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Functional Ingredients and Food Choice: Results from a Choice Experiment

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Abstract

In this paper we present the results of a Choice Experiment (CE) conducted to examine how the inclusion of an attribute for a functional ingredient affects consumer food choice. Specifically, we examine consumer attitudes towards bread and the inclusion of a functional ingredient (eg, inulin), which can be added to bread to increase the quantity and the effectiveness of fibre in the final product A novel feature of the design of this CE was the use of Means-End-Chain analysis via semi-structured interviews to reveal key attributes to be included in the CE. . In addition, the CE included the Dutch Eating Behaviour Questionnaire (DEBQ) so as to collect information on all participants underlying eating behaviours. Preliminary analysis of the data reveals that bread type determines choice, and that the inclusion of a functional ingredient yielded relatively small measures of value. Also, the use of a Latent Class Model reveals that there are differences in willingness-to-pay (WTP) between groups of respondents and that group membership can be partly explained by the DEBQ information. The public health implications of these findings are discussed.

Keywords: Functional Food, Bread, Choice Experiment

JEL codes: I10, Q10, R22

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1. Introduction

Due to advances in food technology and nutritional sciences, many new food products have been developed and have entered the market offering increased health benefits and the potential to reduce the risk of diseases compared to conventional products. These new food product developments have been labelled as functional foods (Siro et al., 2008).[1] To date the size of the functional food market globally has been estimated to worth ten of billons of dollars (Hillman, 2000) and it is expected to grow significantly over the coming decade. However, although consumers have accepted many forms of functional food there is also evidence that consumers are likely to differ to the extent to which they would buy food products with functional properties. For example, in the case of bakery products such as bread, there is little difficulty including functional ingredients, but whether this can be achieved in a manner which yields a product which meets consumer demands is unclear. Indeed, Verbeke (2006) has found that simply relying on consumer to adopt functional food for health benefits when the products in question have been compromised in terms of taste is highly unlikely. Furthermore, Siro et al. (2008) stress that the acceptance of functional foods depends on the product that conveys the benefit.

In this research we examine consumer attitudes toward functional ingredients by employing a Choice Experiment (CE). Our CE examines consumer attitudes to purchasing bread, which might include a functional ingredient such as inulin. Inulin is a prebiotic functional ingredient which is non-digestible and it assumed to have a positive impact on various bacteria in colon. The use of inulin within the food processing industry is growing rapidly. This can be partly explained by its ability to enhance the fibre content of food whilst also being able to substitute for other ingredients. Our research adds to a growing number of CE papers that examine consumer choice in relation to food, nutrition and health labels and product selection (eg, Hu et al, 2004, Teratanavat and Hooker, 2006 and Balcombe et al, 2010).

In addition, our paper includes two extensions to the basic CE approach. First, a novel feature of the design of this CE was the use of results from a Means-End-Chain (MEC) analysis undertaken by Bitzios (2010), which employed semi-structured interviews to reveal key attributes to be included in the CE. MEC is a marketing research tool used to reveal how a consumer values product characteristics in terms of the motivation to purchase a specific product. This form of analysis is based on personal construct theory and links product characteristics to consequences as well as an individual's preferences to motivate a purchase decision. MEC has been widely employed in food research including recent research on biotech functional food (Chema et al., 2006). Second, our survey instrument included within it the Dutch Eating Behaviour Questionnaire (DEBQ). The DEBQ allows us to collect information on all participants underlying eating behaviours. Given the focus of the CE is food consumption we consider it an important design feature to understand underlying respondent eating habits.

The structure of this paper is as follows. In Section 2 we briefly review the antecedent literature. We then describe in detail the various steps undertaken in the design of our CE.

[1] It is worth noting that there is no unique definition of what functional food actually is. The range of definitions is in part a reflection of the difficulty of defining food that is healthy which is in itself, a complex issue.

We then explain how we implemented our CE. In Section 4 we briefly describe the econometric methods employed. In Section 5 we present our results. Section 6 concludes.

2. Literature Review

There is a rapidly growing literature examining consumer attitudes towards food products, such as functional food, that have enhanced benefits or use ingredients that are the result of scientific modifications or new technologies. Comprehensive reviews of these literatures are provided by Siro et al. (2008) and Pothoulaki and Chryssochoidis (2009). There is also a related literature that is also rapidly increasing in size that examines how consumers respond to food packaging and the information conveyed about the products they are willing to buy (eg, Cowburn and Stockley, 2005 and Grunert and Wills, 2007). Within these literatures we are most interested in research that have employed stated preference surveys and have focused on functional foods, in particular bread. We are also interested in the econometric methods that have been employed to estimate data.

In terms of research that has examined functional food West et al. (2002) provides a relatively early example. They investigated the attitudes, beliefs, knowledge and willingness to pay (WTP) for products that promote health. They employed a CE with a sample of Canadian households so as to derive the price/functional property trade-off made by consumers. Employing a random parameters logit (RPL) model they found that Canadian consumers highly rated and approved of the functional properties of the food products used in the CE. In fact, they were WTP for a functional food property under the condition that, apart from the safety and nutritional dimension of food, this would deliver disease prevention properties.

Burton and Pearse (2002) explored consumers' attitudes towards GM technology and functional foods. They tested whether second generation GM products would be successful as they will provide direct benefits to consumers via functional ingredients as opposed to first generation GM products that focused on producer benefits. Burton and Pearse employed a CE and the survey vehicle product used was beer. The statistical analysis of the data revealed three sets of respondents with differences in their preferences towards genetic modification in food – people who are not willing to pay any price level or health benefit, people who are willing to buy the new product subject to a price discount and people who welcome these products with the medicinal benefits.

Teratanavat and Hooker (2006) used a CE to explore consumer preferences and valuations for a new product (tomato juice) containing soya, which may help in the reduction of risks of certain cancers and heat disease. They employed four attributes in the CE: health benefits, organic ingredients, source of nutrients and price. The estimated various model specifications including a mixed logit (ML). The results from the ML revealed heterogeneity in consumer preferences for this new health promoting food. Specifically, more than half of the sample placed an interest in the product and were WTP a price premium to experience its benefits. Analysis of the socio-demographics showed that higher educated people and those with increased income levels had a preference for this product. Also, females and younger members of the population had positive preferences toward the new functional product. Finally, people who had in the past bought products that belong in categories such as organic food and natural food typically expressed positive preferences towards the medicinal tomato juice.

Traill et al. (2008) undertook a pilot CE in the UK to considered consumer attitudes toward enhanced lettuce, strawberries and lamb. These products are defined a being functional as a

result of the growing context or in the case of the lamb the methods used in farming the animals (ie, feed on biodiversity reach pasture which it is claimed enhances long chain fatty acids). Traill et al. report WTP estimates of £1.50 per kg for strawberries, 48 pence per lettuce and £2 per kg for lamb. They suggest that these estimates are somewhat higher than expected. However, like most of the other studies examined they indicate that consumers are WTP a reasonably large price premium for functional food.

In terms of other stated preference methods there have been a number of papers employing Contingent Valuation (CV) and Conjoint methods. For example, Markosyan et al (2009) examine consumers WTP for apples with a coating that contains specific flavonoids and antioxidants. They employed a Contingent Valuation (CV) survey instrument which was implemented using a dichotomous choice double-bound CV. Employing conventional econometric methods, Markosyan et al found that respondents would pay a small price premium for these apples – mean WTP of between 7% and 10%. Hailu et al. (2009) examine consumer preferences for functional foods and nutraceuticals that contain probiotics. They employ conjoint analysis and the design of the attributes in the conjoint includes cost, the health claim and the institutional source of the health claim. Using fractional factorial design the study employed nine profiles. To examine the socio-economic aspect of the results they employed cluster analysis. The emphasis in this study is less WTP estimates but more the socio-economic features that emerge from the study. This study reports that the partworth on cost is negative as theory would predict. The results are more concerned about the relative size of the partworths. What they find is that "mode of delivery" that is, the type of product used to delivery the functional benefit matters. Like many studies they consider yoghurt and other dairy products, in this case ice cream. Another conjoint study is presented by Siegrist et al. (2009). They examine consumer willingness to buy functional food produced using nanotechnology. This study found that products produced using nanoparticulate-engineered additives yielded lower willingness to buy results than for products with functional benefits generated naturally. This study fits in with results summarised by Siro et al. (2008) relating to a general dislike in the EU of food products that have been engineered to have health benefits.

Finally, there are also a number of stated preference studies that have examined consumer choice in relation to bread. For example, Hu et al. (2004) employed CE that presented respondents with a sliced, pre-packaged loaf of bread as the vehicle product. The purpose of this study was examine consumer willingness to trade off various attributes (ie, health, environment and GM) associated with the bread. In an effort to examine preference heterogeneity this study employed a Latent Class Model (LCM). Overall the study identified clear trade-offs between the risks associated with GM and the benefits associated with improved health and the environment. Hu et al. also found that these trade-offs did vary across their sample of respondents indicating preference heterogeneity.

In related research Hu et al. (2006) examined reference point effects in terms of consumer perceptions on price and a quality attribute for bread. As part of the survey design they asked a series of questions that helped them to construct a number of dummy variables to examine the reference point effect. Employing a ML their results suggested strong reference point effects, especially for the price of bread as well as for the GM characteristic of the product.

Boxall et al. (2007) provide another interesting study on bread. Employing CV they examined how consumer responded to information and its impact on consumer WTP for organic bread. Unlike most other studies this research employed a trained sensory panel to help quantify differences between the bread products employed in the survey. The sensory information

component of the survey revealed that the only statistically different sensory attributes were surface texture and density. There was no discernable difference with respect to taste or aroma which had been considered important attributes in determining food choice. Overall Boxall et al. found that when no information about taste was provided with the survey consumer WTP was higher when environmental information was given compared to health information. This result was reversed when taste information was provided. Thus, this implies that when a consumer cannot have a sensory experience of the product that environmental benefits associated with the mode of production are greater than those associated with potential health benefits.

Overall, the existing literature in this area indicates that consumers view food containing functional ingredients positively. However, these findings need to be qualified in terms of how the functional ingredient is produced and the impact it has upon the final product. There have also been efforts to exam the trade-offs consumer will make with respect to functional ingredients especially in relation to GM production technologies. However, one issue that has not received any detailed examination is the extent to which consumers differentiate between health messages compared to the inclusion of functional ingredients. It has been noted in the wider literature on food choice that consumers respond very strongly to positive health messages on food labels. In contrast consumers understand nutritional information but appear to adjust their diet to a lesser extent. It is therefore, an interesting question to consider if consumers respond to the inclusion of a functional ingredient in a specific product to greater or lesser extent than a positive health message.

3. Choice Experiment Design and Survey Returns

3.1 Selection of Attributes and Choice Sets

The design of the CE was undertaken with the main research objective in mind. That is, the survey instrument was designed to reveal WTP estimates associated with enhanced bread products that might include a functional ingredient. As with all CE the main issues to be considered in the design of the CE was the need to make the CE realistic whilst trying to keep the number of attributes to a minimum.

The first part of the CE was the choice of product to employ. Given the focus of our research on bread we decided that our CE would be designed to estimate the public's WTP for a bread product with health-enhancing properties. To do this we followed the approach adopted in Chalak et al. (2008) and employed a standard 800gr loaf of bread.

Once we had decided to employ bread as the subject for the CE it was then necessary to determine the set of attributes to employ in the CE. Given the choice of a loaf of bread this meant that the price attribute for our CE was simply the price for a loaf. In terms of determining the payment levels in the CE these were chosen to be typical of current bread prices in the UK. The price range employed in our CE was determined by undertaking several visits to main UK food retailers as well as online providers to assess appropriate price ranges. Prices were checked for both in-store and premium brands.

To help determine the remaining attributes to be employed in the CE we referred to the findings of Bitzios (2010) who employed MEC and semi-structured interviews (the Laddering

Technique) to examine consumer attitudes towards bread. The MEC and Laddering research undertaken by Bitzios revealed that consumers buy bread with a strong emphasis on the type of bread. Thus, we employed an attribute to describe the type of bread. In our final CE this attribute had five levels. Next we included an attribute describing the bread as being sliced or unsliced as this was identified as being important in our earlier research. We also included an attribute describing bread texture as our MEC/Laddering research had revealed that this is an important characteristic in shaping consumers bread purchases. Both of these attributes where employed as categorical variables with three and four levels respectively. Our next choice of attribute was the method of production used to produce the grain used in the bread. We did this because of the importance some consumers express about the impact of agricultural production on the environment as well as the choice of technology. This variable took the form of a dummy variable.

Finally, we introduced two attributes to examine issues related to health. We already know from the literature that consumers respond positively to health messages on food products. Thus, we employed an attribute to capture this aspect of food choice. We also included a separate attribute to capture if the product included a functional ingredient. The reason for including both attributes relates to the fact that it may well be the case that health messages dominate consumer food choice relative to functional ingredient attributes. They could especially be the case for products that already provide healthy eating options. Indeed, many products such as bread can confer a health benefit without the inclusion of functional ingredients. For example, there is scientific evidence supporting the inclusion of wholegrains in a healthy diet and there are a wide range of bread products on the market that include wholegrains. By including both in the CE we could examine and test this conjecture.

The complete set of attributes employed in our CE and their respective levels are presented in Table 1.

{Approximate Position of table 1}

Given our set of attributes we then employed a main effects orthogonal design to derive the choice sets. Given the number of attributes and their associated levels a complete factorial set of combinations yielded a profile of 2880 alternatives. We then reduced this to 24 alternative sets ensuring balance in the attribute levels. Next we constructed the choice cards by combining the alternatives choice sets along with a status quo option. A status quo option was included to reflect the fact that many individuals still buy lower value sliced white bread. The status quo option had fixed levels in all attributes and it appeared on all choice cards. We also included an opt-out option in the choice set so as to avoid forced choice on the part of our survey respondents. In total each choice card had five options, a status quo, three further variations on the type of bread and the opt-out option. To avoid fatigue in the completion of the choice task we blocked our 24 choice sets into groups of six, with care taken so that each respondent faced almost the same number of different alternatives. This meant that we had four final versions of the survey instrument.

An example of a choice card plus the description of the hypothetical choice scenario is shown in Figure 1.

{Approximate Position of Figure 1}

One final point is worth noting with respect to Figure 1. The choice sets presented to respondents in this CE are unlabelled. We decided to take this approach as we wished our respondents to consider bread a single alternative that can be composed of characteristics. The fact that we employed an unlabelled CE is why in the resulting econometric analysis there is no need to include alternative specific constants for various choice sets.

3.2. Attitudinal Variables and Socio-Economic Data

In addition to the CE we also collected various data on individual specific characteristics, such as socio-economic, behavioural and attitudinal data. In terms of the behavioural and attitudinal data the survey instrument included the Dutch Eating Behaviour Questionnaire (DEBQ) (ie, van Strien et al., 1986). The DEBQ was integrated into the survey instrument in order to collect information about participants underlying eating behaviours. This was considered an important component of the survey as it provided useful enlightenment into the underlying factors that might be driving the responses to the CE. The DEBQ provides an understanding in relation to eating patterns in three contexts: emotional, external and restrained eating.

The first context, emotional eating, refers to a situation of excessive eating which is brought about by a state of confusion between an individual's internal arousal states (ie, anger, fear and anxiety), which normally result in a loss of appetite or hunger. The second context, external eating refers to a situation in which an individual responds to some form of food related stimuli, irrespective of their internal status with respect to hunger or satiety. Lastly, restrained eating, is a state when the conscious restrictive control associated with suppressed eating behaviour (ie restrained eating), may be disrupted by desinhibition factors, such as alcohol or depression, resulting in counter regulation and overeating (van Strien et al, 1986).

A list of the variables used in the estimation of the models is presented in Table 2.

{Approximate Position of Table 2}

3.3. Survey Design, Delivery and Returns

The survey instrument employed a single mail shot postal survey. To enable ease of completion the final design of the survey instrument consisted of five sections. In section A, after welcoming the participant and explaining the purpose of the research in the cover letter accompanying the questionnaire, information was provided about functional foods. Next we provided a series of warm up questions. In section C, the choice task was explained. Specific instructions were given and an example of how the choice cards task should be treated was provided. In section D respondents were asked to answer the choice tasks. In addition, after the choice task was completed we asked all respondents to rank in terms of importance the attributes they took into account, when completing the choice tasks. We have employed this information in the model estimated in this paper. Next in section E we introduced the DEBQ. Finally, section F asked a series of questions for collecting individual-specific information (e.g. socio-economic, attitudinal questions) as well as information on people's feeling about the survey instrument (such as the readiness and clarity of the questionnaire).

The survey instrument was distributed by post using second-class postage to a stratified sample of 3,000 UK households in May 2009. It was a single shot survey employing a simple financial incentive to induce participation (enter a prize draw to win one of four shopping

vouchers). The stratified sample was purchased from a commercial list broker (Marketing File), the largest on-line source of direct marketing data in Europe. As the survey had four different versions the mailing list was randomly divided into four subgroups and each survey version was sent to 750 households. Each survey package contained the survey instrument along with a cover letter attached to it (in the form of a booklet). It also contained prepaid return envelopes, in which participants should enclose and send back to the researcher the completed questionnaires. No reminder postcards were sent out. The last questionnaire was received about three months after the survey was posted. However, most were returned within a month.

The total number of respondents was 444. This corresponds to response rate of 14.8%. However, the final sample size (fully completed surveys that used for the analysis) consisted of 404 questionnaires. The remaining 40 were incorrectly completed. A summary of descriptive statistics is presented in Table 3

{Approximate Position of Table 3}

From Table 3 we can see that we have more female respondents than males (note that gender attribute is a dummy variable that takes the value "1" if the respondent is female). The actual proportion of females in the UK is just under 51 percent. In terms of age our sample has an above average value compared to the UK average of 39. The average income of respondents (excluding non-responses) is just over £31,000 which is very close to average income in the UK. Overall, our sample is reasonably representative albeit with a slightly higher average age.

4. Model Estimation

In terms of data analysis there are various limited dependent models that we could employ. However, the analysis and results presented in this paper are based upon a Latent Class Model (LCM). A LCM was chosen so as to help in our examination of heterogeneity in the choices made. The LCM is proving ever more popular amongst researchers who wish to consider issues of preference heterogeneity because it is reasonable to assume that preferences are not unique to the individual but rather a group of individuals. In this context the LCM is preferred to other models such the ML. Thus, the LCM identifies a discrete number of segments. Within each segment preferences are assumed to be homogenous. Preference variation (heterogeneity) is between the segments.

There are growing number of papers in the food economics literature that have employed the LCM (eg, Hu *et al*., 2004, Kontoleon and Yabe 2006 and Chalak et al., 2008). The appeal of this approach is that it allows the researcher to capture heterogeneity in the data. At the same time the segmentation of the data into several groups allows specific forms of choice to be identified and labelled.

4.1. Model specification

It is common practice to begin by estimating a Conditional Logit model when dealing with data generated by a CE. Next a decision is made with respect to how to take account of respondent heterogeneity. There are two approaches available: the Random Parameter Logit (RPL) and the Latent Class (logit) Model (LCM). The choice of method is generally determined by how the researcher wishes to model respondent heterogeneity. In this paper

we employ the LCM. We make choice because the LCM assumes that respondent preferences are not specific to the individual but rather unique for a number of respondents for a finite number of classes. Thus, all respondents are assumed to be a member of a specific segment or class. With the LCM the researcher is able to allow market segment probabilities to be explained by individual socio-economic characteristics and attitudes.

In this paper we follow Greene and Hensher (2003) and employ a standard LCM specification which assumes a random utility model. This model has two parts, an observable deterministic component and an unobservable random component. Thus, the utility an individual n obtains from selecting alternative j in the t^{th} choice set is

$$U_{njt|s} = \beta_s X_{njt} + \varepsilon_{njt|s} \tag{1}$$

where U is the utility obtained by individual, β is a vector of parameters of segment s, X is a vector of attributes from the CE and ε is a random component assumed to be a Type 1 extreme distribution. Following Swait (1994) we assume that the deterministic component of Equation (1) can be decomposed into two components. The first relates to the specific attributes of the choice made. The second captures individual specific characteristics (ie, socio-economic and attitudinal variables).

It then follows that the choice probability for an individual n, given that they belong to s, will select an alternative i from a choice set of j alternatives, for a specific choice activity is as follows:

$$\Pr_{nit|s} = \left(\frac{e^{\beta_s' X_{nit}}}{\sum_{i=1}^{I} e^{\beta_s' X_{njt}}} \right) \tag{2}$$

Next we follow Greene and Hensher (2003) and employ a Multinomial Logit so as to distribute an individual n to a given class s as follows:

$$\Pr_{ns} = \left(\frac{e^{\alpha_s' Z_n}}{\sum_{s=1}^{S} e^{\alpha_s' Z_n}} \right) \tag{3}$$

where Z_n is a vector of individual-specific variables and α_s a vector of segment specific utility parameters to be estimated.

Next we assume that conditional on an individual respondent being allocated to a specific segment, that the t^{th} choice activities are independent. This then implies that conditional on a specific segment membership, the probability that a respondent n selects an alternative i from a set of j alternatives can be shown as follows:

$$\Pr_{ni|s} = \prod_{t=1}^{T} \Pr_{nit|s} \tag{4}$$

Finally, to estimate the LCM so as to simultaneously take account of the choice made by a respondent and the segment to which they belong we combine equations (3) and (4) as follows:

$$\Pr_{ni} = \sum_{s=1}^{S} \left(\frac{e^{\alpha_s' Z_n}}{\sum_{s=1}^{S} e^{\alpha_s' Z_n}} \right) \prod_{t=1}^{T} \left(\frac{e^{\beta_s' X_{njt}}}{\sum_{j=1}^{J} e^{\beta_s' X_{njt}}} \right) \qquad (5)$$

The term in the first bracket on the right hand side is the probability of observing any individual in segment *s*. The second bracket is the probability of selecting alternative *i* given membership of segment *s*. Note that if $\alpha_s = 0$ then the LCM becomes the standard MNL.

The parameters in Equation (5) are estimated using maximum likelihood estimation. Importantly, estimation requires that the number of segments *S* in advance. The means that it is necessary to estimate this model *S* times and employ various statistical criteria to select the "optimal" number segments. Within the literature a number of criteria are employed, in particular the minimum Akaike Information Criterion (AIC), and the minimum Bayesian Information Criterion (BIC). We employ both of these in helping to determine the number of segments.

Attribute specific WTP estimates can be estimated as follows:

$$WTP_n = -\sum_{s=1}^{S} p_{ns} \cdot \left(\frac{\beta_{as}}{\beta_{ps}} \right) \qquad (??)$$

where is β_{as} a segment-specific non-monetary coefficient and β_{ps} is the segment specific monetary coefficient on price of the device. As WTP estimates are ratios of sums of parameters they are complex non-linear functions of the estimated parameters. We can employ simulation methods to estimate confidence intervals following Greene and Hensher (2003).

5. Results

The results we present below are preliminary and based on an initial examination of the survey data. We begin our analysis by examining how our model performs as we increase the number of segments. In general, although we could derive results for more than two segments, at least one of the resulting segments represented a very low proportion of the sample. As a result we confine our analysis to the two segment LCM. As can be seen the results in Table 4 (ie, LLL, AIC and BIC) indicate that the LCM provides a much improved fit of the data compared to the MNL.

For our preferred specification we have included a limited number of interaction terms. We have include these interactions to capture important trade-offs being made in the CE. Specifically, we are interested to see how survey respondents valued products that might offer a health benefit as well as a functional ingredient. We are also interested to see if the method of production is more or less important than the health benefit and functional ingredient for

the consumer. In addition, we have included alternative specific constants (ASCs). One is to capture any status quo effect and the other is for the No Choice option.

Our results including the segment membership equations are presented in Table 4.

{Approximate Position of Table 4}

The first thing to observe about our results in Table 4 is that the price coefficient is the right sign and statistically significant in both the MNL and LCM. Next consider the ASCs. We can see that that in the MNL the status quo ASC indicates a degree of bias toward the status quo. However, when we consider the LCM results we can see that the sign is reversed for segment one, indicating no bias toward the status quo and that the coefficient is statistically insignificant in segment two. In relation to the no choice ASC we observe that all coefficients are statistically significant and negative indicating a positive preference for the bread options provided.

Moving onto the various attributes we can observe that the signs on the bread types for both the MNL and the LCM are a combination of positive and negative values. In all case there is a strong preference for the Wholegrain product and to a lesser extent Brown. However, there appears to be a general dislike of Rye as a bread type and mixed evidence regarding 50/50. These results indicate that all respondents are prepared to consumer Wholegrain bread.

Next if we consider the Method of Production (MOP) we can see that in the MNL this variable is statistically insignificant. The only time MOP is statistically significant is for segment two of the LCM and the resulting coefficient is negative. This would indicate, at least within the context of this CE that consumers are not interested in the MOP and are happy with conventional methods of farming.

In terms of results relating to the functional ingredients we find that our respondents did view this attribute positively although it is only for segment two of the LCM that we achieve a statistically significant estimate. This does indicate a willingness on the part of consumers to consider buying bread that includes a functional ingredient although this only applies to a proportion of our respondents.

In contrast we find much stronger preferences on the part of our respondents for a product offering an explicit health benefit. What is also apparent is that an explicit health message as opposed to the health enhancing functional ingredient has achieved a higher parameter estimates which will, as we will shortly consider, indicated a stronger preference for the health message associated with the product as opposed to the functional ingredient that may well be health enhancing.

As previously noted we have also introduced three interaction terms to capture the relationship between the health message, the inclusion of a functional ingredient and the method of production. Although many of the resulting estimates are not statistically significant we can observe that there is a negative interaction between health benefits and functional ingredient, and health benefits and MOP. It is only when we consider the interaction between MOP and functional ingredient do we find positive coefficients. We will further consider the importance these result in terms of the resulting WTP estimates presented below.

Finally, we consider the results with respect to whether or not the bread is thick sliced or not. In the MNL and LCM the results indicate a dislike of unsliced bread. However, all the other remaining attributes of the bread appear to have little impact on the choices made as part of the CE.

Next we examine our class membership results. Because we only have two segments there are only one set of results generated. The most striking aspect of these results is the fact that the only conventional socio-economic variable that is statistically significant is income. As we would expect income has a positive coefficient. Amongst the other variables included in the segment equation we find that being health conscious is positive for segment one. Also when we consider our three DEBQ variables we see that they statistically significant and positive for Restrained Eating and Emotional Eating. In contrast External Eating is negative.

The final set of results we examine are the resulting WTP estimates. These are reported in Table 5.

{Approximate Position of Table 5}

In Table 5 we present our point estimates of WTP. A positive sign indicates WTP and a negative sign WTA. The first result of importance is the fact that the highest WTP estimates are for bread type, in particular Wholegrain bread. The importance that respondents have attached to bread is in keeping with the results of the MEC/Laddering undertaken by Bitzios (2010). We also observe that in terms of Rye we have negative results indicating a WTA on the part of respondents. In terms of the magnitude of our WTP results the Wholegrain estimate in segment one (ie £1.84) is a little on the large size, whereas for segment two the WTP of £0.33 is very credible. The segment two result implies a price for a loaf of approximately £1.00 which is a price that can be observed in the market. In terms of the segment one result this implies a WTP of £2.50 for a loaf of wholegrain bread. This is higher than most bread available on the market although there examples of specialist wholegrain bread retailing for more than this. The WTP estimates on the Brown and 50/50 are credible in terms of the prices paid for these products.

The second important result relates to the values for the health, functional ingredient and production attributes. If we concentrate on the results for functional ingredients and compare these to the health benefit claim we observe that although consumers are WTP for both (more so health benefits) there is a stronger preference for an outright health claim as opposed to a benefit that might arises as a result of eating a functional ingredient. In addition, we can also observe that the effect of including both on a product also yields a positive WTP response. However, a product that provides only a health benefit is more highly valued than a product offering both. The finding indicates that consumers are willing to pay more for a product with a specific health claim, but claiming a product is healthy as well as providing further potential benefits as a result of the inclusion of a functional ingredient need not result in a more highly valued product. We also observe that the joint effect of indicating the method of production as well as a health benefit claim or functional ingredient also provided statistically significant WTP results. However, as we would anticipate the resulting WTP are lower than the WTP estimates for a health benefit claim alone.

Finally, if we compare the results for segment one and two we can see that segment one has a much higher WTP for Wholegrain bread compared to segment two. In general segment two has lower WTP estimates for all the attributes As such segment two captures that part of the

sample which have lower WTP estimates. Segment two also captures negative preferences regarding the MOP in that there is no preference for organic grain production. Our results regarding the MOP are probably unsurprising as the CE was general framed within a healthy eating context. As such the lower importance attached to MOP indicates that once we ask consumers about a selection of issues the apparent importance of a particular aspect of a product can become far less important than might be initially assumed..

6. Conclusions and Discussion

In this paper we have presented preliminary results for a CE that has examined consumer willingness to consume bread products that might contain a functional ingredient. As we have explained the market for functional foods is growing rapidly and bakery products appear to offer an obvious source of market opportunities for food manufacturers. Our results indicate that consumers are WTP for a bread product that contains functional ingredients although they appear to have a stronger preference for bread that offers a simple but clear health benefit.

In terms of research findings our main result is that respondents typically select bread based upon the bread type. This finding supports the results of the MEC research undertaken by Bitzios (2010) and used to inform our choice of attributes. Although our results indicate that consumers are willing to pay for bread that may provide a health benefit (directly) as well as products that contain a functional ingredient these attributes are less important. Furthermore, like existing research on consumer choice we do find evidence of heterogeneous preferences. However, when we consider what explains preferences we find that attitudinal variables have far greater power than the more conventional socio-economic variables typically employed in empirical analysis. Maybe we should not be surprised by this finding but it does raise questions about what type of data we need to collect if we are to better understand what determines choice in stated preference research.

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Table 1. Attribute and attribute levels used in the experiment

Attribute	Description	Levels
Type of bread	The different types of bread available in the hypothetical market	White Wholemeal Brown 50:50 Rye
Method of Production	The method of production for the main ingredient of bread	Conventionally Organically
Functional Ingredient	A component that could potentially deliver nutritional benefits, if added	Yes No
Sliced/Unsliced	The attribute indicates whether the bread is sold sliced or not	Medium sliced Thick sliced Unsliced
Texture	The attribute shows the consistency of bread	Soft Firm Crunchy Springy
Health Benefit	The attribute indicates whether the product promotes health	Yes No
Price	The cost (in £) for buying a standard 800gr loaf of bread	0.7 1 1.3 1.6 1.9 2.2

Table 2. Socio-economic and attitudinal variables

Variable	Description
Gender	0 if male; 1 if female
Age	Respondent's age in years. There were six age group categories
Number of dependant children in household	The actual number of dependant children in the household
Education	6 levels coded 0 to 5: GCSE, A-level, Further education, B.A./B.Sc., M.A./M.Sc., Doctorate degree
Income	Thousands pounds per annum
Work	1 if working, 0 otherwise
Exercise	1 if participant exercises, 0 otherwise
Health Conscious	1 if participant health conscious when buying food ,0 otherwise
Gluten Intolerance	1 if participant is gluten intolerant, 0 otherwise
DEBQ – Emotional	Likert scale 1-7
DEBQ – External	Likert scale 1-7
DEBQ - Restrained	Likert scale 1-7

Table 3: Descriptive Statistics

Variable	Mean	SD	Min	Max
Gender	0.636	0.48	0	1
Age (Years)	52.63	13.97	20	70
No. household	1.94	1.29	1	5
No. children	0.48	0.87	0	4
Education	1.73	1.36	0	5
Income (£)	31,086	1927.8	2,500	67,500
Work	0.539	0.49	0	1
Exercise	0.62	0.49	0	1
Health conscious	0.69	0.46	0	1
Gluten intolerant	0.05	0.22	0	1
DEBQ – Emotional	2.11	0.81	1	4.62
DEBQ – External	2.72	0.63	1	4.18
DEBQ - Restrained	2.7	0.88	1	5

Table 4: Model Results

	MNL		Segment 1		Segment 2	
Variables	**Coeff**	**P Value**	**Coeff**	**P Value**	**Coeff**	**P Value**
ASC (Status Quo)	***0.395***	0.026	***-1.601***	0.000	0.175	0.444
Rye	***-0.648***	0.000	***-0.424***	0.000	***-1.413***	0.000
Whole	***0.996***	0.000	***1.261***	0.000	***0.541***	0.000
Brown	***0.213***	0.000	***0.324***	0.000	0.044	0.580
50/50	-0.052	0.408	***-0.152***	0.088	***0.454***	0.000
Method of Production (MOP)	-0.165	0.261	0.257	0.343	***-0.509***	0.002
Functional Ingredient (FI)	0.129	0.381	0.120	0.673	***0.418***	0.017
Slice Unsliced	***-0.118***	0.006	***-0.103***	0.063	***-0.206***	0.003
Slice Thick	0.061	0.159	0.028	0.623	***0.156***	0.009
Texture Springy	0.049	0.318	0.096	0.121	-0.071	0.393
Texture Firm	0.089	0.134	0.087	0.274	0.084	0.291
Texture Crumbly	-0.011	0.803	-0.054	0.383	-0.063	0.395
Health Benefit (HB)	***0.701***	0.000	***0.837***	0.001	***0.455***	0.004
Price	***-0.845***	0.000	***-0.684***	0.000	***-1.612***	0.000
FI*HB	***-0.434***	0.019	-0.312	0.428	***-0.509***	0.021
MOP*HB	-0.057	0.751	-0.384	0.291	0.292	0.142
MOP*FI	***0.397***	0.033	0.086	0.824	***0.423***	0.033
ASC (No Choice)	***-2.444***	0.000	***-1.778***	0.000	***-4.949***	0.000
LL	-3340.8		-2870.5			
AIC	2.77		2.41			
BIC	2.81		2.52			
Segment Probabilities			0.588		0.412	

Segment Variables	**Coeff**	**P Value**
Constant	***-1.346***	***0.051***
Age	0.013	0.195
Gender	-0.023	0.261
Children	0.001	0.432
Education	0.001	0.664
Work	0.093	0.762
Exercise	-0.055	0.844
Health Conscious	***1.597***	***0.000***
Glutton Intolerant	-0.001	0.610
Restrained Eating	***0.290***	***0.048***
External Eating	***-0.675***	***0.000***
Emotional Eating	***0.385***	***0.050***
Income	***0.561***	***0.059***

Note: Results in Bold and italic are statistically significant at the 10 percent level.

Table 5: WTP Estimates (Point Estimates and Standard Errors)

WTP Estimates	MNL	Segment 1	Segment 2
	-0.76	***-0.62***	***-0.87***
Rye	***(0.08)*****	***(0.12)******	***(0.07)******
	1.18	***1.84***	***0.33***
Whole	***(0.09)******	***(0.22)******	***(0.05)******
	0.25	***0.47***	0.03
Brown	***(0.07)******	***(0.13)******	(0.05)
	-0.06	***-0.22***	***0.28***
50/50	(0.07)	***(0.13)****	***(0.05)******
	-0.19	0.37	***-0.32***
Method of Production	(0.17)	(0.40)	***(0.10)******
	0.15	0.17	***0.26***
Functional Ingredient	(0.17)	(0.41)	***(0.11)*****
	-0.14	***-0.15***	***-0.13***
Slice Unsliced	***(0.05)******	***(0.08)****	***(0.04)******
	0.07	0.04	***0.09***
Slice Thick	(0.05)	(0.08)	***(0.03)******
	0.05	0.14	-0.04
Texture Springy	(0.05)	(0.09)	(0.04)
	0.11	0.12	0.05
Texture Firm	(0.07)	(0.11)	(0.04)
	-0.01	-0.08	-0.04
Texture Crumbly	(0.05)	(0.08)	(0.04)
	0.83	***1.22***	***0.28***
Health Benefit	***(0.17)******	***(0.41)*****	***(0.10)******
	0.47	***0.94***	***0.23***
FI*HB	***(0.19)******	***(0.43)*****	***(0.11)*****
	0.57	***1.03***	***0.15***
MOP*HB	***(0.19)******	***(0.45)*****	***(0.12)******
	0.43	***0.67***	***0.21***
MOP*FI	***(0.18)******	***(0.40)****	***(0.12)****

Note: Standard errors of WTP estimates are reported in brackets

Statistically significant at 1% ***, 5% ** and 10% * level of significance

Hypothetical scenario

You are shopping and ready to buy a loaf of bread. This is a standard 800 gram loaf of bread. The bread is sold in a package that presents information describing the product. The relevant information describing the bread is highlighted in bold and each one is explained as follows:

Type of bread: There are five different types of bread available in the store: White bread, Wholegrain bread, Brown bread, Bread containing 50% white & 50% wholegrain flour and Rye bread.

Production method of grain: The flour used for bread making has been produced by wheat or rye that is grown conventionally or organically (with fewer chemicals).

Functional ingredient: If the bread product contains a functional ingredient, it is indicated simply by recording "Yes" on the packaging. If it is absent, a "No" is recorded.

Sliced/Unsliced: The bread can either be unsliced, medium sliced or thick sliced.

Texture: This characteristic describes the consistency of bread. That is, the bread can be soft, firm, crunchy and springy.

Health benefit: If the bread product claims to potentially deliver a health benefit, it is indicated simply by recording "Yes". If no health benefit is claimed, "No" is recorded.

Price: Indicates the cost for a particular type of bread.

An <u>example</u> of how information contained on the package is summarized on the **choice card** is shown below.

Information about the bread contained on the packaging

Option 5 represents the opt-out option

Example

Loaf of bread	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Type of bread	White	50% - 50%	Brown	Rye	I would not buy any of these options
Grain produced	Conventionally	Conventionally	Organically	Conventionally	
Functional Ingredient	No	No	Yes	No	
Sliced/Unsliced	Medium	Thick	Medium	Unsliced	
Texture	Soft	Firm	Soft	Crunchy	
Health benefit	No	Yes	No	Yes	
Price	0.70	1.90	2.20	0.70	
Choose **one & only one** option			✓		

Options 1, 2, 3 and 4 represent the hypothetical, bread products you will be asked to choose between