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Exploring the impacts of food label format on consumer willingness to pay for environmental sustainability: A choice experiment approach in the United Kingdom and Japan

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Abstract

Although there are a plethora of food labels signalling environmental attributes, research examining the impact differing label formats have on preferences is limited. In a choice experiment concerning fruit choices in Japan and the United Kingdom, this study explores impacts on consumer willingness to pay across two formats representing those currently applied, and a nascent compass format. No single format systematically leads to higher or lower values. However, preferences for increased nutrient content are found to be very sensitive to label format, while preferences for carbon emissions reductions are not affected. This finding suggests a degree of homogeneity for public goods versus private. We find a distinction between the compass label design and formats employing text with implications for label design discussed.

Introduction

Concerns about climate change and the general status of the environment have increased demand for food products embodying sustainability credentials (Eurobarometer, 2009). How this information is conveyed to consumers is a central theme in label design and there is a great deal of variation in how labels present and emphasise product information. Many simply consist of written descriptions but also common are visual elements including icons (Bjørner *et al*., 2004) and colour coding to facilitate information processing (Sustain, 2008; Balcombe *et al.*, 2010). The combination of visual and text elements employed in many eco-labels (Tang *et al*., 2004; Ecolabel Index, 2014) has been recommended in some contexts (Hoefkins *et al*., 2012) and may be preferred by consumers (Tang *et al.*, 2004).

When making product choices, consumers can face significant cognitive burden, time constraints and other external noise in processing label information which can be exacerbated by overly complex label formats (Feunekes *et al*., 2008; Vandenbergh *et al*., 2011; Hoefkens *et al*., 2012). Graphical elements may add clarity and may require less cognitive effort (Mueller *et al.*, 2010) improving consumers understanding (Vriens *et al*., 1998) and be quicker to process (Silayoi and Speece, 2007) compared to text only formats. Likewise, the use of symbols is often used to summarise diverse information (Andrews *et al*., 2011) shortening processing time (Feunekes, 2008) as well as being visually attractive (Jarvis *et al*., 2010). However, there is concern that symbol type formats may by overly simplistic, leading to the so-called halo effect (Andrews *et al*., 2011) in which a risk lies in consumers generalising that a product performs favourably on elements that are not able to be explicitly identified in the label. For labels that are intended to represent multiple attributes, this debate highlights the necessity for formats that achieve a middle ground in label design between overly simple and overly complex formats (Hoefkens *et al.*, 2012). This issue in particularly relevant to contemporary debate on sustainability labelling that suggests use of holistic labels as a format comprised of multiple attributes represented in a comparable way (Czamezki, 2011).

This paper uses choice experiment method to test for differences in consumer willingness to pay (WTP) across varying label formats for environmental sustainability attributes of fruit production in Japan and the United Kingdom (UK). We chose the UK and Japan as representing early adopters of environmental labelling schemes, in particularly carbon labelling, having culturally diverse populations, and with significant demand for fruit products. Choice experiments (CE) are a survey based approach frequently employed to estimate

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consumer preferences where direct market data is limited. Although CE literature demonstrates that survey design dimensions can impact respondent preferences (Hensher, 2006) testing for differences across label formats has received scant attention compared to other design elements. Several CE studies of preferences for wine attributes have found elements in wine labels expressed as pictures (Jarvis *et al*., 2010) or graphically (Mueller *et al*., 2010) are more preferred than attributes expressed as text only. Within the transportation mode literature the choice between pictorial or text presentation of attributes has been found to have no effect in terms of choice consistency (Arentze *et al.*, 2003) whereas in a landscape valuation context the use of virtual reality presentation of attributes can reduce variability in responses and lower loss-gain asymmetry relative to a text-only presentation (Bateman *et al*., 2009).

Although there is a plethora of food labelling schemes signalling favourable environmental attributes to consumers, knowledge of how consumers respond to differing label formats is limited (Vandenbergh *et al*., 2011). Moreover, there is a general paucity of information concerning consumer understanding and responses to differing label formats (Vandenbergh *et al*., 2011) and how label formats affect behaviour (D'Souza *et al*., 2006; Van Camp *et al*., 2012). Therefore, the aim of this paper is to shed light on the question, can the same product attributes, presented in alternate formats, lead to differing preferences for those attributes? Whereas previous relevant research has typically focused on formats conveying single product attributes, the current paper extends this debate by investigating how consumers respond to multiple-attribute labels when presented in a text only format, compared to graphical label formats.

The central objective of this paper is to test the hypothesis that the format of a label influences consumer WTP. By empirically testing for differences in WTP between three label formats – text-only, text-plus-graphic, and a sustainability compass, this paper contributes formal tests to a scarce literature. The first two formats are chosen to represent existing labelling formats, while the compass epitomises a nascent format possibly more suitable for handling multiple sustainability criteria, by helping consumers make rapid visual assessments of products credentials that are graded in a comparable way. The compass format has a potentially significant role to play as the limitations inherent in overly simple icon-type formats, such as the halo effect, are more widely recognised. This paper adds to current knowledge about food labelling by extending understanding of the role of label format in consumers' WTP for environmental sustainability attributes.

Testing methods employed including the choice experiment approach are described next, followed by survey development and fruit attribute descriptions. The section following this presents and discusses the modelling and testing results. The paper concludes with implications for label format design.

Materials and Method

Choice experiment

This study employs the stated preference (SP) method of CE to collect information on consumer's fruit choice preferences. This method has been widely used to value consumer preferences for food product attributes where observed market data is poor, and has been applied in Japan (Hu *et al.*, 2006) and the UK (Bitzios *et al*., 2011) as well as to eco-labels (Janssen and Hamm, 2012). The method involves simulating the context in which fruit consumers make choices among a set of competing fruit alternatives. This is achieved by designing an experiment in which fruit attributes are systematically and independently varied to produce multiple choice scenarios. Consumers are then asked to indicate their preferred fruit alternative in each scenario, with the observed levels of attributes in the chosen and non-chosen alternatives modelled in a probabilistic econometric framework. The ability of this method to identify which individual attributes are more important in consumer choices, and to estimate marginal WTP for these attributes, has seen this approach to non-market valuation become increasingly favoured by researchers. As opposed to revealed preference methods such as using direct or indirect market prices, SP approaches facilitate valuation of fruit attributes that may not be directly observable in markets.

In this study, alternative fruit options are described by the environmental impacts of production, vitamin content and price. Consumers are asked to indicate their preferred alternative in each scenario. The observed choice and associated attribute levels of each alternative are modelled in a probabilistic econometric framework using Random Utility Models (RUM) underpinned by the theory of choice behaviour known as Random Utility Theory (McFadden, 1974; Ben-Akiva and Lerman, 1985). In this way, choice experiments provide a utility theoretic measure of preferences over various product characteristics.

The RUM can be made operational by formulising the relationship of an individual's utility function as follows:

$$U_{ni} = \beta_{0,n} + \sum \beta_k x_{ni} + \varepsilon_{ni} \quad (1)$$

Where, U_{ni} is the measure of utility from alternative i for individual n and it is a function of constant variable β_0, the sum of the utilities for each k attribute where β_k is the utility weight to be estimated and x is a vector of observed parameters, and ε_{ni} is an unobserved error term which is randomly distributed. The random component allows analysts to express consumer choice in probabilistic terms that enables the underlying preferences for attributes to be extracted.

$$P_{(ni|A)} = \Pr(U_{ni} > U_{nj}) \mid i \in A \text{ and } i \neq j \quad (2)$$

Where the probability of choosing alternative i in choice set A ($P_{(ni|A)}$) is commensurate with the probability that the utility U_{ni} is greater than the utility of the other alternatives U_{nj} in A. Assuming that the error term is distributed independently and identically (IID) with extreme value type I, results in the multinomial logit (MNL) model (McFadden, 1974). A more flexible alternative is the Random Parameter Logit (RPL) model which represents a full relaxation of the IID assumption, accommodates correlations among panel observations and accounts for uncontrolled heterogeneity in tastes across respondents. Preference heterogeneity is introduced in the individual specific random parameters for attributes. The parameter vector can now be expressed as the population mean β and the individual specific deviation ηn from a specified continuous distribution (Train, 2009). Hence the utility function can be rewritten as:

$$U_n = \beta X_n + \eta_n X_n + \varepsilon_n \quad (3)$$

The stochastic part of utility may now be correlated among alternatives and across the sequence of choices via the common influence of ηn. The choice probability resulting from this specification does not have a closed form solution and requires estimation by simulated Maximum Likelihood (ML). The ML algorithm searches for a solution by simulating draws from distributions with given means and standard deviations. Probabilities can then be calculated by integrating the joint simulated distribution (the mixture distribution of the IID distribution of ε_n and the specified distribution for η_n). The preferred model specifications used here assume all randomly specified parameters are normally distributed allowing for both positive and negative preferences. WTP of fruit attribute j by consumer i is calculated as the ratio of the estimated model parameters accommodating the influence of the random component (Cicia *et al*., 2013) as:

$$WTP_i^j = -\left(\frac{\beta_j + \varepsilon_{ij}}{\beta_{price} + \varepsilon_{ip}}\right) \quad (4)$$

To formally test for differences in WTP between label formats, six CE surveys were conducted (three label formats in each country) with subsequent econometric models for each estimated separately, and WTP estimates compared employing the Complete Combinatorial method (Poe *et al*., 2005). This is a non-parametric approach that compares differences in WTP for all possible combinations of estimates. The proportion of differences that are negative is interpreted as approximating a p-value for the null hypothesis of no difference.

Developing the fruit choice attributes

In order to explore possible attributes to be valued in the choice experiment, literature review was accompanied by two focus groups with the general public, and interviews with key fruit industry stakeholders in New Zealand. Focus group meetings were an important method in trying to understand consumer views and attitudes towards environmental sustainability and how they relate to agricultural production. Fruit industry stakeholder interviews helped to identify the broader process of food consumption decisions and the relevance of information collection, store behaviour, and label priorities within fruit supply-chains. Stakeholder interviews indicated a desire to explore integration of anticipated public policy regarding carbon emissions reduction, and agricultural impacts on freshwater resources, with consumer preferences for fruit products that incorporate these elements as distinct identifiable attributes. This process also recognised communication of attributes as a central theme and a hence a requirement to explore the role of differing labelling formats in consumer preferences. Collectively, these issues became important drivers for focus group discussion. Focus group participants were chosen based on their prominent role in household shopping and were selected from middle and upper income levels, semi-professionals, and as individuals who stated they were concerned about health and environmental issues. The first group were primarily single and a mixture of gender up to 30 years old. The second group were older, with or without children, but otherwise shared the same demographic characteristics. Both focus group meetings followed a similar format including discussion of individual products and awareness and perceptions of environmental sustainability.

Table 1. Fruit attribute descriptions and levels

Price	This attribute compares the price for the fruit in the survey to the price you currently pay for the fruit you normally buy. The fruit in the survey may cost more or may cost less than you currently pay. Levels: -10%, No change, +10%, +20%
Carbon/ greenhouse gas emissions reduction	This attribute concerns the amount of carbon dioxide (CO_2) and other greenhouse gases emitted during production and distribution. For many of the options in the survey, emissions have been reduced. Most scientists believe that greenhouse gas emissions, often expressed as CO_2-equivalents, are causing global climate change or global warming. Levels: -30%, -20%, -10%, No change
Water efficiency	This attribute focuses on the use of water in production and distribution. Greater efficiency means that less water is used to grow the fruit and get it to the consumer. Levels: +60%, +40%, +20%, No change
Vitamins	Fruit is a good source of vitamins. There are natural ways to grow and distribute fruit that is high in vitamins, such as selecting varieties that have higher levels of vitamins or reducing vitamin loss during storage. These changes are reflected in the higher vitamin content of some of the options in the survey. Levels: +100%, +66%, +33%, No change
Waste/ packaging reduction	This attribute indicates that the product is produced and distributed in ways that reduce waste packaging. Reducing waste and packaging means less use of natural resources. Levels: - 60%, -40%, -20%, No change

Overall, the awareness of sustainability issues was similar across both groups, and it was made clear by participants that sustainability is important, even though it may not be the primary driver of their purchase decisions.

To motivate discussion of label formats, participants were presented with three types of carbon labels to assess their preferences and user interpretation. The first label referred to the absolute level of carbon dioxide contained in a product, the second showed that an emissions standard had been met, while the third indicated that a percentage reduction of emissions had been achieved relative to a regular product. Although both groups understood the intent of the labels, there was no clear distinction in which label overcame all concerns expressed by the majority of participants. Participants were concerned about how a standard was set and how it would be measured, suggesting that significant effort would be required to gain enough information from secondary sources so as to gauge the strength of the standard. However, participants agreed that if all products displayed such labels it would be useful for food product comparison. Participants were also concerned about how an absolute carbon measure was set, and were missing reference point and background information that made interpretation of an absolute value difficult. This finding is consistent with criticism of the absolute carbon measure approach as being cognitively difficult for respondents to ascertain meaning from; and that consumers are more likely to be able to comprehend relative changes (Upham *et al*., 2011). These considerations informed the decision to develop a carbon emissions reduction attribute that employed a relative measure of carbon emissions change expressed as a percentage change.

Awareness of freshwater resource issues by industry stakeholders was matched by focus group concerns about the role that agriculture has in using and maintaining freshwater resources. Respondents reflected on a growing public trepidation towards declining water quality and quantity as a consequence of agricultural intensification. To echo this shared concern an attribute measuring increases in water use efficiency in production and product distribution was developed. The next sustainability attribute to be incorporated was reduction in product waste/ packaging during production and product distribution. This is a theme that has significant policy traction in Japan but less so in the UK, and a comparison of WTP could therefore aid in indicating the impact of differing policy environments on consumer preferences. Fruit is considered a healthy food option and increased consumption is often proffered on this basis, for that reason changes in vitamin levels were also included as an attribute important to consumers. The inclusion of vitamins also helps to indicate the relative importance of attributes with private benefits versus those with public good benefits such as carbon reduction. Changes in the price of fruit was expressed as percentage changes, having the advantage of ease of comparison across Japan and the UK. Final attributes are presented in Table 1 which shows the information presented to respondents.

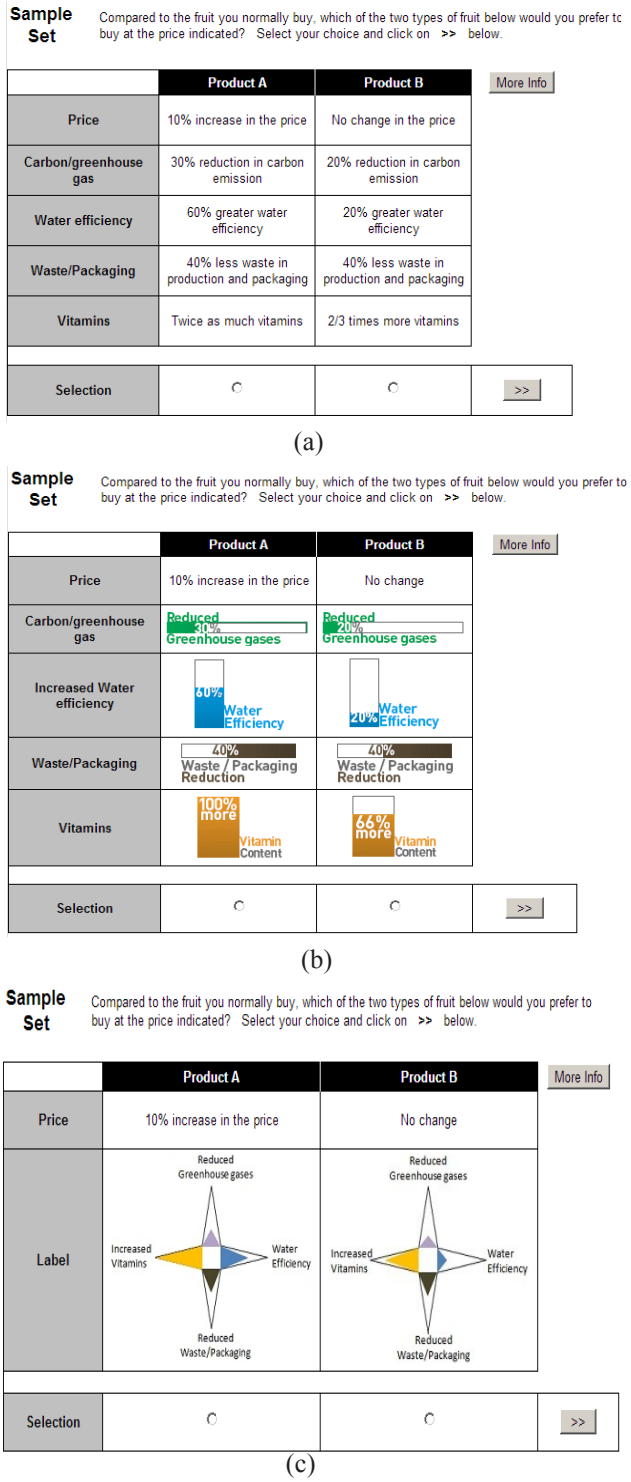

Figure 1. Label formats. (a) Text-only, (b) Graphical-plus-text, (c) Sustainability compass

The chosen range of levels encompasses possible achievable changes in the levels of attributes that were identified in consultation with major primary industry stakeholders including food scientists. We employ a non-specific fruit product framing to avoid any fruit-type specific effects and facilitate industry-wide relevance of results.

To construct the choice sets a D-efficient fractional factorial experimental design approach was used that resulted in each respondent facing twelve choice sets, each made up of a paired comparison of two fruit alternatives where the presentation order of the attributes was randomised across respondents (Figure 1) and included the ability of respondents to opt-out of making a choice.

Development of label formats

The development of differing label formats was informed by observed current labelling practice, literature review, focus group and industry discussion, as well as an impetus to consider relatively emergent approaches. The first of these (Figure 1a) typifies a 'text-only' attribute presentation format. The second (Figure 1b) exemplifies a graphical-plus-text attribute presentation format that combines visual stimulus through graphical representation of attribute level changes with a brief text description with each attribute presented independently. The level of changes in attributes is indicated by the amount of colour in-fill for each bar; more in-fill indicates greater reductions in carbon emissions, increased water use efficiency, increased vitamin content, and reductions in waste and packaging. Although there are many possible graphical label designs, this depiction was chosen to represent a variation of typical eco-labels. Labels incorporating written and graphical presentation are currently in use in both case study countries for carbon labelling, including the Japanese lead weight image and the Carbon Trust footprint in the UK (Ecolabel Index, 2014).

The third format (Figure 1c) is an example of a holistic labelling approach typically referred to as a 'sustainability compass' (Sustain, 2008). The compass developed here is an adaptation of the Sustainability Flower concept developed by a network of pioneering organisations in the organic movement (Eosta, 2013; Sekem, 2014; Soil and More, 2014). The Sekem organisation uses this method for managing, assessing and communicating sustainable development and performance of businesses across economic, social, cultural and ecological dimensions. Each petal of their 'flower' represents a different sustainability factor visualised with Traffic Light System colours. An exemplar adopter is an organic fresh produce distribution firm (Eosta, 2013) who uses the flower to communicate their sustainable development efforts (Soil and More, 2014). Sustain argue that such labels could also be used at a consumer product choice level to communicate sustainability information in a meaningful way. The underlying premise being that a holistic approach is more appropriate for handling multiple sustainability attributes, presented in a coherent manner, and visualised more rapidly allowing for fast and clear assessment. The compass

Table 2. Parameter estimates for random parameter model

	United Kingdom			Japan		
	Text-only	*Text-plus-graphic*	*Compass*	*Text-only*	*Text-plus-graphic*	*Compass*
Random parameters in utility functions						
Carbon reduction	5.5***	3.18***	3.68***	2.35***	2.3***	2.30***
Water efficiency	2.42***	1.88***	1.86***	1.37***	0.73***	0.72***
Waste reduction	3.12***	1.58***	1.61***	0.47**	0.91***	1.54***
Vitamins content	0.85***	1.52***	1.71***	0.51***	2.67***	2.93***
Price	-14.04***	-9.08***	-12.83***	-6.68***	-10.06***	-10.59***
Distributions of standard deviations of random parameters (Normal)						
Carbon reduction	5.55***	3.61***	3.25***	2.72***	3.11***	2.87***
Water efficiency	1.56***	0.65	1.41***	0.6	0.2	0.3
Waste reduction	3.33***	1.09***	2.26***	0.1	1.19***	1.14***
Vitamins content	1.69***	1.09***	2.13***	0.1	2.33***	2.01***
Price	-14.04***	-9.08***	-12.83***	-6.68***	-10.06***	-10.59***
Pseudo-R^2	0.37	0.28	0.34	0.22	0.31	0.33
Number of obs.	1140	1200	1200	1224	1212	1188

Statistical significance at 1%, 5%, and 10% level denoted ***, **, * respectively.

format we develop allows product information to be presented in a holistic way by presenting all the sustainability attributes together, with price given separately reflecting conventional market practice. Each point on the compass corresponds to an attribute in-filled with colour to represent how well the product is performing on that criteria, the more in-fill in a point represents superior performance.

Survey administration

The samples of fruit consumers were obtained from Research Now (researchnow.com) a research consultancy that provides analytical services and maintains one of the largest global databases of survey respondents. Their panel of members are paid for completed surveys. This sampling method allowed for pre-stratification by age, income and gender that would not be possible using other common approaches such as telephone directories or lists of registered voters. Also, as the survey was conducted from New Zealand the use of postal methods would have been logistically cumbersome and prohibitively expensive. The survey instrument included generic questions on shopping behaviour as well as the choice experiment. To improve reliability respondents had to have bought fruit in the previous month. The six surveys were conducted during September and October 2010; sample sizes are given in Table 2.

Results and Discussion

Statistical analysis was conducted using econometric software Limdep v.9™ and Nlogit v.4.3™. We specify normally distributed random parameters for all attributes estimated as continuous variables. The survey also included questions regarding attitudes, perceptions, and knowledge of sustainability concepts and food labelling. Although these variables could be used as covariates within the modelling process alongside fruit attributes presented in the choice experiment, due to the need to maintain identical model specifications for comparative testing procedures this is not done here. Moreover, due to the large number of surveys conducted, separate presentation of the analysis of these questions is beyond the scope of this paper and those interested readers can find a fuller scrutiny in Guenther *et al.* (2012). All parameters display a priori expected signs (Table 2) with carbon, water, waste and vitamins being positive and the cost attribute negative. All attribute parameters were significantly different from zero across all estimated models.

As both the price and non-price attribute levels are defined as percentage changes, the appropriate interpretation of WTP is the percentage change in the price of fruit for a percentage change in the level of an attribute (Snowball and Willis, 2006). Although reduction of carbon emissions is valued most in five out of the six models (Table 3) there is a lack of any clear systematic pattern that might indicate that a particular presentation format is consistently associated with a higher or lower WTP. However, considering jointly the two formats that incorporate text descriptions, when compared to the compass format appear overall to have higher WTP, with higher WTP for all attributes in the UK sample and for carbon and water in the Japanese sample.

Testing these apparent differences formally (Table 4) we find that this distinction between the text

Table 3. Willingness-to-pay across country and label format

	United Kingdom			Japan		
	Text-only	Text-plus-graphic	*Compass*	*Text-only*	Text-plus-graphic	*Compass*
Carbon	39%	35%	29%	35%	23%	21%
Water	17%	21%	15%	21%	7%	7%
Waste	22%	17%	12%	7%	9%	14%
Vitamins	6%	17%	13%	8%	23%	28%

Note. Means of unconditional simulated distributions

based and compass formats is supported. Looking first at the within-country across-format tests reveals that for the UK there are differences between the text-only format, and both the text-plus-graphic and compass formats. While there are no differences between the compass and text-plus-graphic formats. The latter finding may be a logical outcome given that the graphic and compass formats are more alike as they both provide visual cues. Notably this result is consistent with Japan, while differences are also found between the text-only format and both the text-plus-graphic and compass formats. A useful finding is that consumer WTP for reductions in carbon emissions is independent from label presentation format.

Overall, these results suggest that differing label formats can lead to differences in preferences when format design moves away from a text-only based format towards a graphical format. This difference may be the consequence of several effects. A weakness of holistic type formats such as the compass, is that they require consumers to assess the absolute change in an attributes levels based on their individual interpretation of how full each of the points of the compass is. This could induce a measurement error from the consumer that may lead them to under (or over) estimate the magnitude of attribute changes. In line with this argument is the possibility that text-only formats could aid interpretation as actual numbers are displayed (Cowburn and Stockley, 2005; Grunert and Wills, 2007). If this cognitive effect is significant, it could partially explain the observed differences in preferences as respondents supposed they were reacting to differing levels of environmental improvement, when changes were actually equivalent. However, this view contrasts with findings of Feunekes *et al.* (2008) who compare six food label presentation formats and found that when compared to graphical and holistic formats, a text-only numerical format was the least comprehendible. Moreover, they found that a holistic format was perceived as the most comprehendible. This would support our finding of diminutive differences between graphical-plus-text and compass formats as they both include graphical depictions, and distinct differences in WTP between text-only and these two formats. Consistent with our result, Feunekes *et al*. (2008) were unable to establish a clear pattern regarding perceived healthiness of a product and label format. Our general finding of a text versus graphic effect is also supported by Mueller *et al.* (2010) who found that a graphical wine label format was the most important attribute after price; and Jarvis *et al.* (2010) who focused on how wine attributes impact on choice when they were expressed graphically or by text-only, finding that overall, graphical formats had the greatest impact on choice.

Our results are also broadly in line with those of a CE study of preferences for beef steak and ground-beef (Mathew, 2014) that tested for a picture effect on preferences. Similar to our approach, this study employed a split-sample method where half of respondents received a CE with pictures of the product and the other half received only written descriptions. Differences between choice shares according to label format were found, although WTP were similar. Contrasting with our results, Arentze *et al.* (2003) employ a within-respondent testing design in a transportation mode choice context, presenting respondents with both text-only and text-plus-picture attribute presentation formats. The authors' found that adding pictures had no impact on preferences. This may in part be due to contextual affects. Within a general transportation context attributes being valued were relatively familiar to respondents, and importantly visual cues may not be as relatively important, as search criteria are not as central to mode choice relative to food choices. We must also consider the possibility that any observed sensitivity of preferences to format could reflect the complexity of trade-offs that people are exposed to in completing this type of survey, rather than an assessment of preferences more generally (Mueller *et al*., 2010).

Turning to the tests of differences between countries, the lowest number of differences are between the text-only format models with just

Table 4. Testing for differences in willingness-to-pay across presentation formats and countries

Comparisons	Carbon	Water	Waste	Vitamins
Within country-across presentation format				
UK text-only vs. Text-plus-graphic	0.29	0.84	0.11	0.99***
UK Text-plus-graphic vs. compass	0.22	0.06	0.11	0.13
UK compass vs. text-only	0.08	0.21	0.01**	0.99***
Japan text-only vs. Text-plus-graphic	0.08	0.00***	0.68	0.99***
Japan Text-plus-graphic vs. compass	0.44	0.46	0.93	0.91
Japan compass vs. text-only	0.05	0.00***	0.98**	1.00***
Within presentation format-across country				
Text-only Japan vs. UK	0.69	0.21	0.99***	0.28
Text-plus-graphic Japan vs. UK	0.93	0.99***	0.98**	0.07
Compass Japan vs. UK	0.86	0.98**	0.30	0.00***

P-values calculated as a two tailed test; e.g. p-values < 0.025 and > 0.975 are significant at 5% level.
***, **, * denotes statistically significant difference at 1%, 5% and 10% levels respectively.

one significant difference. While two significant differences are found for each of the graphical based formats. Examining the observed differences in WTP for waste/packaging reduction we see that UK consumers are WTP significantly more for reductions in production waste and product packaging than their Japanese equivalents. This result may reflect the previously comparatively high level of participation in recycling in Japan compared to the UK. Only 16 per cent of total municipal waste is landfilled in Japan compared to 49% in the UK (EEA, 2013). This cultural difference may lead Japanese consumers to not consider recycling a distinct product attribute as it is conventionally incorporated within product design and part of ordinary behaviour in line with recognised social norms. The observed differences in WTP for water efficiency suggest that UK consumers are WTP significantly more for fruit production and distribution systems that minimise the amount of water used. This result may reflect Japans relatively abundant freshwater resource, with the nation's average annual precipitation almost double that of the world average. This relative lack of water scarcity could mean that Japanese consumers do not demand food producers, and other consumers of freshwater, to minimise the amount that they use as there is a perception that there will still be enough for other uses. An important finding is that WTP for reductions in carbon emissions are not statistically significantly different across countries for each label format. There is a lack of equivalent studies in the literature providing a direct cross-country comparison of label formats on WTP. However, Feunekes *et al*. (2008) European study found that UK respondents liked, understood and found the multiple Traffic Light System label the most credible format. The authors conclude that the overall effects across five European countries were quite similar. This result is consistent with findings for the carbon attribute in our study, whereas there may be some country-specific format sensitivity concerning how to present the remaining non-price attributes.

Considering all the pair-wise model comparisons in sum reveals that the majority of pair-wise comparisons for the vitamins attribute yield differences, while preferences over the carbon attribute are consistent across label formats and countries. The finding that WTP for vitamins is highly sensitive to label format and country is in line with Beattie (2012) who suggests that people may respond more personally and emotionally to nutritional information on food labels compared to carbon information. Moreover, there is a suggestion that consumers may react more strongly to changes in private benefits such as nutritional related health effects than public benefits such as environmental sustainability (Vandenbergh *et al.,* 2011; Rousseau and Vranken, 2013).

Conclusions

This study was motivated by complexities in design of food labels concerning how to communicate product attributes to consumers who require sufficient information to make informed choices, while preferring simple presentation formats. The environmental sustainability attributes considered here were found to be important contributors to consumers' fruit choices, irrespective of the label format used. In particular, carbon labelling was found

to be one of the most important attributes for both countries consumers across all presentation formats. The influence of presentation format was most apparent between text-only and compass formats. While WTP for carbon was found to be insensitive to format, the reverse result is found for WTP for vitamins.

A central contribution of this study extends knowledge about carbon emission label design that is relevant to international climate change mitigation policy. Dietary changes are linked to increased climate change (Röös and Tjärnemo, 2011) and labels are an established way of communicating this effect that can influence choices in global markets (Vandenbergh *et al*., 2011) aiding in supporting emission mitigation efforts. Effective carbon labels, besides been accredited or audited, should be universal and adoptable across cultures (Vandenbergh *et al*., 2011). Our results imply that although different countries may employ various approaches to carbon and other environmental sustainability labelling design, variations in label format may have little distortionary impact on consumer preferences; encouraging initiatives to develop meta or overarching carbon labelling schemes (Dendler, 2012).

Associations found in this study require corroboration from comparable studies that differ in product type, country, and label format design to enable stronger implications to be realised. Search attributes additional to price such as colour or other appearance characteristics may be important factors in consumer choice of food products such as fruit, but were not included in this research design as a relatively generic framing was chosen to avoid any fruit-type specific effects. Choice experiments in which taste is another design factor could be conducted to explore the role this experience attribute has in repeat choices. The role of literacy levels in label design may have important implications for global labelling schemes in developing countries (Arentze *et al.*, 2003) that has yet to be explored in the context of food labels. This subject offers significant potential research opportunities given a context of rising incomes in developing economies and associated dietary changes exacerbating environmental pressure from agricultural production.

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