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Consumer attitudes towards sustainability attributes on food labels

Caroline Saunders
Lincoln University, New Zealand
e-mail: caroline.saunders@lincoln.ac.nz

Meike Guenther
Lincoln University, New Zealand
e-mail: meike.guenther@lincoln.ac.nz

William Kaye-Blake
Lincoln University, New Zealand
e-mail: bill.kaye-blake@nzier.org.nz

Sini Miller
Lincoln University, New Zealand
e-mail: sini.hakola@lincolnuni.ac.nz

Peter Tait
Lincoln University, New Zealand
e-mail: peter.tait2@lincolnuni.ac.nz

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Caroline Saunders, Lincoln University
caroline.saunders@lincoln.ac.nz

Meike Guenther, Lincoln University
meike.guenther@lincoln.ac.nz

William Kaye-Blake, Lincoln University
bill.kaye-blake@nzier.org.nz

Sini Miller, Lincoln University
sini.hakola@lincolnuni.ac.nz

Peter Tait, Lincoln University
peter.tait2@lincolnuni.ac.nz

Summary

With current concerns about climate change and the general status of the environment, there is an increasing expectation that products have sustainability credentials, and that these can be verified. Labelling is a common method of communicating certain product attributes to consumers that may influence their choices. There are different types of labels with several functions. The aim of this study is to investigate consumers' purchase decisions towards certain sustainability claims on food products, particularly by displaying the reduction of carbon emissions. Choice outcomes will be evaluated using Discrete Choice Modelling (DCM). Data for the study is obtained by a web-based consumer survey undertaken in the United Kingdom (UK). Results provide information on different attributes effects on consumers' purchase decisions, particularly their willingness to pay. This study provides information on consumers' attitudes that will assist industries and firms to benefit from market opportunities, in particular assessing the methods by which carbon footprinting measures can be incorporated alongside information on other sustainability criteria in product marketing.

Keywords: FOOD LABELLING, CARBON FOOTPRINT, DISCRETE CHOICE MODELLING

Introduction

With current concerns about climate change and the general status of the environment, there is an increasing expectation that products meet certain sustainability standards, and that these can be verified. This is reflected in changes in consumer and retailer demands in some markets and is driving changes in the value chains and markets that New Zealand's primary industries participate in. In particular, there is significant and increasing pressure in some key export markets for information on the Greenhouse gas (GHG)-intensity for products throughout the product life-cycle. Thus, alongside

corporate disclosure and consumer pressure, demand for carbon labelling has increased and with it the development of carbon labelling schemes. Labelling is the method that is considered in this study to meet consumer's expectation of communicating relevant product attributes. The literature uses the term 'label' in various ways. In this study a label is considered a display of different attributes of a product on or attached to the product's packaging. There are different types of labels which have several functions. Consumers', firms, third-party entities, and governments all play a role in determining which of the products many attributes are described on the product's label.

An important consideration in product labelling is the distinction between search, experience and credence product attributes (see Darby & Karni, 1973; Nelson, 1970). These attributes take into account the various possibilities that consumers have for obtaining information about the quality and other characteristics of products. Search attributes of a product can be experienced before the consumption, whereas experience attributes imply that the consumer can identify the quality attributes after purchase and during consumption of the product. In contrast, credence attributes of goods imply that the impact and quality of the use or consumption cannot be identified, experienced and inspected by consumers whether before or after purchase. In particular for credence attributes of products, there is an information asymmetry between consumer and producer. A common method to reduce information asymmetry is to conduct external audits. Products then are checked against determined criteria and when they meet these standards the producer can display the logo of the awarding third-party institution. This may contribute to improved acceptance, credibility and comprehensibility of information about certain attributes on product labels.

Consumers react differently towards different attributes on food product labels and these labels have an impact on consumer's choices, therefore it is important to understand which of the many attributes appeal to consumers and which product they finally choose. Several methods exist to measure consumer choices, one of which indicates how much money a consumer is willing to pay for a change in the level of another attribute. Moreover, willingness-to-pay (WTP) can be evaluated using for example Discrete Choice Modelling (DCM). This method estimates parameter attributes and further quantifies preference trade-offs. DCM is based on random utility theory assuming that people make their decisions by maximising utility, where utility is a measure of the preferred choice out the combinations of attributes (Ben-Akiva & Lerman, 1985). This technique involves choice data that is commonly obtained by surveying. The survey is designed by using statistical properties to increase the efficiency of the experiment and hence find the optimal combination of the questions (i.e. choice sets). In the choice data, the preferences are captured by describing the products by relevant attributes.

The main contribution of this paper is therefore to specifically address the way in which different aspects of food labelling affects choices and in particular if people are willing to pay more for products that have a lower carbon footprint.

To facilitate the selection of attributes for the choice set a literature review, focus group meetings and stakeholder interviews were conducted. Various types of labels were considered in the literature review to provide information on consumer attitudes and preferences to various labelling options. In particular, environmental product attributes, genetically-modified (GM) - ingredient display, carbon emission information and nutritional information of food products are within the scope of this project. The inclusion of several types of product attributes broadens the scope of current labelling practice.

Literature review

Many studies have examined consumer's attitudes toward environmental labels, nutrition fact panels and labelled information on GM ingredients of a food product by assessing consumer's WTP for certain product information. This indicates wheather consumers would pay a premium for a specific product attribute. Furthermore, it suggests an *'inclination to buy because of expected satisfaction from a product'* (Pride, Elliott, Rundle-Thiele, Waller, & Paladino, 2006).

Several international empirical studies on consumer's WTP for different types of food product labels were examined by McCluskey & Loureiro (2003). With regards to eco-labels on food products the authors show that consumer preferences for certain environmental attributes on food products may depend on the product the attribute is displayed on. Thus, the response to an environmental attribute on a food product may be different for different products. Furthermore, McCluskey & Loureiro (2003) argue that consumers from different countries may respond differently to the same environmental attribute that is labelled. For example, results of a study on consumer response for environmentally friendly seafood in the U.S. and Norway showed differences of consumer preferences for price premium, species, consumer group, and certifying agency. McCluskey & Loureiro (2003) conclude that especially for socially responsible and origin-based food products consumers must perceive high food quality to pay a price premium for the labelled food product.

Noussair et al. (2002) conducted an experimental study in France investigating consumers' WTP for GM information on cornflakes containers. Results showed that consumer's WTP decreased by 27.3 per cent for a product that displays the content of GM ingredients when the consumer is aware of the labelled information. Lack of reaction to the introduced GM information was explained by the authors as due to the fact that consumers do not notice information on GM ingredients. They argue that consumers appear not to notice information they are not looking at in the first place. Furthermore, the results show that almost 80 per cent of the respondents would purchase the GM food when they are offered it at a lower price (Noussair, Robin, & Ruffieux, 2002)

In contrast, Gaskell et al. (2006) investigated European perceptions towards biotechnology. The survey was based on responses from approximately 1,000

individuals from each of the 25 European Union (EU) Member States. Results showed that GM food is predominantly perceived negatively, most consumers don't see any clear benefits associated with genetically engineered crops. Meanwhile, the public is clearly concerned about potential risks to human health and the environment. The striking feature of the study is the low level of support for GM food, relative to the other biotechnological applications. Even in Spain, where tens of thousands of hectares have been planted with GM crops, the support is only 7 per cent above the European average of 27 per cent (Gaskell et al., 2006).

Consumers also respond to animal welfare labels on food products. Several studies have been conducted on the tuna-dolphin controversy. Teisl et al. (2002) showed that consumer's WTP changed when dolphin-safe information is displayed on canned tuna, indicating that the fish has been caught without harming or killing dolphins. They assume that this is due to the fact consumers do not want to contribute personally to dolphin mortality when making food choices. Furthermore, the authors suggest that consumers may or may not react instantly when a certain attribute is introduced to the food product label when market or welfare effects are investigated.

Label information on electrical appliances also has an impact on consumer's purchasing behaviour. Sammer and Wuestenhagen (2006) investigated consumers WTP for the display of the mandatory EU Energy Label Scheme on washing machines in Switzerland. The EU Energy label is attached to a range of whiteware as well as on light bulbs and cars. It assesses the products and ranks them into energy efficiency classes from A to G on the label with A being the most energy efficient, and G the least efficient. The study's findings of demonstrate that there is considerable WTP for A labelled energy efficient products. The premium for an A versus a C - labelled product was estimated to be 455.63€ (NZ$ 936.55) for washing machines. This represents about a 30 per cent premium. Furthermore, the findings show that brands of washing machines influence consumer's WTP. The respondents were willing to pay 800.00€ (NZ$ 1,644.40) more for a washing machine from one of the two favourite brands compared with a no-name product. This is about a 50 per cent premium and almost twice as much as the difference between A and C - labels (Sammer & Wuestenhagen, 2006).

Concerns about climate change have also been seen through changes in markets and development of labelling schemes. The importance and role of sustainability and carbon footprint labelling for consumers has been investigated in several studies. Fischer (2009) investigated consumer perceptions of different environmental labels. Results showed that consumers are willing to pay at least a small difference for sustainability attributes. The majority of consumers are willing to pay more when the product label covers fair trade issues and sustainable manufacturing. Fischer (2009) assumes that many consumers are willing to pay a premium for products that support sustainability requirements in order to give 'peace of mind'.

A 2007 survey, with 14,220 participants across 22 countries, showed that around 68 per cent of consumers were concerned about climate change (Synovate, 2007). Within this, over two-thirds of participants claimed to have actively engaged in consumption

behaviour that could be seen to be effective in promoting environmental wellness. However, while these consumers considered environmental wellness in their purchase decisions, between 5 and 10 per cent were willing to accept trade-offs, i.e. lower quality product, or a higher price for environmentally sustainable goods. WTP for products with sustainable or environmentally-friendly attributes also scored low within this survey, while ethical foods such as fair trade and local food scored high. Japan however, showed high levels of concern with around 30 per cent of Japanese consumers purchasing products made by companies actively involved in environmentally beneficial activities (Synovate, 2007).

A survey undertaken in 2008 by Research New Zealand for the Ministry of the Environment measured the perceptions of New Zealanders towards sustainability issues (Research New Zealand, 2008). This study identified groups of consumers and their willingness and potential to take action about sustainability. Results showed that the general public's levels of perceived knowledge of environmental issues are mixed. While 55 per cent of respondents believe they know a fair amount to a lot about climate change and 58 per cent about global warming levels of knowledge about carbon footprint (40 per cent), carbon dioxide emissions (46 per cent) and carbon offsetting (18 per cent) are significantly lower. The study developed seven consumer segments (see Table 1) which were derived from a model developed by DEFRA (Department for Environment Food and Rural Affairs, 2008). Consumers were categorized by their ability and willingness to care for the environment and their perceived knowledge about certain sustainability issues. In the matrix, the consumer segment with the highest perceived knowledge about climate change (69 per cent), global warming (70 per cent), and the term, carbon footprint (53 per cent) are the 'positive greens'. This represents 14 per cent of New Zealand's population. Consumers in this segment are reported as being particularly environmentally friendly and that they do quite a few things that are environmentally friendly. This is in contrast to the segment of 'honestly disengaged' which represents 11 per cent of New Zealand's population. Consumers in this group are the least likely group to care for the environment. The largest segments are the 'waste watchers' which represent 39 per cent of the population. With regards to their behaviour 'waste watchers' are similar to 'positive greens', 57 per cent of 'waste watchers' feel that they do quite a few things that are environmentally-friendly and 24 per cent claim to do mostly environmentally-friendly things.

Table 1: Sustainability segmentation

Segment	Proportion of the Population
Positive Greens	14%
Concerned Consumers	18%
Sideline supporters	5%
Waste watchers	39%
Cautious Participants	8%
Stalled Starters	5%
Honestly Disengaged	11%

Adapted from (Research New Zealand, 2008)

With regards to consumers' attitudes towards climate change the Australian Department of Primary Industries reviewed several studies from different countries as support for strategy development for Australia. The review showed that the consumer segment concerned with climate change, which influences their purchasing behaviour, is still very small. The price is still the main factor that is of interest for consumers rather than climate change. The review also demonstrated that consumers are not well informed about carbon footprinting and carbon labelling (Creese & Marks, 2009).

To summarize, the reviewed literature on consumers WTP for certain product attributes showed that WTP differs for various product attributes and that this may differ across countries. The literature review showed that most research has investigated consumer attitudes towards product labels claiming single sustainability attributes, while a limited number of studies have examined the labelling of multiple sustainability claims on food products. Therefore, this research contributes to the literature by estimating consumers WTP for product characteristics within a context that includes multiple sustainability attributes on a product label.

Methodology

In order to understand what people are willing to pay for products across different sustainability attributes, an evaluation methodology is required. In our study, a choice experiment within the DCM is chosen. This choice experiment requires choice data that can be either stated preference (SP) a hypothetical scenario, or revealed preference (RP) using actual choices in related market. The choice experiment is a collection of choice sets consisting of fixed choice options (alternatives) described by a set of attributes and their levels (Louviere, 2001). Outsider expertise may assist in the attribute determinations, together with in-depth interviews and focus group meetings as Hensher, Rose and Greene (2005) note. The completed choice experiment will yield data on preferred choice outcomes conditional on different combinations of attribute levels.

Using different experimental designs, the researcher can work towards the efficiency of possible combinations of attributes and the difference in their levels. Hensher et al. (2005) state that a scientific definition for an experiment involves an observation variable (response, here the choice outcome) and other variables (here the attributes) manipulated by the (attribute) levels. These manipulations take place by the design, resulting in a set of attribute combinations used in a survey – "hence the name 'experimental design'" (Hensher et al., 2005).

In order to evaluate choice experiment data, a theoretical approach is assumed that individuals behave in a way to maximize satisfaction (Train, 2003). This is, based on random utility theory the choice probability implies that person *n* chooses the utility (*U*i) over (*Uj*) only if it gives higher satisfaction:

$$\Pr(i_n) = \Pr(U_{ni} > U_{nj}) = \Pr(V_{ni} + \varepsilon_i > V_{nj} + \varepsilon_j) \tag{1}$$

where *U* is an unobserved utility by researcher, *V* is *representative utility* (observed by researcher) and ε is *unknown utility* (unobserved by researcher) (Hensher et al., 2005; Train, 2003). In the equation (1) can also be included a situation or time dimension which is excluded here for the sake of simplicity.

As the choice data includes information that is known for the respondent but unobservable for the researcher. Statistical analysis makes it possible to draw inference from the error term representing unknown information (Train, 2003). Moreover, the choice model specification employed depends on the assumption of the distribution of the density of this error term ε (Train, 2003). The usual way is to use a model from the logit family assuming ε ~ Extreme value type (1) model (also known as the Gumbel model) resulting in a mathematically convenient model – a multinomial logit[1] (MNL) model (McFadden, 1974):

$$\Pr(i_n) = \frac{\exp\{V_{ni}\}}{\sum_{j=1}^{J} \exp\{V_{nj}\}} = \frac{\exp\{\beta_i x_{ni}\}}{\sum_{j=1}^{J} \exp\{\beta_j x_{nj}\}} \tag{2}$$

The first component, parameter β is the utility weight, unobserved and random in nature, and is hence a coefficient to be estimated. The second component is the observed factor *x* that is a vector of non-stochastic variables (attributes) with possible interactions. (Fiebig, Keane, Louviere, & Wasi, 2009; Hensher & Greene, 2003; Train, 2003) These interactions make possible to add constant variables (such as socio-economic characteristics) to the model as they cannot be estimated singularly.

MNL was introduced over 30 years ago and it was soon realised that it suffers from some unrealistic and strict conditions; such as independence from irrelevant alternatives (IIA) (Train, 2003). Hence enhanced models have been proposed in the literature, for example the mixed logit model. However, in this paper the MNL is used as a valid

[1] Also known as conditional logit model.

approach – as Hensher et al. (2005) write: *a work horse* of choice modelling. This popularity is due to some convincing reasons: for example, MNL is a convenient model in its mathematical properties which of the closed form gives a unique solution. In addition MNL estimation procedures can be found from several software. (Hensher et al., 2005; Train, 2003). This study uses Nlogit™ in Limdep™ estimation software. Respondent WTP is calculated as a ratio of an attribute parameter and the cost parameter (Hensher et al., 2005; Scarpa & Rose, 2008).

$$WTP_j = -\beta_j / \beta_{cost} \quad (3)$$

The survey described below yields data to answer the study hypothesis: *are consumers willing to pay for improved sustainability credentials in food products*. In order to answer this hypothesis, a choice experiment concerning a food product is conducted with some attributes representing sustainability measures. WTP for improved sustainability credentials is then calculated from estimated parameters.

Survey description

Questionnaire development took place over an extended period. The sustainability attributes identified by focus groups participants were supplemented by literature review and discussions with experts in the field. Focus group meetings are an important aspect when trying to understand the importance and role of sustainability and particularly of carbon footprint labelling. It is necessary to understand the larger process of food consumption decisions including information collection, store behaviour, and label priorities. In order to determine the study attributes for the survey, focus group meetings and interviews with key stakeholders in the food industry were conducted. In these interviews participants were predominantly concerned about the future of water scarcity and quality. Hence, an attribute describing water efficiency is included in the study.

Two focus groups were held in February 2010 in New Zealand to derive an understanding of people's views and attitudes towards different food product labels and to identify attributes for inclusion in the choice experiment. The participants in the first group were aged 20 to 30 years whereas the second group include people aged 30 to 60 years. Both groups meetings followed a similar format including discussion of individual products and awareness and perceptions of sustainable, especially carbon footprint labelling. The level of awareness was roughly the same across both groups although Group One may have a slightly higher level of involvement and awareness than those in Group Two. The lower level reflects that people believed it would be difficult to make a decision based on sustainability due to limited knowledge and information provided.

This difficulty was found when three specific carbon labels were presented to the participants for preference and user interpretation. Participants were concerned about how the standard of the carbon measure was set. In addition, respondents were missing a reference point and background information but it was agreed that if all products had such labels it would be more useful because food items could be compared.

The focus groups responses reflected the complexity of decision-making facing individuals. The variety of responses and the influence of sustainability criteria reflect the nature of the decision process and constraints that individual consumers face. The awareness of sustainability issues is encouraging even though it may not be the primary driver of the decision-making. It is expected that the use of the DCM in the third component of this study will shed more light on the priorities and use of information when specific labels are obvious and available to consumers.

The final questionnaire includes twelve choice sets each made up of a paired comparison of two alternatives. The final attributes selected for the choice experiment were:

- PR for price,
- CA for reduced carbon emissions,
- WA for increased water efficiency,
- WP for reduced waste and packaging in production, and
- NU for nutrition content (measured in 'increased vitamins').

Table 2 shows the levels of these attributes.

Table 2: Attribute levels

Attributes	Level 1	Level 2	Level 3	Level 4
PR	- 10%	No change	+ 10%	+ 20%
CA	- 30%	- 20%	- 10%	No change
WA	+ 60%	+ 40%	+ 20%	No change
WP	- 60%	- 40%	- 20%	No change
NU	+ 100%	+ 66%	+ 33%	No change

The survey includes generic questions on shopping behaviour, demographics and a choice experiment. The generic questions and demographics are included in the computer programme Qualtrics™ a system for survey designs. The choice experiment is described later, after a brief introduction of the experimental design behind survey creation. This was tested by a pilot survey in the United Kingdom using a pre-test with 15 respondents.

Experimental Design

To create a more efficient choice experiment, an experimental design is a fundamental part of the study. Therefore, in our research, for a statistically efficient (informative) design, the final design was constructed around five attributes each with four levels. The full factorial design would yield a total of $4^5 = 1024$ treatments; therefore a fractional factorial design was used. Besides the main-effects, an additional focus of interest is the WA*CA*WP interaction and so this is included in the experiment design as a column of a product of the attributes. The prior values used in the design were -1 for PR, 0.5 for CA, WA and WP, and 1 for NU. These priors were assumptions made by the research group and are not results of a previous or pilot study.

The choice experiment is allocated into 12 sets of two choice options each (Street, Burgess, & Louviere, 2005). By randomly varying the levels (Table 2), the final experiment was generated with a help of the search algorithm in Excel software (Visual Basic macro). The macro constructs the variance-covariance matrix resulting from randomized level assignment. The design was judged by D-optimality criteria. Comparing several designs, the one with the smallest D-error was chosen to be the final set of treatments.

Data collection

The web-survey was conducted in July 2010 in the United Kingdom. Respondents were selected by a commercial research company. The study received 103 completed choice answers.

In a survey, each respondent is shown 12 choice sets. Figure 1 provides an example of a choice set. The first row shows the choice alternatives of product A and B, revealing that this is an un-labelled experiment. In the left-hand column the sustainability attributes and price are listed, while the two alternatives show their varying levels.

Figure 1: Choice set in survey

	Product A	Product B
Carbon/greenhouse gas	30% reduction in carbon emission	20% reduction in carbon emission
Waste/Packaging	40% less waste in production and packaging	20% less waste in production and packaging
Water efficiency	60% greater water efficiency	20% greater water efficiency
Price	10% increase in the price	No change in the price
Vitamins	Twice as much vitamins	2/3 times more vitamins
Selection	○	○

Results & Discussion

The gender distribution of respondents was 45 per cent male and 55 per cent female. Other categories showed highest proportions for respondents aged over 60, married, living in a household without children. The level of education did not have a clear distinction.

An initial part of the survey asked respondent's to indicate their knowledge of general sustainability issues using a likert scale varying between "a lot" and "never heard of it". Overall the average knowledge of respondents' could be considered good with the bulk of respondents indicating that they had a fair amount or a little knowledge of the majority of issues presented (Table 3). Results indicate "a little" knowledge about carbon off-setting, carbon dioxide emissions, carbon footprint and sustainability is chosen by 44.7 per cent - 50.5 per cent of respondents and "a little/ a fair amount" about global warming by 44.7 per cent. "A fair amount" for climate change, animal welfare and fair trade are chosen by 43.7 per cent and 53.4 per cent of responses. Respondents had the least knowledge about water foot-printing with 35 per cent having "never heard of it" (35 per cent), while they had the most knowledge about Climate change.

Table 3: Respondent knowledge of general sustainability issues (%)

	A lot	A fair amount	A little	Heard of it	Never heard
CA off-setting	2.9	23.3	45.6	20.4	6.8
CA dioxide emissions	3.9	36.9	44.7	13.6	1.0
CA footprint	6.8	34.0	48.5	10.7	-
Global warming	7.8	44.7	44.7	2.9	-
Climate change	7.8	51.5	37.9	2.9	-
Sustainability	7.8	30.1	50.5	8.7	2.9
Animal welfare	11.7	43.7	36.9	7.8	-
Water footprint	1.9	11.7	27.2	23.3	35.0
Fair trade	9.7	53.4	33.0	3.9	-

Total n = 103, missing n =1 in Carbon off-setting and in Water footprint

Econometric results for two preferred models are presented in Table 4. The first model is described as the 'separate attributes' model and can be considered as base model estimating the attribute parameters separately. Alternatively, the second model is described as the 'combined attributes' model and is used to describe a possible structure

for how consumers perceive sustainability indicators as a combined variable, rather than separately.

Both of these preferred models were chosen based on statistical measures indicating their preference over others estimated. The fit measures shown in Table 4 one are the Akaike information criterion (AIC), Bayesian information criterion (BIC) and McFadden's pseudo-R^2. Also shown is the value of the log likelihood function estimated using the Maximum Likelihood method. Models that minimise the AIC and BIC, optimise the log likelihood, and with larger pseudo-R^2 are preferred.

Table 4: Discrete Choice Modelling estimates

Variables	Separate Attributes	Combined Attributes
Price	- 9.72***	- 8.21***
Nutritional Content	0.65***	0.70***
Carbon Reduction	2.89***	
Water efficiency increase	1.61***	
Waste/Packaging Reduction	2.28***	
Female*Carbon	2.09**	
Carbon + Water + Waste		1.45***
Female* (Carbon + Water + Waste)		0.85***
Model Diagnostics		
AIC	0.946	0.947
BIC	0.973	0.965
Log likelihood	- 525	- 527
McFaddens pseudo-R^2	0.332	0.329

Notes: *, ** and *** denote statistical significance at a 1%, 5% and 10% respectively.
n = 103.

In Table 4 it can be seen that all the attributes in both models are highly statistically significant indicating that consumer choice is influenced by changes in all attributes. Overall both models represent a good fit to the data with a McFadden's pseudo-R^2 that is considered to be relatively high. The 'combined attributes' model exhibits a lower BIC compared to the 'separate attributes' model and so could be argued as the preferred model of the two. The other measures of fit are so similar as to not decisively indicate one model over the other based on statistical properties alone.

Separate attributes model

The 'separate attributes' model suggests that consumers are more likely to select a product alternative with a lower price, higher nutritional content, lower carbon, greater water efficiency, and a lower amount of waste/packaging. How consumers' trade-off an attribute for price is calculated from equation (3).

The average consumer is willing to pay a 1 per cent increase in price

- for a 30 per cent reduction in carbon emissions
- for a 7 per cent increase in nutrition content
- for a 17 per cent increase in water efficiency
- for a 23 per cent reduction in waste/packaging

Alternatively, if investigating the trade-offs between non-price attributes the average consumer is willing to trade a 1 per cent increase in carbon for a 22 per cent increase in nutrition, a 1 per cent increase in carbon for a 55 per cent increase in water efficiency and a 1 per cent increase in carbon for a 23 per cent reduction in waste/packaging.

Combined attributes model

The second model estimated provides evidence supporting a consumer perspective that reductions of carbon, water and waste *all together*, can be considered to be a general 'sustainability' variable. Within this perspective consumers are willing to trade-off one-for-one against other sustainability criteria. This model exhibits a lower value of the BIC suggesting that this model has some statistical improvement over the 'separate attributes' model. Consistent with the previous model, this model shows that consumers are more likely to select a choice alternative with a lower price, higher nutrition, greater water efficiency and lower carbon and waste/packaging.

This model indicates that the average consumer is willing to pay a 1 per cent increase in price for a 9 per cent increase in nutrition and a 1 per cent price increase for an 18 per cent improvement in each of carbon, water and waste/packaging. The model also demonstrates that females care more about reduction in carbon, water and waste/packaging than their male counterparts and are willing to accept a 1 per cent increase in price for a 16 per cent reduction, that is, females are willing to pay the same amount for a lower reduction than males. In terms of the non-price trade-offs, the average consumer is willing to trade a 1 per cent deterioration in each of carbon, water and waste/packaging for a 48 per cent increase in nutrition.

Conclusion

There is an increasing expectation from consumers that products have sustainability credentials, and that these can be verified. These sustainability criteria cover a whole range of attributes from environmental, social and ethnic dimension. Product labels are important for these credence attributes as they generate and increase the credibility of the attributes of the product. As an example, carbon accounting is growing in its use and importance for industries, corporations and individuals around the world. Alongside corporate disclosure and consumer demand, the development of carbon labelling schemes has increased.

Many factors require consideration when a label is developed which is supposed to display numerous sustainable attributes of a product. A common method to investigate consumer attitudes is to measure consumer's WTP for certain product attributes. This elaborates if consumers would pay a premium for a specific product attribute. The increase in carbon accounting and the associated calculation of the GHG footprint is important in raising the profile of climate change. This should not be seen in isolation from the other environmental and social impacts which production and/or consumption of products and services has. These factors include the broader components of a life cycle assessment, together with of growing concern is the embedded water in products with calls for water footprinting of products and services.

Overall the results of this study find evidence that consumers are influenced by all of the attributes modelled here. In particular interest, carbon reduction appears to play a role in consumers' choices because respondents preferred choice alternatives with lower carbon levels. They also require relatively large improvements in the other attributes to compensate for an increase carbon. However, consumers are willing to accept a smaller increase in nutrition for the same price increase compared to each of the other attributes. Indicating that nutrition is the most important model attribute in this choice experience considering attributes in food labels. Moreover, carbon levels must improve the most to compensate consumers for the same price increase.

The study, however, has some limitations. For instance, the literature review is inevitably limited by resources and a partial look on the literature. It should be also pointed out that the online survey method may exclude some respondents who are not common users of the internet, and maybe a larger sample size would demonstrate a more representative results and reducing possible bias. In a statistical point of view, the fractional factorial design is not covering all the possible level combinations, which may have some impacts on the survey construction process. However, this design is a valid approach in order to keep the choice experiment manageable in the size. Last, it is well known that human behaviour cannot be completely captured with even the most sophisticated econometric models.

To conclude, carbon labelling is in its infancy and further research is required to investigate consumer attitudes and consumer segmentation. In fact, this study is the first attempt of a series of surveys in the ongoing research. The final survey takes four different forms, varying from pure text, to pictorial and to a combination of these two. Hence, this manner enables to test several research interests, one of which is to compare if displayed information has different effect on consumers' decision making. However, it is important to note that a single respondent will be only shown one choice experiment each hence one survey at a time. The aim is also to include other countries, in particular the Japanese market. In addition, in econometric point of view, another component of the future research is to utilise more sophisticated techniques familiar with DCM, such as the mixed logit model. However, the aim of this paper was to use MNL as a valid starting point of investigation.

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