Consumer acceptance of an EU/non-EU label of origin of beef: An analysis of attribute attendance in a discrete choice experiment

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Abstract

This paper reports on consumer acceptance of an EU/non-EU label of origin instead of a specific country of origin denomination. Data from a discrete choice experiment were analysed for attribute attendance using a Generalised Linear Random Effects Panel Model with Logistic Link function. The results indicated that the propensity to choose EU/non-EU denomination of origin depended on the total number of other labelling credence attributes provided. Interaction effects were found between number of quality cues and price level. The direct effect of price outweighed the influence of more information, and the amount of information in itself was not enough to grant choice. The compensatory qualities of each credence attribute in relation to the EU/non-EU origin denomination differed. Cues relating to animal welfare and far-reaching traceability had the highest likelihood of influencing choice of the EU/non-EU denomination of origin.

Keywords: Meat labelling; information cues, consumer acceptance; choice experiments; attribute attendance

1.Introduction

In December 2014, a new, updated EU law on the provision of food information to consumers will take effect (EU Regulation No 1169/2011). The new regulation combines two EU directives, Directive 2000/13/EC on labelling, presentation and advertising on foodstuffs and Directive 90/496/EEC on nutrition labelling for foodstuffs, into a single piece of legislation. For non-minced beef, following the BSE crisis there has been a requirement in the EU since 2000 to provide information about place (country) of origin (COO) (EU 1760/2000), including presentation of an individual reference or code number referring to the specific animal and a licence number for the slaughterhouse. This is in order to allow traceability to the country where slaughter took place and where cutting was performed. Hence, this mandatory labelling requirement regarding origin was motivated by an information asymmetry perspective in relation to consumer concerns about food safety and quality. In the new EU law, these mandatory origin labelling requirements will be extended to cover swine, sheep, goat and poultry meat. Furthermore, the European Commission has been authorised to evaluate the need for mandatory labelling on origin for other types of meat, meat as an ingredient, single ingredient products and ingredients that constitute more than 50% of a food product. Hence, for these product groups, a decision on determination of the geographical delimitation of origin has yet to be made. As the risk of BSE is no longer considered imminent, it is less obvious why the rules for labelling of origin should differ for beef products according to level of processing, or indeed, between beef and other meat. A further option currently under consideration by the European Commission is to define origin on a zone basis, such as an EU/non-EU denomination, without reference to a specific country, as an alternative to the current COO denomination. This form of labelling is currently employed for honey (Directive 2001/110/EC).

Existing data show that country images (origin) provide cognitive, ethical and moral meaning to consumers making comparisons of domestic and imported food (Loumala, 2007). Country-of origin or region-of-origin has been found to have a larger influence on consumer purchase intentions for food versus non-food products (Kemp et al. 2010). COO images have a direct affective effect (i.e. sense of belonging) on consumers' purchasing decisions (Van der Lans et al., 2007). The relationship between COO and consumer perception of food quality seems mixed, however. Some studies suggest absence of a relationship (e.g. Verbeke and Ward, 2006). However, Bernués et al. (2003) reported that COO was used as an extrinsic cue in European consumers' decision-making for beef purchases. Other studies confirm that

COO functions as an extrinsic cue, either alone or in conjunction with other credence attributes (e.g. Häubl and Elrod, 1999). Interestingly, COO as an extrinsic cue was found to have a greater impact on product evaluation when consumers were less involved in information processing (Lantz and Loeb, 1996). Hence, with such links, COO can be expected to be used as a heuristic for product quality and safety through an availability bias.

Cue-based decision making has recently come to be recognised as a stand-alone evaluation and consumer decision model (Hamlin, 2010). This approach integrates cue utilisation with consumer heuristics. Consumers are then modelled to make decisions based on immediately present information which is consistent with positional theory (Hirsch, 1977), in that they seek to gain information so that they can position their past experience in relation to new information, while asserting their own position (i.e. willingness-to-buy; like or dislike). Following Zand (1981), credence quality cues can then be expected to be considered ad hoc and only to the extent that they are congruent with current behaviour or deeds. However, when encountered, credence quality cues seldom occur in isolation, but rather with other cues as a related set in a choice situation. Those sets, when and where encountered, provide a temporal structure which "triggers a short-term set of related heuristics" (Hamlin, 2010, p. 95). An analysis of consumer evaluation of credence cues should therefore benefit from examining such a temporal evaluation over a range of choices in order to reveal any significant relationships between choice and available credence cues.

The first objective of this study was therefore to investigate whether beef consumers can be expected to make their choices of an EU/non-EU denomination of origin based on the label of origin only. The working hypothesis was that the propensity to choose this zone denomination of origin depends on the total number of other labelling credence attributes, so as to compensate for the lack of specific COO information. When testing this hypothesis empirically, we also investigated whether the probability of choosing EU/non-EU denomination of origin depended on interaction effects between the number of quality cues and the price level, in order to examine the extent of direct and indirect effects on choice. The second objective was to examine how the detailed type of credence attributes present in the choice task in combination with the associated price level influenced the choice. This part of the analysis addressed the compensatory qualities of each credence attribute in relation to the zone of origin denomination. For the purposes of this study, data from a discrete choice experiment (DCE) were used while adopting the general structure of a Linear Mixed Effects Model (LME) as the statistical modelling approach. This model determines the probability of respondents selecting EU/non-EU denomination of origin given price and extent of available credence labelling cues.

2. Material and methods

2.1 Research approach

For consumers, food labels provide information and reassurance about the quality and safety of the product, as well as about production and processing throughout the supply chain (Caswell, 2006). However, it has been demonstrated that consumers have difficulties in forming expectations of meat quality (Grunert, 2001). Therefore, there has been an increasing use of labels to provide consumers with information about credence quality attributes (i.e. aspects referring to the production and processing, but not to the product itself), such as health-related effects, convenience, ethical factors, farm animal welfare, etc. (e.g. Bernués et al., 2003). Price information is similar to other food labelling cues in having to be processed for its subjective relevance. Lockshin et al. (2006) showed that low involvement consumers were more prone to use price as a criterion in making purchase decisions than high involvement consumers.

Using a discrete choice experiment (DCE) to obtain observations for consumer choice of food labelling information is congruent with the cue-based decision making model. Through that experimental design, credence quality cues are presented as sets to form the basis of the choice situation and therefore provide the temporal structure to trigger choices from which preferences can be inferred.

By focusing the analysis on choices made for a product with the EU/non-EU labelled denomination, the analysis was directly related to choices made, instead of inferring information processing strategies from what was not chosen. This can be expected to have led to considerations of the determinance of each attribute other than origin. Determinance of an attribute corresponds to the importance of the attribute in the decision-making of the consumer (Myers and Alpert, 1977) and depends on the differences in levels between attributes considered when making the decision (van Ittersum et al., 2007).

The modelling of attribute attendance in this study contributes to the recent literature on endogenous attribute attendance (Hole, 2011) and to the independent availability model by Swait and Ben-Akiva (1987). However, the model proposed here takes the nested nature between choice of denomination (individual preferences) and the (exogenous) explanatory variables into account within mixed effect estimation, thus allowing a random error component for each individual to be related to the set of explanatory factors within and across choice sets. Hole (2011) explicitly modelled a two-stage attribute selection process (which is less supported by cue-based decision making), which cannot handle attribute dependencies or zero preference weights of an attribute.

2.2 Recruitment and data collection

The data used in this study were collected in Sweden in November-December 2012. A sub-set of the data (for respondent ages 20-65) was used in a study by Lagerkvist et al. (forthcoming) to compare the structural reliability of data from DCE with and without a price vector. For the present study, the complete dataset was used. Respondents (age 18-75) were randomly recruited from an online panel provided by a marketing research company (n=440). Respondents were initially screened for their beef purchasing frequency (purchasing beef at least 1-2 times per quarter-year was used as the cut-off). The response rate was 76.4% (n=336). A small participation fee in the form of reward points (equivalent to 10.5 SEK) was provided. The sample contained slightly more men (54%) than women (46%). Participant age was slightly higher than the corresponding age distribution of the Swedish population.

The choice experiment concerned beef with two alternative regional origin denominations. These denominations were either ‘specific country’, or as an alternative option, ‘EU/non-EU label’. Prior to the design of the DCE, four focus group discussions (n=31) were conducted by a marketing research company to identify beef labelling attributes considered important in relation to the choice of beef with the two alternative denominations of origin. These attributes were included in the DCE because they were judged as representing aspects for which origin could be a proxy. This included traceability (reference code and with respect to actor within the supply chain) and credence characteristics (farm animal welfare and other qualitative information). Participants expressed the need for adequate assurance related to credence information and it was therefore explicitly stated that such attributes had been verified by the EU or by a competent national authority. This is in line with previous findings that trust in search attributes is a key determinant in meat consumption (Van Wezemael et al., 2012). The assurance given complied with the main European Directive for nutrition and health claims (Council Directive 1924/2006/EC; OJ L 404, 30.12.2006, p. 9), which in all cases requires substantiation based on scientific evidence and, in some member states, prior authorisation. A detailed presentation of the EU labelling

requirements can be found in Cheftel (2005). Table 1 presents the attributes and their associated levels.

Each respondent was then faced with 22 choice tasks. In each task, respondents were told to examine three generic beef alternatives (exemplified with minute steak, pepper beef, roast beef, sirloin steak and tenderloin). Respondents were told to assume that all mandatory information regarding the choice was always present and that the alternatives presented only differed in the attributes presented and their levels. The food labelling rules are set at the European Union level for all member states and currently, general labelling requirements are set out in Directive 2000/13/EC. This directive outlines the mandatory information that must be included on all food product labels, including the product name, ingredient list, use-by date, and any specific instructions or conditions of use.

Table 1. The attributes used and their levels in the choice experiment

	Attribute	**Level**
1.	Origin	Information about specific country of origin available; or information about geographical zone of origin (beef labelled with origin as either inside or outside the EU) available
2.	Reference code	Information present on package/not present
3.	Traceability to specific slaughterhouse	Information present on package/not present
4.	Traceability to group or specific animal	Information present on package/not present
5.	Traceability to specific breeder	Information present on package/not present
6	Extent of good animal welfare for livestock production[a]	Information present on package/not present
7	Information about organic production	Information present on package/not present
8	Environmental impact of livestock production[a]	Information present on package/not present
9	Health impact from consumption of beef [a]	Information present on package/not present
10	Extent of social responsibility for livestock production[a]	Information present on package/not present
11	Information about whether or not the animal was medicated for preventative purposes	Information present on package/not present
12	Type of animal feed given during raising the animal	Information present on package/not present
13	Price[b] (SEK) per kilogram	200, 225, 250, 275, 300, 325

Note: [a]Verified by government authority or EU body. [b]At the time of the survey 1SEK = 0.11 EUR or 0.14 USD.

2.3 Design of choice experiments

For the purposes of this study, a partial profile rather than a full-profile design of the discrete choice experiment (DCE) was created. Partial profile design was first described by Green (1974) and can reduce non-compensatory choice behaviour. The alternative to a partial profile design is a full-profile design (across all choice tasks and concepts all attributes are present, although levels of each attribute vary according to the experimental design). A full-profile design works well (and is recommended) when the number of attributes is not too large, or when there are only few levels per attribute, or both (Green and Srinivasan, 1990). Details about the design of the DCE are presented elsewhere (Lagerkvist et al., forthcoming).

The partial design meant that the DCE presented choice tasks that varied only in the levels of a subset of all attributes. Each choice task included at most seven attributes (Table 1), in addition to the origin and the price attribute. The set-up of the partial design followed

Kessels et al. (2011) and was generated using Sawtooth Software in two steps. First, a master design was generated to determine the attributes to be presented in each choice set. This step ensured that for each respondent, each attribute was presented at least three times. The second step determined the levels for each selected attribute. Together, these two steps provided a balanced approach (equal occurrence of each attribute and level). In each choice task there were at least two concepts which included the same denomination of origin, so as to allow for trade-offs between the remaining attributes presented as well as with the alternative origin type. To establish a link to random utility theory and avoid the unfeasibility problem (Louviere et al., 2010), each choice task included at least one concept with origin denoted as specific country, as this corresponds to existing labelling requirements. Moreover, a heterogeneous design (Sándor and Wedel, 2005), rather than a blocked design, was used to increase statistical efficiency in providing more variation across respondents, as well as to reduce problems of scale effects (i.e. variations in preferences due to the block of the design from which data were generated). The heterogeneous design meant that respondents were randomly assigned one of 100 versions of the full design.

2.4 Statistical analysis

In order to model the nested data structure of *i* persons who completed *j* choice tasks, with each task including *k* choice concepts, the general structure of a Linear Mixed Effects Model (LME) was adopted:

$$y = X\beta + Z\zeta + \varepsilon \qquad [1]$$

The $q \times n$ matrix $\boldsymbol{Z}$ is a representation of the q Random Effects and ζ is a $q \times 1$ matrix of Random Effect coefficients to be estimated on $\boldsymbol{Z}$. The $r \times n$ matrix $\boldsymbol{X}$ is a representation of the r explanatory variables, and β is a $r \times 1$ matrix of parametric coefficients to be estimated on $\boldsymbol{X}$.

However, $\boldsymbol{y}$ is specified as a variable that follows a binomial distribution; for each respondent and for each choice concept in each choice task, this dependent variable takes a value of 1 for all those observations under which a respondent has chosen the EU/non-EU denomination of origin rather than the 'specific country', and a value of zero otherwise.

Therefore, we could not model the relationship between the dependent variable and the right-hand model in Eq. 1 through a linear regression model that assumes a normally distributed dependent variable. Instead, the structure of a General Logistic Mixed Model (GLLM) was adopted, which can be regarded as a combination of a General Linear Model (GLM) and a LME model that takes the nested structure of the data into account. We employed a logistic link function $g(\cdot) = ln(\frac{p}{1-p})$ such that the model in Eq. 1 becomes:

$$g(E(y)) = X\beta + Z\zeta + \varepsilon \qquad [2]$$

This type of model is less common in econometrics, but widely used for experimental data as they occur e.g. in crop sciences, medicine or psychology. In these disciplines the models are known as 'linear mixed models' (e.g. Pinheiro and Bates, 2000).

The model developed here can thus be viewed as a 'Generalized Linear Random Effects Panel Model with Logistic Link function' in which the time dimension (typical for panel models) was replaced by one of the levels *i, j* or *k* (although in other contexts the model could still include a variable that reflects time).

The model in Eq. 2 was estimated using Restricted Maximum Likelihood (REML) as implemented in the lme4 package (Pinheiro and Bates, 2000; Bates et al., 2012)[1] from the R network software (R Development Core Team, 2006).

Marginal effects were computed according to procedures outlined by Fernihough (2011)[2]: The marginal effects presented for the GLLM Models in conjunction with our results were averages of the sample marginal effects (rather than average marginal effects). Our marginal effects were computed by multiplying each estimated coefficient $\hat{\beta}$ from estimation of Eq. 2 with the transformed values from the logistic probability density function of the predicted values (Fernihough, 2011).

3. Results

There were *i*=336 persons who completed *j*=22 choice tasks, with each task including *k*=3 choice concepts, leading to *n=22176* observations. In the CE, 68 respondents (20.2%) never chose an alternative with the EU/non-EU denomination. This left 268 persons who chose the EU/non-EU labelled denomination in at least one choice set. Among the respondents who selected the EU/non-EU denomination at least once, there was a minority (n=52) with less frequent use (maximum three selections) of this alternative, whereas the average was 6.2 (SD=4.7). In total, the EU/non-EU alternative as denomination of origin was selected 2,094 times.

When estimating the Restricted Maximum Likelihood (REML) model for explaining the choice of the EU/non-EU denomination as a function of price levels and the number of extrinsic attributes, it was found that in all model specifications the model without random effects was rejected based on AIC and likelihood ratio tests. Furthermore, when assessing alternative random effect specifications, it emerged that models with random effects for *individual respondent* and *concept* performed best according to the AIC and Likelihood Ratio test criteria, respectively.

As Table 2 (marginal effects) shows, the effect of a one-unit change in price on the log of odds of choosing beef with a EU/non-EU denomination compared with a product with a specific country denomination was negative, whereas the effect of adding information through provision of additional extrinsic attributes was positive. In this estimation, dummy variables for price levels (base level was set at 200 SEK/kg) and number of extrinsic attributes (base level was set at zero) were used. The negative estimates for higher levels of the price attribute and the estimates for the information provision indicate a declining propensity to select the EU/non-EU denomination at higher price levels. The results also indicate that a positive information effect already exists for one additional labelling attribute and that the marginal effect then declines for provision of two to three additional attributes, but increases again and reaches its maximum at six additional attributes, after which it again declines.

Furthermore, we tested for interaction effects between the total number of extrinsic attributes present in the choice concept and the price level in order to identify interdependencies between information provision and price. It was not possible to estimate other combinations of interaction effects due to singularities.

Interestingly, the results suggest that the provision of a larger set of extrinsic attributes (more information) alone did not significantly increase the probability of a respondent choosing the EU/non-EU denomination. On the other hand, an increasing price level of a beef

[1] Users of SAS may find the PROC MIXED procedure closest, but not identical, to the lme4 command that we use; see http://cran.ma.imperial.ac.uk/web/packages/SASmixed/vignettes/Usinglmer.pdf

[2] The programming code in R that Fernihough provides on p. 6, Section 5, is in error because it simulates only one standard error for all marginal effects. For the results presented here we have revised this code accordingly; it is available from us upon request.

product with the EU/non-EU denomination alone was sufficient to decrease the choice probability.

However, the joint effect of the price variable and the number of extrinsic attributes was found to be positive and significant, although the significance level for the price level of SEK 225 per kg was just below the 5 per cent threshold. Taken together, this suggests that a higher price level and more information give a slightly positive effect, but the increasing marginal effect for this is much smaller than the decreasing negative marginal effect on price. So even though there was a partial positive effect of higher price and more information on the likelihood of selecting the EU/non-EU origin denomination, it is most likely that this effect would be over-compensated for by the negative price effect.

Table 2. Restricted Maximum Likelihood Estimates.

	AIC	BIC	logLik	deviance		
	12530	12650	-6250	12500		
Number of observations:	22176		Respondents: 336	Concept: 3		
Random effects:						
	Groups	Name	Variance	Std.Dev.		
	Respondents:	(Intercept)	1.2809	1.1318		
	Concept	(Intercept)	0.0073	0.0855		
Parameter estimates:						
	Estimate	*Std. Error*	*z value*	*Pr(>|z|)*	*Marginal effects*	*Std. Error*
(Intercept)	-5.83388	0.72359	-8.062	<0.0001		
Price level=2	-0.15095	0.07198	-2.097	0.0360	-0.0118	0.0115
Price level=3	-0.37365	0.07483	-4.993	<0.0001	-0.0291	0.0237
Price level=4	-0.68166	0.07926	-8.601	<0.0001	-0.0532	0.0417
Price level=5	-1.02598	0.08595	-11.938	<0.0001	-0.0800	0.0626
Price level=6	-1.29648	0.09337	-13.885	<0.0001	-0.1011	0.0786
Info=1	3.74336	0.72247	5.181	<0.0001	0.2920	0.2293
Info=2	3.30929	0.72047	4.593	<0.0001	0.2582	0.2116
Info=3	3.12401	0.72114	4.332	<0.0001	0.2437	0.1999
Info=4	3.71468	0.72037	5.157	<0.0001	0.2898	0.2338
Info=5	3.96785	0.72023	5.509	<0.0001	0.3095	0.2457
Info=6	4.18235	0.71994	5.809	<0.0001	0.3263	0.2606
Info=7	4.07659	0.72096	5.654	<0.0001	0.3180	0.2541

Note: Price level 2 (225 SEK/kg) to 6 (325 SEK/kg). At the time of the survey 1SEK = 0.11 EUR or 0.14 USD. 'Info' refers to number of additional credence attributes (beyond origin and price) within the choice concept when EU/non-EU origin was selected.

The extent to which each attribute influenced the choice of the EU/non-EU denomination is reported in Table 4. The REML model was then re-estimated with each credence attribute coded as a dummy variable. This part of the analysis addressed the compensatory qualities of each credence attribute in relation to the zone of origin denomination. It was found that the extent of good animal welfare and information about whether the animal was medicated for preventative purposes had the highest marginal effects. The results from the model also suggest that information about organic production and traceability to group or specific animal had an intermediate influence over the respondents' choice. Type of animal feed during production and traceability to either a specific slaughterhouse or a specific breeder had the lowest positive effect on choice of the EU/non-EU denomination, but were still significant factors.

Turning to a comparison between the REML models for the amount of information provided (i.e. Table 2) and the quality of information provided (i.e. Table 3), a likelihood

ratio test of (two times) the difference of the log-likelihoods from both models confirmed that the specification in Table 3 fitted the data significantly better (χ^2=123.32 df=4, Pr(> Chisq.)=0.0000). In this standard test, the model in Table 2 (df=15) served as the 'null' model and the model in Table 3 (df=19) as the 'alternative' model. The underlying null hypothesis of this test was that the model with more informative parameters does not fit the data significantly better (according to the log-likelihood) than the model with the less informative parameters. In the test, this hypothesis was rejected.

Table 3. Price level discrete and each informational attribute treated as a dummy variable.

	AIC	BIC	logLik	deviance		
	12415	12567	-6188	12377		
Random effects:	Groups	Name	Variance	Std.Dev.		
	Respondents:	(Intercept)	1.3205	1.1491		
	Concept	(Intercept)	0.0095	0.0973		
Parameter estimates:	*Estimate*	*Std. Error*	*z value*	*Pr(>|z|)*	*Marginal effects*	*Std. Error*
(Intercept)	-3.2370	0.1131	-28.6310	<0.0001		
Price level=2	-0.1449	0.0725	-2.0000	0.0455	-0.0112	0.0114
Price level=3	-0.3847	0.0755	-5.0990	<0.0001	-0.0296	0.0247
Price level=4	-0.7127	0.0799	-8.9210	<0.0001	-0.0549	0.0444
Price level=5	-1.0636	0.0866	-12.2790	<0.0001	-0.0819	0.0661
Price level=6	-1.3081	0.0940	-13.9240	<0.0001	-0.1008	0.0808
Reference code	0.3025	0.0507	5.9710	<0.0001	0.0233	0.0193
Trace. to spec. slaught. house	0.2111	0.0508	4.1550	<0.0001	0.0163	0.0134
Trace. to group/spec. animal	0.2896	0.0507	5.7100	<0.0001	0.0223	0.0183
Trace. to spec. breeder	0.2161	0.0508	4.2550	<0.0001	0.0166	0.0142
Animal welfare	0.4187	0.0501	8.3510	<0.0001	0.0323	0.0261
Medicated prevent. purposes	0.3656	0.0504	7.2490	<0.0001	0.0282	0.0229
Organic production	0.2943	0.0503	5.8460	<0.0001	0.0227	0.0185
Environmental impact	0.2444	0.0507	4.8170	<0.0001	0.0188	0.0157
Health impact	0.2482	0.0511	4.8610	<0.0001	0.0191	0.0160
Extent social responsibility	0.2836	0.0506	5.6040	<0.0001	0.0218	0.0178
Type of animal feed	0.2088	0.0507	4.1150	<0.0001	0.0161	0.0140

Note: Price level 2 (225 SEK/kg) to 6 (325 SEK/kg).

4. Discussion

A vast body of literature has reported that consumers in many countries have preferences for domestic beef (e.g. Bernués et al., 2003; Alfnes, 2004). This line of research has provided evidence on the importance of country, or more local, specific origin denomination and, when the methodology has allowed, on the relative importance of origin versus other attributes included in the studies. However, such research has typically provided less information about the drivers for alternative levels of the origin used within each study. Despite the importance attributed to a specific COO denomination, the possibility that consumers would be willing to choose beef with an alternative denomination of origin when such is available still cannot be ruled out. The result from the present study confirm this: 268 of 336 respondents (79.8%) chose the broader denomination instead of the country-specific denomination in, on average, 6.2 out of 22 choice sets (28%). Using data from a discrete choice experiment (DCE) provided the possibility in this study to analyse the joint probability distribution of the choice of an alternative broader EU/non-EU denomination given the quality and quantity of information provided within each choice concept for which such a decision was taken. This approach is consistent with a cue-based evaluation and decision-making process.

The importance of COO information for beef has been attributed to its role as a proxy, or heuristic, for meat safety (e.g. Verbeke et al., 2010), hence working to reduce consumer quality uncertainty and choice complexity. Findings by Dickinson and Bailey (2002) confirm that consumer preference for COO might be low if not supported by other safety attributes. In line with this, the present study first examined how choice of EU/non-EU origin depended on the number of other credence attributes which, together with the price information, could be evaluated by the respondents at each point of decision throughout the DCE.

The probability of choosing the EU/non-EU origin denomination decreased in relation to an increasing price for the beef concepts. This effect of price corroborated results by Mesías et al. (2005) and reflected that beef with this origin label is considered a normal good. The negative marginal effect of the choice probability with respect to price was found to increase at a declining rate, however. If we are willing to accept the choice probability as an approximation of the actual quantity demanded, this non-linear relationship suggests that the demand curve is likely to be more elastic for relatively high prices. At higher price levels, small changes in price will most likely have a much stronger negative effect on the quantity purchased, compared with the range of lower prices.

The conditional probability marginal effects estimates obtained related to the number of other credence attributes presented provided somewhat mixed results. The largest choice likelihood occurred with as much as six additional attributes. Therefore, when weighted against labelling with a specific COO, the EU/non-EU origin alternative required a larger set of additional information to compensate and to qualify the decision. However, the likelihood function was asymmetrical, with the provision of only one additional credence attribute as the second most decisive level of information. Verbeke and Ward (2006) and Verbeke and Roosen (2009) found weak consumer interest in meat labelling information. Hence, having just one additional cue functioned just as well as having more. One reason for the stronger requirement for more information found in the present study may be due to the choice of the EU/non-EU denomination triggering a more analytical evaluation. This seems plausible, as respondents indicated that their perceived level of difficulty with the choice format was low and that they were able to understand the meaning of the attributes quite well. In a more contextual setting, consumers would face a broader set of labelling information. Further testing in real purchasing occasions would bring an understanding of the compensatory role of credence labelling information for consumer acceptance of the EU/non-EU denomination.

Another finding concerned the joint influence of price and the quantity of other credence attributes for the joint probability of choosing the EU/non-EU denomination of origin. Provision of information, irrespective of extent, was found to have a much lower influence than price. Keeping price constant while increasing the extent of other credence information had no significant effect on choice probabilities, while the opposite significantly reduced the choice probabilities. The existence of an nested effect of price and scope of labelling information has received little attention within research on food decision-making. This suggests that the preferences between the price attribute and the other attributes may not be weakly separable, meaning that the underlying utility function would not be linear in its arguments, as is typically assumed, but rarely asserted, in the mainstream research using DCE to estimate willingness-to-pay for food quality attributes.

Lastly, the analysis in this study examined the importance of different types of information so as to identify the major drivers for the probability of choosing the EU/Non-EU denomination rather than the specific COO denomination. Bernués et al. (2003) noted that information about production system and quality control constitutes credence cues which can be transformed into search attributes to guide the evaluation of concerns by the consumer. It has been predicted that future developments in the production and consumption of beef will

focus on environmental protection, animal welfare, health benefits related to nutrition and aspects relating to responsibility (Kearney, 2010).

Findings concerning attributes related to production systems showed that labelling information on the extent of good animal welfare during production was the most decisive attribute to drive the choice of the EU/non-EU denomination of origin. Information about whether or not the animal was medicated for preventative purposes was also of high determinance. Use of preventive medication such as antibiotics is in itself a typical indicator of animal welfare problems (Hansson and Lagerkvist, 2013). However, such information has not yet been provided to Swedish meat purchasers, as by national law medication is only permitted based on disease incidence. Together, these findings corroborate findings in earlier studies that Swedish consumers place high importance on animal welfare aspects in livestock production (e.g. Lagerkvist et al., 2006). Furthermore, information about organic production and extent of social responsibility was given an intermediate position of influence of the choice probability. The environmental impact of production together with health information on consumption of beef and type of feed given during raising the animals were of the lowest importance among factors to increase choice probability.

Among the cues related to quality control, traceability to group or specific animal had a higher influence on choice probabilities. As the additional attributes related to a specific slaughterhouse, which is mandatory information, or to a specific breeder, this result means that consumers choosing the broader EU/non-EU denomination gave priority to higher depth in their information search. Interestingly, the marginal choice effect for the reference code attribute, which is also mandatory, was similar to the effect of traceability to a specific group or animal. The reference code provides a passive system for product verification, which in itself is of little usefulness to guide the consumer with respect to information content. The importance found here may mean that consumers assign a value to the objective nature of this attribute.

5. Conclusions and implications for the industry

For the food industry, a decision on the particular labelling of origin information to provide to downstream consumers may have implications for its competitive advantage. Firms within food supply chains typically operate private systems for traceability, transparency and quality assurance and further obligations set by mandatory labelling requirements for identity or product segregation are costly, with the potential to distort investments and marketing incentives in relation to markets or products with a lesser extent of such obligations. Hence, an EU/non-EU label of origin for meat could reduce the costs of segregation and identity preservation, increase mobility of meat produce within the EU, and affect trade leading to potential consumer price decreases.

This study showed that adopting an EU/non-EU label of origin, instead of today's mandatory label of specific country of origin, would require priority to be given to information depth (i.e. the amount of information sought) and content (i.e. the type of information examined). Regarding depth of information, we found that relatively many informational items were used by consumers as a basis for choosing the EU/non-EU label of origin. It was also found that consumers in such decisions considered the joint influence of price and depth of information, with the price being the overwhelming aspect influencing consumer behaviour. As the provision of information is costly from the perspective of the industry, this means that the EU/non-EU origin label would be more useful for products in the lower range of the quality span. Regarding the content of information, we found that Swedish consumers in that case would give priority to information relating to animal welfare. Far-reaching information on traceability to a specific group or animal was also found to be of high importance.

References

Alfnes, F. (2004). Stated preferences for imported and hormone-treated beef: Application of a mixed logit model. *European Review of Agricultural Economics*, 31, 19-37.

Bates, D., Mächler, M., and Bolker, M. (2012). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, in press (available at http://listengine.tuxfamily.org/lists.tuxfamily.org/eigen/2011/06/pdfKU_S0z6LjT.pdf.

Bernués, A. Olaizola, A., & Corcoran, K. (2003). Labelling information demanded by European consumers and relationships with purchasing motives, quality and safety of meat. *Meat Science*, 65, 1095-1106.

Caswell, J.A. (2006). Quality assurance, information tracking, and consumer labelling. *Marine Pollution Bulletin*, 53, 650-656.

Cheftel, J.C. (2005). Food and nutrition labelling in the European Union. *Food Chemistry*, 93, 531-550.

Dickinson, D.L., and Bailey, D. (2002). Meat traceability: are US consumers willing to pay for it? Journal of Agricultural and Resource Economics, 27, 348-364.

Fernihough, Alan (2011). Simple Logit and Probit Marginal Effects in R, Working Papers 201122, School of Economics, University College Dublin.

Gracia, A., Loureiro, M.L., and Nayga Jr., R.M. (2009). Consumers valuation of nutritional information: A choice experiment study. *Food Quality and Preference*, 20, 463-471.

Green, P.E. (1974). On the design of choice experiments involving multi-factor alternatives. *Journal of Consumer Research*, 1, 61-68.

Green, P.E., and Srinivasan, V. (1990). Conjoint analysis in marketing: new developments with implications for research and practice. *Journal of Marketing*, 54, 3-19.

Grunert K.G. (2001). Current issues in the analysis of consumer food choice. In *71st EAAE Seminar: The food consumer in the early 21st century*, 19-20 April 2001, Zaragoza, Spain.

Hamlin, R.P. (2010). Cue-based decision making. A new framework for understanding the uninvolved food consumer. *Appetite*, 55, 89-98.

Hansson, H., and Lagerkvist, C.J. (2013). Decision making for animal health and welfare: integrating risk-benefit analysis with prospect theory. *Risk Analysis* (forthcoming).

Häubl. G., and Elrod, T. (1999). The impact of congruity between brand name and country of production on product quality judgements. *International Journal of Research in Marketing*, 16, 199-215.

Hirsch, F. (1977). Social limits to growth. Routledge & Kegan, London.

Hole, A.R. (2011). A discrete choice model with endogenous attribute attendance. *Economics Letters*, 110, 203-205.

Kemp, K., Insch, A., Holdsworth, D.K., and Knight, J.G. (2010). Food miles: Do UK consumers actually care? *Food Policy*, 35, 504-513.

Kearney, J. (2010). Food consumption trends and drivers. *Philosophical Transactions*, 365, 2793-2807.

Kessels, R., Jones, B., and Goos, P. (2011). Bayesian optimal designs for discrete choice experiments with partial profiles. *Journal of Choice Modelling*, 4, 52-74.

Lagerkvist C.J., Carlsson F.,and Viske D. 2006. Swedish Consumer Preferences for Animal Welfare and Biotech: A Choice Experiment. *AgBioForum* 9, 51-58.

Lagerkvist, C.J., Berthelsen, T., Sundström, K., and Johansson, H. (2014). Country of origin or EU/non-EU labelling of beef? Comparing structural reliability and validity of discrete choice experiments for measurement of consumer preferences for origin and extrinsic quality cues. *Food Quality and Preference* (forthcoming). DOI 10.1016/j.foodqual.2013.12.009.

Lantz, G., and Loeb, S. (1996). Country-of-origin and ethnocentrism: An analysis of Canadian and American preferences using social identity theory. *Advances in Consumer Research*, 23, 374-378.

Lockshin, L., Jarvis, W., d´Hauteville, F., and Perrouty, J-P. (2006). Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price and awards in wine choice. *Food Quality and Preference*, 17, 166-178.

Louviere, J.J., Flynn, T.N., and Carson, R. T. (2010). Discrete choice experiments are not conjoint analysis. *Journal of Choice Modelling*, 3, 57-72.

Luomala, H.T. (2007). Exploring the role of food origin as a source of meanings for consumers and as a determinant of consumers' actual food choices. *Journal of Business Resear*ch, 60, 122-129.

Mesías, F.J., Escibano, M., de Ledesma, A.R., and Pulindo, F. (2005). Consumers' preferences for beef in the Spanish region of Extremedura: A study using conjoint analysis. *Journal of the Science of Food and Agriculture*, 85, 2487-2494.

Myers, J.H., and Alpert, M.I. (1977). Semantic confusion in attitude research: salience vs. importance vs. determinance. *Advances in Consumer Research*, 4, 106-110.

Pinheiro, J., and Bates, D. (2000). *Mixed-Effects Models in S and S-PLUS*. New York: Springer.

R Development Core Team (2013). R, A language and environment for statistical computing. (Vienna, Austria, R Foundation for Statistical Computing; 2006.) http://www.R-project.org. Accessed ?

Sándor, Z., and Wedel, M. (2005). Heterogeneous conjoint choice designs. *Journal of Marketing Research*, 42, 210-218.

Swait, J., and Ben-Akiva, M. (1987). Incorporating random constraints in discrete models of choice set generation. *Transportation Research*, Part B 21B, 91-102.

Van der Lans, I.A., Van Ittersum, K., De Cicco, A., and Loseby, M. (2001). The role of the region of origin and EU certificates of origin in consumer evaluation of food products. *European Review of Agricultural Economics*, 28, 451-477.

Van Ittersum, K., Pennings, J.M.P., Wansink, B., and Trijp, H.C.M. (2007). The validity of attribute-importance measurement: A review. *Journal of Business Research*, 60, 1177-1190.

Van Wezemael, L., Ueland, O., Rodbotten, R., De Smet, S., Scholderer, J., and Verbeke, W. (2012) The effect of information on consumer expectations and liking of beef. *Meat Science*, 90, 444-450.

Verbeke, W., and Ward, R.W. (2006). Consumer interest in information cues denoting quality, traceability and origin. An application of ordered probit models to beef labels. *Food Quality and Preference*, 17, 453-467.

Verbeke, W., and Roosen, J. (2009). Market differentiation potential of origin, quality and traceability labelling. Estey Centre. *Journal of International Law and Trade Policy*, 10, 20-35.

Verbeke, W., Pérez-Cueto, F.J.A., de Barcellos, M.D., Krystallis, A., and Grunert, K.G. (2010). European citizen and consumer attitudes and preferences regarding beef and pork. *Meat Science*, 84, 284-292.

Zand, D.E. (1981) Information, organization and power: effective management in the knowledge society. McGraw-Hill, New York.