	0.688	0.149	0.619	0.271	0.565	0.302	0.601	0.292
5	0.702	0.132	0.634	0.254	0.589	0.272	0.616	0.275

Note: Probabilities of Option C "no choice", can be obtained subtracting to 1 the sum of the probabilities of choosing option A and B.

5. Conclusions

A key feature of this paper is that the research is explorative in nature. Indeed, a survey of the literature reveals very few studies examining preferences for walnuts, whilst in Spain, to the best of our knowledge, there are none. Despite the fact that nuts are part of the Mediterranean diet and that scientific research highlights their beneficial properties in terms of nutrition and health, little is known about how important these beliefs are among consumers and which attributes influence their preferences. Likewise, new package formats, more informative labels and new varieties different from the widely known California, are being introduced in the market, although there is not enough evidence on how receptive consumers are.

The paper shows that, even in a quite homogeneous group of consumers in socio-demographic terms, preferences are heterogeneous. Two possible sources of heterogeneity have been explored: how often walnuts are consumed and how driven by health/nutrition attitudes or convenience the consumer is. In each case, two segments of consumers have been identified, of equal size in the latter case. Consumption of walnuts, on the other hand, is mainly occasional, with only 35% of consumers eating walnuts on a regular basis, either weekly or monthly.

The average consumer prefers branded products, sold packaged instead of non-branded and in bulk, and would pay as much as 0.381€ for this characteristic. This could also go up to 0.430 €, for consumers relatively more motivated by health and nutrition considerations. Consumer is then receptive to differentiation strategies which relegate in-bulk and non-branded products, and is willing to pay for the additional utility provided by brand and package, and probably linked to quality and safety. Labels with nutritional information, such as daily recommendation in-take, would also be

appreciated, as half of the consumers are led by a favourable attitude towards the nutritional and healthy properties of walnuts.

The average consumer has not a predilection of in-shell over kernel walnuts, *ceteris paribus* other attributes. However, we have identified a group of consumers relatively more driven by convenience, who see in walnuts a tasty snack, who prefer in-shell nuts, because they keep the intrinsic properties better and probably because shell provides a ludic entertainment to the action of eating.

As in other food products, organic production technique is an attractive characteristic, preferred over conventional production systems. An average consumer would pay 0.475€ more for organic walnuts than for conventional ones, and it could go up to 0.765€ by regular consumers. Nonetheless, the maximum willingness to pay is only 25% more than the most frequent price of conventional walnuts (around 3€), still lower than the usual over-price charged for organic products. Therefore, it is not very likely that this stated preference would become an actual purchase, moreover when the price is one of the main attributes to dictate preferences. Besides, preferences towards price are quite homogeneous across consumers, at least with respect to the segmentation criteria used in this paper.

Pecan variety is only known by a minority of consumers (26%) in comparison to California (92%). Consumers are found to be reluctant to choose this new and unknown variety, and should compensated, on average, by reductions in price of around 0.394€ with respect to California. Nevertheless, occasional consumers do not perceive as much risk in trying Pecan, and would require less reductions, around 0.178€. Simulating an scenario of competition between both varieties, with equal characteristics (brand and package, in-shell and conventional production), and in which California has a price of 3€, to reach the regular consumer segment Pecan should be offered 75 cents of an euro cheaper to be chosen with similar probability. The regular consumer segment is much easier attained if Pecan nuts are also organic. Then, even at an identical price of 3€, the probability of choosing Pecan is much higher than California, been able to put the price up to 3.75€ to get a similar market share to California.

Spanish consumer is ready for a new variety as Pecan if it is offered at a competitive price. Besides, as long as organic production can be offered at more attractive prices, there is a possible demand growth. Preferences, however, are not homogeneous, and vary depending on how often the consumption takes place and which attitude towards walnuts prevails.

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