Customisable or local? Consumers' preferences and willingness for the characteristics of fruit and vegetable box schemes in Scotland

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Abstract:
The demand for fruit and vegetable boxes (FVB) has increased sharply (111%) as a result of the Covid19 pandemic. Nonetheless, there is a growing fear that FVB schemes may increase food waste at home as, for example, many of the available fruit and veg boxes are not fully customisable. A choice experiment-based survey with 500 Scottish consumers was conducted to estimate consumers' preferences and willingness to pay for strategies (e.g., completely customisable fruit and veg boxes) that can help reduce food waste that may result from the purchase and use of FVB. The preliminary results showed that customisability is a major barrier that is deterring over 76% of consumers from buying FVB. The sample consumers were found to be willing to pay a substantial price premium to improve the customisability of the FVB. Other FVB's attributes that are frequently promoted by the sellers of FVB were found to be significantly less valued by 37% of the sampled Scottish consumers.

Key words: Food waste, local, organic, consumer, willingness to pay
JEL Code: Q13

1. Introduction

A recent phone survey of fruit and vegetable box (FVB) schemes across the UK showed sales of fruit and vegetable boxes increased by 111% in six weeks as a result of the Covid19 pandemic (Wheeler, 2020). The literature on consumers' preferences for FVBs has grown considerably in the last two decade. For instance, Brown et al (2009) found that the locality and environmental friendliness (freshness, taste, and environmental friendliness) of the fruits and vegetables are the main motives for buying FVB in England (France). The authors also found that in both countries, cost was cited as the main barrier to buying more FVB. Hashem et al. (2017) reported that English consumers' demand for FVB is driven by their negative perceptions of the current agri-food sector (i.e., fresh food products are mainly marketed through supermarkets, and a high share of them is imported). FVB schemes offer these consumers an alternative agricultural food network characterised by shorter supply chains that rely on the local supply of more sustainable fruits and vegetables.

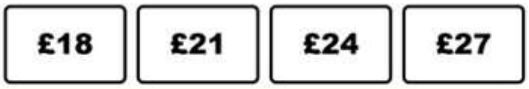
Nonetheless, there is a growing fear that FVB schemes may increase food waste due to the risk that the FVB may contain food items that the buyer may not like or does not know how to prepare. This is mainly because most of the currently available FVBs are not fully customisable (in terms of product types and quantities) due to the seasonality of the local supply of fruits and vegetables in the UK. Improving the customisability of FVB schemes is likely to increase the reliance on out-of-season and non-local fruit and vegetables. Nonetheless, to the best of our knowledge, no previous studies have investigated whether consumers value an improvement in the customisability of FVBs and whether they are willing to give up on the locality of fruit and vegetable supply for an improvement in the customisability of FVBs.

In this study, we used a choice experiment-based survey with 500 Scottish consumers to (1) determine the benefits and the limitations of the fruit and veg box schemes in the eyes of Scottish consumers, (2) estimate consumers' preferences and willingness to pay for FVBs' attributes strategies (e.g., customisability, locality, reducing food waste, recyclability of FVB's packages, type of production [organic or not], and price), and (3) assess how consumers' preferences and WTP vary across different consumer segments so that they can be subsequently targeted with tailored interventions through their socio-demographic characteristics.

2. Data collection

The data was collected using an online choice experiment-based survey. A choice experiment is a quantitative research technique that involves asking individuals to state their preference over hypothetical alternative scenarios, products or services. In this study, the FVB are different only in terms of six attributes of two levels each, except the price (4 levels): packaging (recyclable/no label), origin (Scottish/no label), customisability (customisable/no label), type of production (organic/no label), food waste (reduced food waste/no label), price of a 5kg of fruits and vegetables (£18, £21, £24, and £27). Attributes' labels that were used in the study are displayed in Table 1.

Table 1: attributes and attributes' levels

Characteristics	Characteristics' levels	
Packaging		
Origin		
Customisability		
Type of production		
Food waste		
Price (5 Kg)		

Regarding the design of the choice experiment, the Ngene Software was used to generate a Bayesian D-optimal design that allows robust estimation of all main and two-way interaction effects. The final design consisted of 24 choice sets of three alternatives each (i.e., two fruit and vegetable box alternatives and the opt-out alternative). To make the choice task cognitively easier for respondents, the choice sets were presented in four blocks (i.e., six choice sets per respondent). An example of a choice set/card used in the study is displayed in Figure 1.

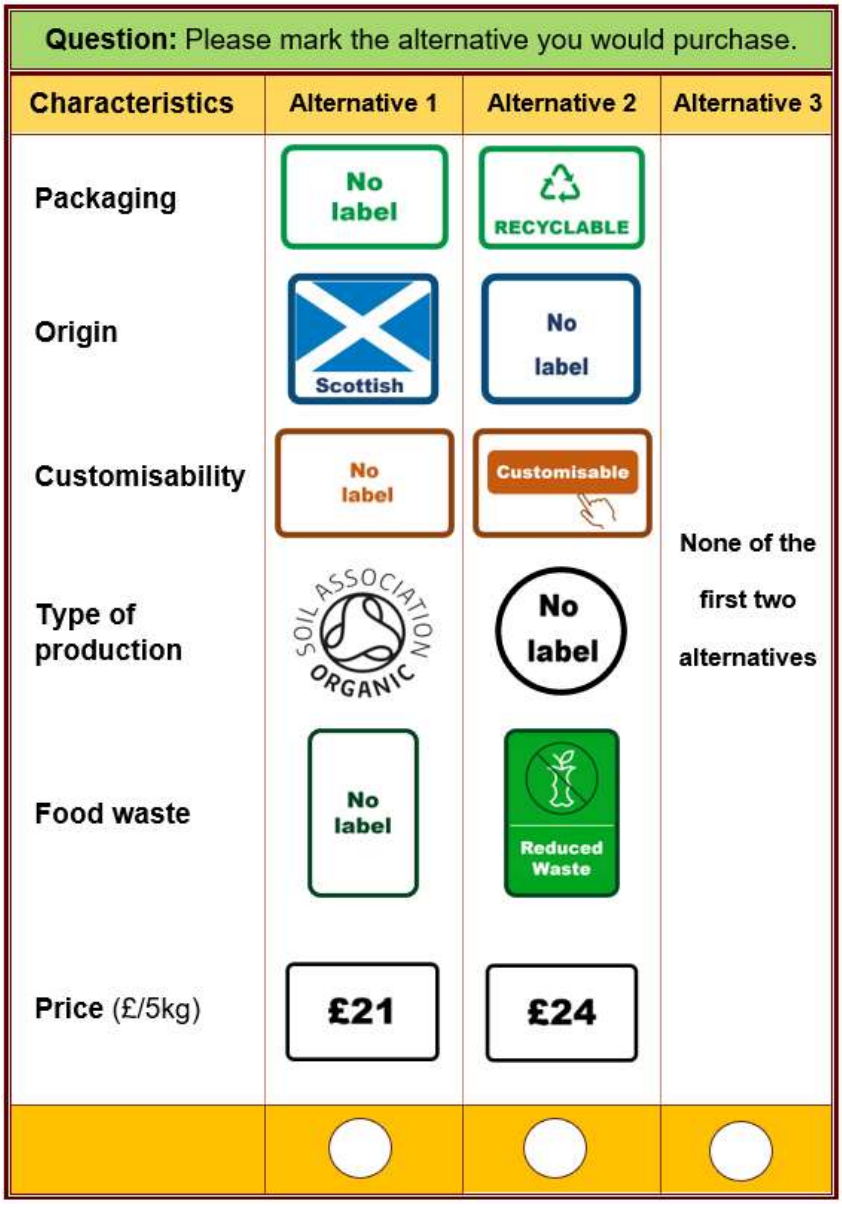


Figure 1: an example of a choice set/card used in this study

In addition to collecting data on consumers' choices, the survey for the choice experiment was also used to collect information on respondents' socio-demographic characteristics as well as their purchasing habits and attitudes toward food waste and sustainability-related issues. The sample of respondents used in this study is representative of the Scottish population in terms of age, gender, education level, and employment status.

3. Data Analysis

The data were analysed within a random utility framework (McFadden, 1974). Thus, an individual n presented with j alternatives at a choice occasion t is expected to choose the alternative that maximises his/her utility. Following Lancaster's concept that any product is a bundle of attributes (Lancaster, 1966), the utility that an individual n derives from the consumption of a product is assumed to be equal to the sum of his/her marginal utility for each of the product's attributes. Consequently, if we assume a sample of N respondents who are presented with T choice occasions of J alternatives each, individual n's utility (U_{njt}) from choosing the j^{th} alternative at a t^{th} choice occasion takes the form:

$$U_{njt} = V_{njt} + \varepsilon_{njt} \quad (1)$$

where V_{njt} is the deterministic (observed) component and ε_{njt} is the random (unobserved) component. ε_{njt} is assumed to be independent and identically distributed. Assuming that the deterministic component of the utility is linear-in-parameter, equation (1) can be written as:

$$U_{njt} = \beta X_{njt} + \varepsilon_{njt} \quad (2)$$

where β denotes the K×1 vector of unknown utility parameters. In this study, X_{njt} represent the following attributes levels "Customisable", "Reduced waste", "Recyclable package", "Organic", "Scottish", and "Price". The level "No label" was dropped from the estimation to avoid the problem of perfect multicollinearity. It is also used as the baseline level when interpreting the estimated effects.

Conditional logit (CL) is the workhorse model for analysing discrete choice data (McFadden, 1974). However, its assumptions (i.e., homogeneity of respondents' preferences and the independence of the alternatives included in any choice set) do not generally hold (Train, 2003). Revelt and Train (1998) proposed a less restrictive model (Random Parameter Logit (RPL)) that allows individuals' preferences to be heterogeneous and the assumption of the independence of alternatives to be relaxed. In the RPL, at least one parameter is specified as random. In other words, each

individual is considered to have a unique set of preferences, reflected in the individual parameters β_i.

In the RPL, the choice probability that individual n chooses alternative j at a choice occasion t, conditional on knowing β_n, is specified as:

$$L_{njt}(\beta_n) = \frac{\exp(\beta_n' X_{njt})}{\sum_{j=1}^{J} \exp(\beta_n' X_{njt})} \tag{3}$$

In choice experiments, individuals are generally shown a sequence of choice cards (S) and are asked to indicate their most preferred alternative in each choice card. Therefore, conditional on knowing β_n, the choice probability of the observed sequence of choices (S) is given by:

$$S_n(\beta_n) = \prod_{t=1}^{T} L_{nj(n,t)t}(\beta_n) \tag{4}$$

where $j(n,t)$ is the alternative chosen by individual n on choice occasion t.
The unconditional choice probability is the expected value of the logit probability integrated over all possible values of β and weighted by the density of β:

$$P_n(\Omega) = \int_{\beta} S_n(\beta)\, f(\beta|\Omega) d\beta \tag{5}$$

The log-likelihood for the RPL model is given by:

$$LL(\Omega) = \sum_{n=1}^{N} ln\, P_n(\Omega) \tag{6}$$

Since the unconditional choice probability $P_n(\Omega)$ does not have a closed-form solution; simulation methods are used to estimate the parameters Ω. For example, to estimate the values of parameters β, R draws of β are taken from the distribution $f(\beta|\Omega)$. For each draw, the choice probability is calculated. Then the resulting probabilities from the R draws are averaged. The simulated log-likelihood (SLL) for all respondents, which is estimated via maximum likelihood procedures, is calculated as:

$$SLL = \sum_{n=1}^{N} ln\left(\frac{1}{R}\sum_{r=1}^{R} S_n(\beta^r)\right) \tag{7}$$

In this study, the parameters for all the non-price attributes were assumed to be normally distributed. Theoretically, the estimated coefficient for the price is expected to be negative. Therefore, to avoid obtaining unrealistic positive values for the parameter price, we first multiplied the price variable by −1. Then, a lognormal distribution was imposed on the variable price instead of a normal distribution (Hensher and Greene 2003).

While the RPL model controls and accounts for heterogeneity, it does not explain the source of the heterogeneity of respondents' preferences and WTP. To better understand the heterogeneity of consumers' WTP for the different meat attributes considered in this study, the latent class model (LCM) for discrete choice analysis was estimated (Greene and Hensher, 2003). LCM assumes that individuals can be intrinsically sorted into a number of latent classes. It also assumes that individuals' preferences and WTP are homogeneous within each class but are heterogeneous across classes.

In LCM, the deterministic component (V_{njt}) of utility can be separated into a component related to the product's attributes considered in the study and a latent component related to the individuals' socio-demographic and psychometric characteristics. The log-likelihood of the LCM can be expressed as follows:

$$\ln L = \sum_{n=1}^{N} ln \left[\sum_{q=1}^{Q} H_{nq} \left(\prod_{t=1}^{T_n} P_{nt|q}(j) \right) \right] \quad (7)$$

Where H_{nq} denotes the prior probability of individual n to be assigned to class q. The probability H_{nq} is unknown to the analyst and various formulations have been used. For this study, the convenient multinomial logit is assumed (Greene and Hensher, 2003):

$$H_{nq} = \frac{\exp\left(z_n' \theta_q\right)}{\sum_{q=1}^{Q} exp\left(z_n' \theta_q\right)}, \quad q = 1, \dots, Q, \theta_Q = 0 \quad (8)$$

Where z_n denotes a set of observable characteristics which enter the model for class membership. Notice that the Q^{th} parameter vector is normalised to zero to secure identification of the model (Greene, 2003, Chapter 21).

$P_{nt|q}$ is the choice probability that individual n, conditional to belonging to class q ($q = 1,\dots,Q$), chooses alternative j from a particular choice set t. $P_{nt|q}$ can be expressed as follows:

$$P_{nt|q}(j) = \frac{\exp\left(x'_{nt,j}\beta_q\right)}{\sum_{j=1}^{J} exp\left(x'_{nt,j}\beta_q\right)} \quad (9)$$

β_q, θ_q are the parameters to be estimated.

To determine the number of classes, the Consistent Akaike Information Criterion (CAIC) and the Bayesian Information Criterion (BIC) were used.

In addition to obtaining information on consumers' preferences, the use of discrete choice models allows the derivation of measures designed to determine the amount of money individuals are willing to give up in order to obtain some benefit from the non-price attributes of the product (e.g., "Customisable", "Organic"). Such measures are referred to as measures of WTP. The most used approach to calculate consumers' WTP consists of computing the ratio of two estimated parameters, holding all else constant. In particular, WTP is commonly expressed as the negative ratio of the non-price attribute coefficient (e.g., the coefficient for the level "Reduced methane") to the price coefficient:

$$WTP_{non-price\ attribute} = -\frac{\beta_{non\ price\ attribute}}{\beta_{price}} \quad (10)$$

The calculated value represents respondents' marginal WTP. In this study, the attributes' levels considered in the estimation of the RPL model were all coded as dummies. Therefore, the calculated WTP value represents respondents' marginal WTP for the attribute level considered in the estimation (e.g., "Reduced waste") relative to the baseline level (e.g., "No label"). The standard error of consumers' WTP was computed using the delta method (Cox, 2005).

In this first draft of the paper, only preliminary results are reported. However, the data analysis will be completed soon, and the full set of results will be presented at the conference.

4. Results

The preliminary results showed that 24% of the sampled consumers are buyers of FVBs. Forty-five per cent of them revealed to buy FVBs at least once a week. Thirty-three per cent of the buyers of FVBs also mentioned that their purchases of FVB have increased significantly since the beginning of the Covid 19 pandemic. Furthermore, the buyers of FVB mentioned the following factors as the main incentives for buying

FVB: “Seasonal”, “Organic”, “Fresh”, “Support local producers”, “Tasty”, “Local”, “Less food waste”, and “Support small producers”.

Seventy-six per cent of the sampled consumers described themselves as non-buyers and non-consumers of FVB. They mentioned the following factors as the main barriers to the purchase of FVB: “Expensive”, “content not known”, “Few choices”, “Not customisable/no choice”, “I can't use all the content”, “Don't know where to order”, “Freshness not guaranteed”, and “Variable quality”

The preliminary results from the estimation of random parameter logit showed that the labels “Scottish” and “Customisable” are the most valued labels in the eyes of the sampled consumers, while “Organic” is the least valued label. In particular, Respondents were found to be willing to pay £5.05, £3.08, £2.82, £2.39, and £1.68 for the labels “Scottish”, Customisable”, “Reduced waste”, “Recyclable”, and “Organic”.

Furthermore, the preliminary results from the estimation of the latent class model suggested the existence of three classes of respondents with distinctive preferences and WTP values for the attributes considered in the study. Segment 1 ("indifferent" consumers; 49% of all respondents) is composed of respondents who are indifferent to whether the FVBs is labelled or not as “Scottish”, “Customisable”, “Reduced waste”, “Recyclable”, and “Organic”. In other words, the members of Segment 1 did not value the use of any of the labels considered in this study.

Segment 2 (pro-customed FVBs; 37% of all respondents) corresponds to respondents with a higher price premium for the use of the label “Customisable” (£2.50) than the use of the labels “Reduced waste” (£1.79), “Scottish” (£1.29), and “Organic” (£1.25). The members of Segment 2 were found to be unwilling to pay a price premium for the use of the label “Recyclable”.

Segment 3 (Pro-origin consumers, 14%) comprises the group of respondents who are willing to pay the highest price premium for the use of the label “Scottish” (£9.25) on FVBs. The member of this segment also highly valued the use of the labels “Organic” (£5.21), “Customisable” (£3.81), and “Recyclable” (£3.82). They are, however, unwilling to pay a price premium for the use of the label “Reduced waste”.

5. Conclusion

Most of FVB schemes in Scotland mainly promote their fruits and vegetables as local and organic. Very few of them allow buyers to choose the type and the quantity of fruits and vegetables to be included in the box. The findings from this study suggest

that customisability is one of the most valued attributes of FVB by Scottish consumers. Interestingly, the customisability of the FVB was found to be significantly more valued by consumers than other frequently promoted FVB's attributes, such as organic and the locality of the product. The non-customisability of many of the current FVB schemes was also mentioned by most of the sampled consumers as one of the major barriers that deter them from buying FVB. Therefore, the results suggest that the demand for FVB can be boosted if they are made customisable. This may also contribute to the reduction of food waste due to the fact that consumers will be able to buy only the fruits and vegetables they want to consume.

The preliminary results also showed that the demand for customisable FVB can be further increased if FVBs are also labelled as "Recyclable", "Scottish", "Reduced waste", and "Organic". Nonetheless, it is noteworthy that the providers of FVB do not have full control over the supply of fruits and vegetables, especially if they are exclusively selling local and organic fruits and vegetables. Many of the fruits and vegetables sold in the UK are imported and/or not organic. Are consumers willing to sacrifice the Scottishness of FVB for customisability, and to what extent? The preliminary results from the estimation of the latent class model showed that only 37% of consumers valued the label "Customisable" more than the label "Scottish".

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