Examining how German and British Consumers' Food Safety Concerns Moderate their Country of Origin Preferences for Beef

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Abstract

In the European Union (EU), country of origin labeling (COOL) became mandatory in 2002 in response to the United Kingdom's bovine spongiform encephalopathy (BSE) crisis. Although the EU has enacted one of the most information rich COOL policies for beef globally, little research has focused on origin labeling in the EU. Therefore, we determined how German and British consumers' food safety concerns moderated their willingness to pay (WTP) for foreign (country of origin labeled) beef. Additional attributes, such as hormone-free labeling, quality assurance seals and promotional gourmet labeling were also analyzed. Random parameter logit model results indicated that British and German consumers' WTP for foreign beef is moderated by their specific food safety concerns. For example, as German consumers are increasingly concerned about BSE, their WTP for beef from Great Britain was most negative. When controlling for consumers' food safety concern in general, British consumers had the lowest WTP for beef from France, and German consumers had the lowest WTP for beef from the U.S. German and British consumers' had the highest WTP for hormone-free beef. These results are informational to the international trade of beef.

JEL Code: Q13, Q18

Keywords: European Union, Beef, Food Safety, Country of Origin Labeling, Great Britain, Germany

Introduction

In the European Union (EU), country of origin labeling (COOL) for beef is mandatory (European Parliament, 2015). The EU's mandatory COOL laws became effective in 2002 and require packages to indicate the place of birth, rearing and slaughter of the animal (European Parliament, 2015). Mandatory COOL laws in the EU were passed in response to the bovine spongiform encephalopathy (BSE) crisis that occurred from 1986 through the early 1990s in the United Kingdom (U.K.) (European Parliament, 2015). Over this time period, 170,000 cattle in the U.K. became infected with BSE which resulted in the killing of 4.4 million cattle in the U.K. (Cleeland, 2012). The U.K. BSE crisis resulted in the EU banning exports of beef from the U.K. in 1996; however, this ban was lifted in 2006 (EU Commission, 2015a). Although the EU has enacted one of the most information rich COOL policies for beef globally, little consumer and economic research has focused on country of origin labeling in the EU. Therefore, we examined consumers' preferences for country of origin labeled beef in two major member countries of the EU. We determined how British and German consumers' concerns regarding food safety moderated their willingness to pay (WTP) for country of origin labeled beef from the U.S., Canada, Argentina, Germany and Great Britain (G.B.). In particular, we determined how German and British consumers' concerns regarding food safety in general, BSE, Escherichia coli O157:H7 (E. coli), Clostridium perfringens (C. perfringens) and Listeria monocytogenes (L. monocytogenes) moderated their WTP for foreign (country of origin labeled) beef. Additional food safety attribute labels, such as hormone-free labeling, quality assurance seals and promotional gourmet labeling were also analyzed to measure their impact on consumers' WTP for beef. These attributes were assessed in a choice experiment survey in each country.

We hypothesized that food safety pathogen concerns regarding E. coli, C. perfringens and L. monocytogenes would have a moderating impact on consumers' WTP for foreign beef

because they are the primary food-borne illnesses related to meat (Center for Disease Control and Prevention, 2014). In the EU, human listeriosis (caused by L. monocytogenes) and E. coli infections steadily increased from 2009 through 2013 (European Food Safety Authority, 2015). Overall, in 2013 there were 43,183 cases of foodborne illness, 5.9 hospitalizations and 11 deaths. Three of these deaths were related to L. monocytogenese and one was related to C. perfringens (European Food Safety Authority, 2015). Thus, we hypothesized that consumers' specific pathogen and animal disease concerns would have a stronger moderating effect on consumers' COOL preferences than their concerns about food safety in general. For example, COOL of beef in the EU was mandated largely because of the BSE outbreak the U.K. (European Parliament, 2015); thus, we hypothesized that German consumers would have the most negative WTP for British beef when accounting for their concerns about BSE.

In addition to COOL, hormone-free labeling, quality assurance seal labeling and gourmet labeling were hypothesized to have a significant and positive impact on consumers' WTP for beef. The Red Tractor quality seal was used in the British choice experiment and is known as the British Farm Standard and was developed by the Assured Food Standards' panel of experts from farms and the food industry (Assured Food Standards, 2014). The Red Tractor seal was developed in 2000 as an attempt to restore public confidence in the food supply after BSE crisis in the U.K. (Assured Food Standards, 2014). In Germany, the QS quality assurance seal is applied to beef and stands for total quality assurance, from the field and shed to the grocery store (German Meat, 2015) and was used in the German choice experiment. A hormone-free label was also included in both countries' choice experiments given the use of growth hormones for livestock is banned in the EU due to food safety concerns among the public related to growth-hormone usage in livestock production (EU Commission, 2015b). Therefore, a measurement of

consumers' WTP for the growth hormone label is valuable to assist policy makers in determining the premium consumers are willing to pay for hormone-free beef.

Finally, a purely promotional label stating 'gourmet' was also included in both choice experiments to measure consumers' WTP for claims made by beef manufacturers that their product is of a superior quality and safety. In addition to third party certification, such as the Red Tractor seal, it is also important to measure consumers' WTP for quality and safety assurance seals which are placed on products directly from the manufacturer. Since these labels are not certified consumers should not place a higher value on meats carrying them. This also means that there is no additional certification cost associated with these labels. If such labels show that consumers are willing to pay a premium even without the product being superior in terms of quality and safety this means further education is needed to enable the consumer to make an informed decision and recognize the difference between certified and promotional quality and safety claims.

Results of this research have several implications regarding the international trade of beef. To the authors' knowledge, this is the first known research to provide insight into German consumers' preferences for beef from G.B. since the BSE crisis and the EU export ban of U.K. beef was been lifted. We also are the first to determine the moderating impact of German consumers' specific concerns regarding BSE in determining their preferences for British originating beef. Additionally, we provides insight into EU consumers' preferences for beef from the U.S. which is valuable considering the U.S. and EU are currently negotiating the Transatlantic Trade and Investment Partnership and beef is a contentious aspect of negotiations. One point of contention is the EU's fear of U.S. beef containing growth hormones if exported to

the EU (Reuters, 2014). Therefore, we add to the literature by providing an estimate of EU consumers' WTP for hormone-free beef.

Literature Review and Theoretical Background

COOL and Food Safety

Several previous studies have examined COOL for beef products (e.g. Tonsor et al., 2012; Peterson & Burbidge, 2012; Gao & Schroeder, 2009; Tonsor et al., 2009; Loureiro & Umberger, 2007; Loureiro & Umberger, 2005; Tonsor et al. 2005; Alfnes, 2004; Umberger et al., 2003; Schupp & Gillespie, 2001; Becker et al., 2000). Literature regarding consumers' COOL preferences for meat has consistently found that consumers use COOL as a signal for the safety of the meat (e.g., Loureiro & Umberger, 2007; Loureiro & Umberger, 2005; Umberger et al., 2003; Schupp & Gillespie, 2001; Becker et al., 2000). For example, Umberger et al. (2003) conducted an auction to determine U.S. consumers' WTP for country of origin labeled beef. They found that U.S. consumers were willing to pay 19% more for "USA Guaranteed" steak. Auction participants were also asked why they prefer U.S. country of origin labeled beef. Among the most commonly cited reasons why consumers preferred U.S. labeled beef were food safety concerns about imported beef. Schupp and Gillespie (2001) surveyed a sample of U.S. households and found that a majority of consumers preferred COOL to be mandatory because they considered domestic beef safer than imported beef. Loureiro and Umberger (2007) examined U.S. consumers' WTP for several COOL related attributes. They found that consumers valued the certification of USDA food safety inspection more than other attributes including COOL.

Loureiro and Umberger (2005) surveyed U.S. consumers and found that consumers' preference for certified U.S. products was small; however, U.S. consumers were very concerned

about food safety issues and viewed U.S. meat as the safest compared to beef from Canada, Mexico, Australia, New Zealand, Denmark and Argentina. Becker et al. (2000) surveyed German consumers and found that when assessing the safety of meat, country of origin was among the most important cues. Tonsor et al. (2005) surveyed consumers in London, Frankfurt and Paris to determine their WTP for various beef attributes such as hormone-free, genetically modified-free, and domestic origin. They found that consumers in Paris are willing to pay the most for domestic source verified beef and that consumers in London and Frankfurt have the highest WTP for hormone-free beef. Tonsor et al. (2009) examined Canadian, Japanese, Mexican and U.S. consumers' preferences for beef steak food safety assurances and COOL. Tonsor et al. (2009) found that consumers preferred beef from their domestic country and also were willing to pay more for food safety assurances regarding the beef.

Building on this stream of existing COOL literature regarding food safety and beef, this research surveyed British and German consumers and determined the relationship between their food safety concerns and their WTP for country of origin labeled beef. We chose G.B. and Germany because they are two of the largest economies, as measured by gross domestic product, in the EU (World Bank, 2013). With the exception of Tonsor et al. (2005), previous research has not exclusively focused on British and German consumers. Given the EU has adopted mandatory COOL due to concerns regarding food safety, it is important to examine British and German consumers' WTP for country of origin labeled beef and the role of their food safety attitudes in these estimates. While previous studies have determined that consumers consider COOL a signal of beef safety, this research empirically estimated how consumers' concerns for food safety in general, specific food safety pathogens, and BSE moderated their WTP for country of origin labeled beef.

Methodological Background

Choice Experiments

An online survey with choice experiment using shelf simulation (Mueller-Loose et al., 2013) was conducted. The attributes included in the choice experiment were price, COO labels, a growth hormone label, quality assurance labels, and a gourmet label. The different country of origin labels that were used were G.B., U.S.A., Canada, France, Germany and Argentina. Similar to Grebitus et al. (2013), the price attribute levels were determined through market observation of beef in the EU. In order to compare the impact of attributes in G.B. and Germany, the same prices were used for both the German and G.B. model, even though the currencies used were Euros and Pounds, respectively. Table 1 displays the product attributes and levels. Figure 1 displays an example of the choice set completed by the participants.

Insert Table 1 about Here

Insert Figure 1 about here

The software NGENE was used to generate an efficient random parameter panel design with three blocks and twelve choice sets in each block (thirty-six choice sets in total) for the beef (Street and Burgess, 2007). As a result, each participant made twelve choices regarding the beef. A block design was used to avoid possible fatigue effects that participants may have experienced from completing all thirty-six choice sets (Savage and Waldman, 2008). Additionally, the survey order of the choice sets was randomized to prevent ordering effects (Loureiro and Umberger, 2007).

Food Safety Attitude Scale

To determine consumers' attitudes towards food safety and food safety issues, a series of food safety questions were asked to participants after they completed the survey choice sets. Participants were asked on a scale from 1=no affect at all, to 5= major affect, "how the following issues affect your meat consumption patterns." The issues were the following: food safety in general, BSE, E. coli, C. perfringens and L. monocytogenes.

Model Estimation - Random Parameters Logit Model

A random parameters logit (RPL) model was used to estimate consumers' utility for beef labeled with different COOL and food safety labeling information. The RPL model was utilized because it is superior to the standard logit model since it allows for correlation in unobserved factors over time, random taste variation, and unrestricted substitution patterns (Train 2003, Revelt and Train 1998). It is likely that unobserved heterogeneity is present in consumers' preferences for beef labeled with different COOL and food safety labels which makes using the RPL model appropriate. To determine each *n* participant's utility from each beef alternative *j*, within the choice situation *t*, a linear random utility framework was applied. Each participant, *n* (*n*=1,…,*n*) faces at total of *t* (*t=1,..,12)* choice situations for beef. Following Train (2003), the utility of individual *n* from beef alternative *j*, in the choice scenario *t*, is denoted by

(1) $U_{njt} = \boldsymbol{\beta_n x_{njt}} + \varepsilon_{njt}$

where $\boldsymbol{x_{njt}}$ are observed variables that relate to alternative *j* and decision maker *n* for choice scenario *t*, $\boldsymbol{\beta_n}$ is a vector of coefficients of these variables for individual *n* which represent individuals' tastes and ε_{njt} is a random error term that is *iid* extreme value. The coefficients vary over individuals in the population with density *f* (*β*). The density, *f* (*β*), is a function of the

parameters θ which represent the mean and covariance for the β's in the population when β is distributed normally (Revelt & Train, 2000). Expanding equation (1) to incorporate the COOL and food safety labeled attributes for beef, the following represents the utility of individual *n* from beef alternative *j* in choice scenario *t*:

(2) $U_{njt} = \beta_0 p_{njt} + \beta_1 hormone_{njt} + \beta_2 QA_{njt} + \beta_3 gourmet_{njt} + \beta_4 ARG_{njt} +$

$\beta_5 GER/G.B._{njt} + \beta_6 FRA_{njt} + \beta_7 CAN_{njt} + \beta_8 US_{njt} + \beta_9 FS * ARG_{njt} + \beta_{10} FS *$

$GER/G.B._{njt} + \beta_{11} FS * FRA_{njt} + \beta_{12} FS * CAN_{njt} + \beta_{13} FS * US_{njt} \varepsilon_{njt}$

where *p* represents the price of the beef alternative *j*, *hormone* represents the dummy variable equal to one if the beef was labeled as "No growth hormone" and zero otherwise, *QA* represents the quality assurance dummy variable which was equal to one if the beef was labeled with the quality assurance seal (Red Tractor seal for the British survey and QS seal for the German study) and zero otherwise, *gourmet* is the dummy variable indicating if the beef had the gourmet seal, the variables *ARG, FRA, CAN* and *US* represent the dummy variables for beef originating in Argentina, France, Canada and the U.S., respectively and the variable *GER/G.B.* is a dummy variable indicating that the beef originated from Germany for the British survey and indicates that the beef originated from G.B. for the German survey. *FS* is the variable relating to the particular food safety scale which is interacted with the COOLs. The dummy variable for beef from G.B. was dropped for the British survey and the dummy variable for beef from Germany was dropped for the German survey so a comparison is made between consumers' preferences for beef from their home country compared to beef from the foreign originating countries.

Following from equation (1) and Train (2003), $\boldsymbol{\beta_n}$ is unknown and the unconditional choice probability of individual *n*'s choice of alternative *j* in choice set *t* for beef is the following:

(3) $P_{njt} = \int \left(\frac{e^{\beta_n x_{njt}}}{\sum_j e^{\beta_n x_{njt}}} \right) f(\beta) d\beta$

where j is the j^{th} choice for respondent n in choice set t and the variables are defined the same as in equation (2). P_{njt} is the probability of the individual's sequences of choices conditional on the parameters of the population distribution $f(\beta)$ and is referred to as the mixed logit probability (Train, 2003). The parameter estimation is obtained by maximizing the simulated log-likelihood function. Following Revelt and Train (2000), properties of the maximum simulated likelihood estimator are given by Hajivassiliou and Ruud (1994).

The parameter distributions are assumed to be independent normal distributions for all estimated models. Additionally, the price coefficient was fixed across individuals. Because the price coefficient is fixed, the WTP for each non-price attribute has the same distribution as the attribute's coefficient. The RPL estimates were obtained using a simulated maximum likelihood using 250 Halton draws and the RPL code in NLogit was used to calibrate the models. The NLogit code is designed for panel data and accounts for the correlation over time in unobserved utility that arises when there are repeated choices by a given individual. The panel version of the RPL was used because each participant's choices make a panel of twelve choices for the beef.

From the estimated coefficients, WTP was calculated by dividing the attribute coefficient by the negative of the price coefficient ($\beta_k/-\beta_0$). The variance of the WTP estimates were calculated following Daly et al. (2012),

(4) $\left(\frac{\beta_1}{\beta_2}\right)^2 \left(\frac{\omega_{11}}{\beta_1^2} + \frac{\omega_{22}}{\beta_2^2} - 2\frac{\omega_{12}}{\beta_1\beta_2}\right)$

where β_1 and β_2 are the parameters of the attribute and price respectively, and ω_{ij} is the variance and covariance for the respective parameter estimates.

Model Variations

Six different models for each country, following equation (2), were estimated. In the first model, *FS* was the scale regarding how food safety concerns in general affects consumers' meat consumption patterns. In the second model, *FS* was the scale regarding how BSE affects consumers' meat consumption patterns; in the third model, *FS* was the scale regarding how E. coli affects consumers' meat consumption patterns. In the fourth model, *FS* was the scale regarding how C. perfringens affects consumers' meat consumption patterns and in the fifth model *FS* was the scale regarding how L. monocytogenes impacts consumers' meat consumption patterns. In the sixth and final model, a composite food safety model was created which averaged participants' scores for the BSE, E. coli, C. perfringens and L. monocytogenes scales. It is hypothesized that the composite food safety model results will be similar to the food safety in general model results because BSE, E. coli, C. perfringens and L. monocytogenes are the most likely sources of food safety concerns regarding beef.

Data

Sample Characteristics

A survey pre-test was conducted before the final version of the survey was distributed. The final survey was administered in the Fall of 2013 by the international market research company Taylor Nelson Sofres (TNS). Adults (aged 18 and over) who were frequent shoppers and familiar with beef were recruited for the survey. As shown in Table 2, a total of 402 British respondents and 503 German individuals completed the survey. Approximately 47% of both samples were males. The average age of the respondents was 48 and 47 for G.B. and Germany, respectively. Average household income of the interviewees was approximately £28,369 in G.B. and 27,863€ in

Germany. The average household size and percent of children under 12 years old were similar in both the German and British surveys.

Insert Table 2 about here

Food Safety Attitudes

Table 3 displays participants' responses to the food safety attitude scales. Participants' average response to the issue of food safety in general was the highest with a mean of 3.82 and 3.94 in G.B. and Germany, respectively. Participants' average response to C. perfringens was the lowest at 3.34 in G.B. and 3.29 in Germany. Ultimately, the scale responses had similar summary statistics.

Insert Table 3 about here

Empirical Results

General Food Safety Model

Table 4 displays the results of the RPL model when the variable *FS* was equal to participants' responses to the general food safety scale. Price had a significant and negative impact on participant's utility for beef for both the G.B. and German model, as expected. The quality seal and the "no growth hormones" label were significant and positive indicating that consumers' utility was improved if the beef contained these labels. The promotional gourmet label was not significant in the G.B. model but was significant and positive in the German model. The country of origin labels were all significant and negative in the G.B. model indicating that consumers have negative utility associated with beef labeled from Germany, the U.S., France, Canada and Argentina compared to domestic beef labeled as from G.B. Meanwhile, in the German model, consumers only have significant and negative utility for beef from the U.S. and Canada

compared to beef from Germany. Interestingly, interacting the COOL variables with the food safety in general scale resulted in negative and significant utility estimates for all countries in both surveys. The standard deviation coefficients were also statistically significant in many cases indicating that preference heterogeneity among participants for beef preferences was present.

Insert Table 4 about here

WTP estimates for the specific beef label attributes also are shown in Table 4. British and German consumers' had the highest WTP for hormone-free beef. British consumers' had a negative WTP for all beef originating from foreign countries compared to from G.B. In order, British consumers least preferred beef from France, Argentina, Canada, the U.S. and then Germany. Meanwhile, German consumers only had a significantly negative WTP for beef from France, the U.S. and Canada and compared to German beef. However, when food safety concerns were taken into consideration, they had significant and negative concerns about beef from all foreign countries. As food safety in general affected consumers' meat consumption patterns, British and German consumers disliked beef from foreign countries at an increasing rate. In particular, as food safety in general affected consumers' meat consumption patterns, British consumers had the lowest WTP for beef from France and Argentina, and German consumers had the lowest WTP for beef from the U.S. and Canada.

Specific Food Safety Attitudes affecting COOL preferences

G.B. Model

Table 5 displays the RPL British model results following equation (2) where the variable FS is equal to participants' responses regarding several different specific food safety issues ranging

from BSE to L. monocytogenes. To exemplify, in the BSE model, FS is equal to participants' rating of how much BSE affects their meat consumption patterns. Similar to the results for the general food safety model (Table 4), price had a significant and negative impact on participants' utility for beef in all models. Also similar to Table 4 results, the food safety labels for the Red Tractor seal and the "no growth hormones" label were significant and positive. Once again, similar to the food safety in general model (Table 4), the gourmet label was not significant in any model. Similar to the general food safety model, the country of origin labels and the different food safety scale issues interacted with the country of origin labels were mostly all negative and significant. Many of the standard deviation estimates were significant which indicates that there was preference heterogeneity among participants regarding beef preferences.

Insert Table 5 about here

Table 5 also displays the WTP estimates for the different beef attribute labels. Consistently throughout the models, and consistent with the general food safety model (Table 4), consumers' least preferred country to have their beef originate in was France and they most preferred beef from hormone-free animals. In the composite, BSE, and C. perfringens models, G.B. consumers' preferred beef from the U.S. and Germany compared to beef from Canada, Argentina and France. In the L. monocytogenes and E. coli models, G.B. consumers preferred beef from Germany and Argentina compared to beef from the U.S., France and Canada. In all models, as consumers' were more concerned with specific food safety issues, they were less likely to prefer beef from foreign countries compared to beef originating domestically. As evidenced by the models, as G.B. consumers' meat consumption patterns were considered to be more affected by

BSE, E. coli, C. perfringens and L. monocytogenes issues, they least preferred beef from Argentina, Canada and France.

German Model

Table 6 displays the RPL estimated German model results following equation (2) where the variable FS is equal to participants' responses regarding several different specific food safety issues ranging from BSE to L. monocytogenes. Price had a significant and negative impact on participants' utility for beef in all models and the QS quality assurance seal, the gourmet label, and the "no growth hormones" label were significant and positive. The country of origin labels were all negative and significant. However, only a few of the specific food safety scale interactions were significant. Many of the standard deviation estimates were also significant.

Insert Table 6 about here

In terms of WTP, consistently throughout all models, consumers' least preferred their beef originate in the U.S. and G.B. When controlling for the specific food safety issues, German consumers' lowest WTP was for beef from G.B. German consumers' positive WTP premium for the QS and Gourmet label were of similar magnitudes. German consumers were WTP nearly 2 euros more for hormone-free beef.

Conclusions and Discussion

Country of origin labeling (COOL) for beef in the EU is mandatory as a result of the U.K. BSE outbreak that occurred in the mid-1980s to early 1990s (European Parliament, 2015). Little previous consumer and economic research has focused on how food safety concerns moderate

EU consumers' WTP for country of origin labeling. We determined how British and German consumers' concerns regarding food safety moderated their WTP for country of origin labeled beef. Additionally, we investigated consumers' WTP for hormone-free labeled beef, quality assurance labeling and a promotional gourmet label.

Consistent results indicated that British consumers least preferred French and Argentinian originated beef while German consumers least preferred British and American beef. When controlling for British and German consumers' food safety concerns, their WTP for foreign originating beef decreased in nearly all cases. When controlling for specific food safety concerns, German consumers least preferred beef from G.B., which is expected considering their past history with the BSE crisis. Results also indicated that hormone-free beef is among German and British consumers' most preferred beef label attribute followed by the respective country's quality assurance seals. Third party food safety certification, such as the Red Tractor seal, is preferred to purely promotional claims such as a "gourmet" label made by food manufacturers in G.B. Meanwhile, German consumers place nearly identical premiums on the QS quality assurance seal and the promotional gourmet label.

Results of this research have several international trade implications. This is the first known research to provide insight into German consumers' preferences for beef from G.B. since the EU export ban of U.K. beef was lifted in 2006; and, our results show that German consumers have the most negative preference for British beef when controlling for their food safety concerns. Information regarding EU consumers' preferences for beef from the U.S. was also determined which is valuable in regards to the Transatlantic Trade and Investment Partnership. We found that German consumers have more negative preferences for U.S. beef compared to British consumers both in relative (compared to other foreign countries) and in absolute (WTP

amount) terms. Our results also confirm that Europeans placed the highest value on hormone-free beef. This confirms that the EU will likely not be willing to import U.S. beef that uses growth-hormones.

References

Alfnes, F. (2004). Stated preferences for imported and hormone-treated beef: application of a mixed logit model. *European Review of Agricultural Economics*,*31*(1), 19-37.

Assured Food Standards. (2014). The history of the Red Tractor. Retrieved from http://www.redtractor.org.uk/the-history-of-red-tractor

Becker, T., Benner, E. & Glitsch, K. (2000). Consumer perception of fresh meat quality in Germany. *British Food Journal 102*(3), 246-266.

BSE Info. 2014. BSE Detection of cases. Retrieved from http://www.bseinfo.org/bsedetectionofcases.aspx

Center for Disease Control and Prevention. 2014. Food safety. Retrieved from

Cleeland, B. 2014. The Bovine Spongiform Encephalopathy (BSE) Epidemic in the United Kingdom. Retreived from http://irgc.org/wp-content/uploads/2012/04/BSE_full_case_study_web1.pdf

Daly, A., S., Hess and G. de Jong. 2012. Calculating errors for measures derived from choice modelling estimates. *Transportation Research Part B: Methodological* 333-341.

European Food Safety Authority. 2015. The EU Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-Borne Outbreaks in 2013. Retrieved from http://www.efsa.europa.eu/en/efsajournal/doc/3991.pdf

European Parliament. 2015. Country of Origin Labelling for Meat in Processed Foods. Retrieved from http://www.europarl.europa.eu/EPRS/EPRS-AaG-548972-Country-of-origin-labelling-for-meat-in-processed-foods-FINAL.pdf

EU Commission. 2015a. BSE: UK Beef Embargo to be Lifted. Retrieved from European Union Commission. 2015a. Report on the Monitoring of Ruminants for the Presence of Transmissible Spongiform Encephalopathies (TSEs) in the EU in 2011. Retrieved from http://ec.europa.eu/food/food/biosafety/tse_bse/docs/annual_report_tse2011_en.pdf

EU Commission. 2015b. Hormones in Meat-Introduction. Retrieved from http://ec.europa.eu/food/food/chemicalsafety/contaminants/hormones/index_en.htm

Gao, Z. & Schroeder, T. C. (2009). Effects of label information on consumer willingness-to-pay for food attributes. *American Journal of Agricultural Economics*, 91(3), 795-809.

German Meat. (2015). Quality Assurance: The Basis for Trust. Retrieved from http://www.german-meat.org/en/meat-germany/quality-assurance/

Grebitus, C., H.H. Jensen, J. Roosen and J. G. Sebranek. 2013. Fresh meat packaging: consumer acceptance of modified atmosphere packaging including carbon monoxide. *Journal of Food Protection* 76(1): 99-107.

Hajivassiliou, V. and P. Rudd. 1994. Classical estimation methods for LDV models using simulation. In: Engle, R., McFadden, D. (Eds.), *Handbook of econometrics* 4, (pp. 2384-2441). New York, NY: Elsevier.

Huffington Post. 2014. Countries with the most college degrees. Retrieved from http://www.huffingtonpost.com/2010/07/22/countries-with-the-most-c_n_655393.html#s117394&title=United_Kingdom_318

Loureiro, M. L. & Umberger, W. J. (2005). Assessing consumer preferences for country-of-origin labeling. *Journal of Agricultural and Applied Economics 37*(1), 49-63.

Loureiro, M. L. & Umberger, W. J. (2007). A choice experiment model for beef: What U.S. consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. *Food Policy 32*, 496-514.

Peterson, H. H., & Burbidge, L. D. (2012). Japanese consumers' valuation of US beef and pork products after the beef trade ban.

Public Health England. 2014. Escherichia coli (E. coli): guidance, data and analysis. Retrieved from https://www.gov.uk/government/statistics/escherichia-coli-e-coli-bacteraemia-annual-data

Reuters. 2014. Europe's Fear of U.S. Hormone Meat, GM Food Sows Divide in Trade Talks. Retrieved from http://www.reuters.com/article/2014/03/12/eu-usa-trade-idUSL6N0M920R20140312

Revelt, D. and K. Train. 2000. *Customer-specific taste parameters and mixed logit: Households' choice of electricity supplier* (Working Paper No. E00-274). Berkley, CA: Department of Economics, University of California Berkley. Retrieved July 20, 2013, from http://escholarship.org/uc/item/1900p96t

Revelt, D. and K. Train. 1998. Mixed logit with repeated choices: Households' choices of appliance efficiency level. *Review of Economics and Statistics* 80: 647-657.

Savage, S. J. and D. M. Waldman. 2008. Learning and fatigue during choice experiments: A comparison of online and mail survey codes. *Journal of Applied Econometrics,* 23: 351–371.

Schupp, A. & Gillespie, J. (2001). Consumer attitudes toward potential country-of-origin labeling of fresh or frozen beef. *Journal of Food Distribution Research* 33(3), 34-44.

Spriggs, J., & Isaac, G. (2001). *Food safety and international competitiveness: The case of beef.* CABI.

Street, D. J. and L. Burgess 2007. *The Construction of Optimal Stated Choice Experiments: Theory and Methods*. Hoboken, NJ: John Wiley and Sons, Inc.

Tonsor, G. T., Schroeder, T. C., & Lusk, J. L. (2013). Consumer valuation of alternative meat origin labels. *Journal of Agricultural Economics*, *64*(3), 676-692.

Tonsor, G. T., Schroeder, T. C., Fox, J. A., & Biere, A. (2005). European preferences for beef steak attributes. *Journal of Agricultural and Resource Economics*, 367-380.

Tonsor, G. T., Schroeder, T. C., Pennings, J. M., & Mintert, J. (2009). Consumer valuations of beef steak food safety enhancement in Canada, Japan, Mexico, and the United States. *Canadian Journal of Agricultural Economics*, *57*(3), 395-416.

Train, K. E. 2003. *Discrete Choice Methods with Simulation.* Cambridge, MA: Cambridge University Press.

Umberger, W.J., Feuz, D.M., Calkins, C.R. & Stiz, B.M. (2003). Country-of-origin labeling of beef products: U.S. consumer' perceptions. *Journal of Food Distribution Research 34*, 103–16.

World Bank. 2013. GDP. Retrieved from http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?order=wbapi_data_value_2013+wbapi_data_value+wbapi_data_value-last&sort=desc

Table 1. Product Attributes and Levels

Attribute	Description
Price per kg (total price)[1]	13.02 (4.88)
	15.12 (5.67)
	17.23 (6.46)
	19.31 (7.24)
	21.41 (8.03)
	23.51 (8.82)
Food standard assurance	Quality Seal[2]
	None
Growth hormone-free	No growth hormone
	None
Promotional claim	Gourmet (premium quality)
	None
Country of origin	G.B.[3]
	France
	Germany[3]
	Argentina
	U.S.A.
	Canada

[1] Total product price for a 0.375kg of beef is shown in parentheses, which is the price used for the RPL model. The quality seal for the G.B. was the Red Tracker seal. In German, this was a quality seal. [3]In the Germany model, Germany was the COOL that was dropped from analysis for comparison purposes and in the G.B. model, G.B. was the COOL that was dropped.

Table 2. Descriptive Statistics of the Sample

Variable	G.B. Sample (n=402) Mean	Germany (n=503) Sample Mean
% Male	47.3%	47.82%
Age	47.98	46.52
Household income	£28,369	27,863€
Household size	2.45	2.20
Children under 12 years old in household	20.4%	17.3%

Table 3. Food Safety Scale Results

	G.B. (n=402)		Germany (n=503)	
Variable	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
Food Safety in General	3.82	1.13	3.94	1.10
BSE	3.53	1.35	3.74	1.30
E. coli	3.41	1.34	3.37	1.30
C. perfringens	3.34	1.32	3.29	1.32
L. monocytogenes	3.37	1.31	3.33	1.30
Composite	3.41	1.27	3.53	1.09

Note: Scale: Please indicate on a scale how the following issues affect your meat consumption patterns (1=no affect; 5=major affect).

Table 4. Food Safety in General Model

	G.B.			Germany		
	Utility	WTP	S.D. of Estimates	Utility	WTP	S.D. of Estimates
Mean Estimates						
Price	-0.800***			-0.612***		
France	-2.176***	-£2.72	0.968***	-1.107**	-1.81 €	0.399
USA	-0.992**	-£1.24	0.311	-1.216***	-1.99 €	0.289
Canada	-1.287***	-£1.61	0.070	-1.120**	-1.83 €	1.010***
Argentina	-1.421***	-£1.78	1.408***	0.300	0.49 €	1.485***
German/G.B.	-0.891*	-£1.11	1.138***	-0.511	-0.84 €	0.249
Quality Seal[1]	0.400***	£0.50	0.847***	0.246***	0.40 €	0.485***
Gourmet	0.067	£0.08	0.297*	0.234***	0.38 €	0.367**
Hormone Free	1.070***	£1.34	1.155***	1.159***	1.89 €	1.510***
FS*France	-0.337***	-£3.14	0.968***	-0.291***	-2.29€	0.203***
FS*USA	-0.620***	-£2.02	0.284*	-0.342***	-2.55 €	0.239***
FS*Canada	-0.511***	-£2.25	0.277***	-0.371***	-2.44 €	0.023
FS*Germany/G.B.	-0.588***	-£1.85	0.321***	-0.651***	-1.90 €	0.371***
FS*Argentina	-0.704***	-£2.66	0.269***	-0.600***	-0.49 €	0.003
None	-8.389***		3.924***	-5.468***		4.164***
Observations	4824			6036		
Log-likelihood(LL)	-3089.24			-4018.16		
McFaddens' R^2	0.417			0.3941		

Note: ***, **, * = Significance at 1%, 5%, 10% level. [1]Quality Seal for G.B. is the Red Tractor seal. Quality Seal for Germany is the Quality and Safety (QS) seal.

Table 5. G.B. Beef RPL Models

	Specific Food Safety Scales									
	BSE		**E. coli**		**C. perfringens**		**L. monocytogenes**		**Composite**	
	Utility	WTP	Utility	WTP	Utility	WTP	Utility	WTP	Utility	WTP
Mean Estimates										
Price	-0.803***		-0.812***		-0.815***		-0.822***		-0.809***	
France	-2.636***	-£3.28	-2.551***	-£3.14	-2.875***	-£3.53	-3.294***	-£4.01	-2.852***	-£3.52
USA	-1.996***	-£2.49	-2.453***	-£3.02	-2.335***	-£2.87	-2.858***	-£3.48	-2.333***	-£2.88
Canada	-2.285***	-£2.85	-2.509***	-£3.09	-2.659***	-£3.26	-2.955***	-£3.59	-2.529***	-£3.13
Argentina	-2.209***	-£2.75	-2.239***	-£2.76	-2.875***	-£3.16	-2.663***	-£3.24	-2.430***	-£3.00
German	-1.826***	-£2.27	-2.223***	-£2.74	-2.115***	-£2.60	-2.212***	-£2.69	-2.038***	-£2.52
Red Tractor	0.416***	£0.52	0.401***	£0.50	0.432***	£0.53	0.429***	£0.52	0.450***	£0.56
Gourmet	0.079	£0.10	0.087	£0.11	0.061	£0.08	0.063	£0.08	0.037	£0.04
Hormone-Free	1.023***	£1.27	1.050***	£1.29	1.087***	£1.33	1.152***	£1.40	1.080***	£1.33
FS*France	-0.243**	-£3.58	-0.316***	-£3.53	-0.207*	-£3.78	-0.073	-£4.09	-0.216*	-£3.79
FS*USA	-0.400***	-£2.98	-0.269***	-£3.35	-0.336***	-£3.28	-0.206*	-£3.73	-0.336***	-£3.30
FS*Canada	-0.289***	-£3.20	-0.231**	-£3.38	-0.206**	-£3.52	-0.133	-£3.76	-0.240**	-£3.42
FS*Germany	-0.408***	-£2.78	-0.303***	-£3.11	-0.365***	-£3.04	-0.308**	-£3.07	-0.240***	-£2.97
FS*Argentina	-0.558***	-£3.44	-0.589***	-£3.48	-0.512***	-£3.79	-0.497***	-£3.84	-0.361***	-£3.67
None	-8.467***		-8.214***		-8.850***		-8.872***		-8.781***	
S. D. of Estimates										
France	1.096***		0.832***		1.06***		1.238***		1.068***	
USA	0.803**		0.177		0.631**		0.972***		0.702**	
Canada	0.797***		0.927***		0.513		0.456		0.116	
Argentina	1.814***		1.828***		1.983***		2.402***		2.029***	

Note: ***, **, * = Significance at 1%, 5%, 10% level. FS represents specific food safety scales which are labeled on the top of this table (e.g., FS represents BSE, E. coli, C. Perfringens and L. monocytogenes depending on which column you are examining).

Table 5. G.B. Beef RPL Models Continued

	Specific Food Safety Scales				
	BSE	**E. coli**	**C. perfringens**	**L. monoctogenes**	**Composite**
S.D. of Estimates					
German	1.013**	0.890***	0.733	1.309***	1.687***
Red Tractor	0.868***	0.800***	0.936***	1.048***	0.949***
Gourmet	0.092	0.176	0.340*	0.2882*	0.164
Hormone-Free	1.221***	1.351***	1.171***	1.273***	1.213***
FS*France	1.096***	0.832***	1.0625***	0.295***	0.143***
FS*USA	0.244**	0.422***	0.331***	0.305***	0.313***
FS*Canada	0.207***	0.149***	0.276***	0.285***	0.279***
FS*Germany	0.351***	0.399***	0.529***	0.437***	0.318***
FS*Argentina	0.232***	0.276***	0.054	0.044	0.03
None	3.779***	4.236***	3.884***	3.975***	3.943***
Observations	4824	4824	4824	4824	4824
Log-likelihood(LL)	-3093.4	-3094.83	-3094.81	-3088.81	-3093.41
McFaddens' R^2	0.4163	0.4160	0.4160	0.4172	0.4163

Note: ***, **, * = Significance at 1%, 5%, 10% level. FS represents specific food safety scales which are labeled on the top of this table (e.g., FS represents BSE, E. coli, C. perfringens and L. monocytogenes depending on which column you are examining).

Table 6. Germany Beef RPL Models

	Specific Food Safety Scales									
	BSE		**E. coli**		**C. Perfringens**		**L. monoctogenes**		**Composite**	
	Utility	WTP	Utility	WTP	Utility	WTP	Utility	WTP	Utility	WTP
Mean Estimates										
Price	-0.609***		-0.612***		-0.611***		-0.604***		-0.615***	
France	-1.586***	-2.60 €	-2.263***	-3.70 €	-2.039***	3.34 €	-2.084***	-3.45 €	-1.933***	-3.14 €
USA	-1.775***	-2.92 €	-2.657***	-4.34 €	-2.209***	3.62 €	-2.107***	-3.49 €	-2.049***	-3.33 €
Canada	-1.336***	-2.19 €	-2.069***	-3.38 €	-1.964***	3.21 €	-1.984***	-3.29 €	-1.625***	-2.64 €
Argentina	-0.719*	-1.18 €	-1.096***	-1.79 €	-0.812**	1.33 €	-1.039***	-1.72 €	-1.008***	-1.64 €
G.B.	-1.610***	-2.64 €	-2.553***	-4.17 €	-2.270***	3.72 €	-2.313***	-3.83 €	-1.734***	-2.82 €
QS	0.281***	0.46 €	0.272***	0.44 €	0.266***	0.44 €	0.280***	0.46 €	0.262***	0.43 €
Gourmet	0.208***	0.34 €	0.216***	0.35 €	0.222***	0.36 €	0.231***	0.38 €	0.238***	0.39 €
Hormone-Free	1.164***	1.91 €	1.184***	1.94 €	1.177***	1.93 €	1.129***	1.87 €	1.108***	1.80 €
FS*France	-0.167*	-2.88 €	-0.01	-3.71 €	-0.075	-3.46 €	-0.036	-3.51 €	-0.087	-3.29 €
FS*USA	-0.207*	-3.25 €	0.009	-4.33 €	-0.122	-3.82 €	-0.134	-3.71 €	-0.151	-3.58 €
FS*Canada	-0.307***	-2.70 €	-0.147	-3.62 €	-0.181*	-3.51 €	-0.167*	-3.56 €	-0.266***	-3.08 €
FS*G.B.	-0.389***	-3.28 €	-0.156	-4.43 €	-0.245**	-4.12 €	-0.219**	-4.19 €	-0.418***	-3.50 €
FS*Argentina	-0.337***	-1.73 €	-0.285***	-2.26 €	-0.378***	-1.95 €	-0.303***	-2.22 €	-0.316	-2.15 €
None	-5.308***		-5.624***		-5.602***		-5.522***		-5.624***	
S. D. of Estimates										
France	0.497*		0.657**		0.605**		0.626***		0.763***	
USA	0.913***		0.658***		0.619**		0.165		0.531**	
Canada	1.092***		1.189***		1.184***		1.106***		0.610	
Argentina	1.630***		1.597***		1.597***		1.693***		1.620***	

Note: ***, **, * = Significance at 1%, 5%, 10% level. FS represents specific food safety scales which are labeled on the top of this table (e.g., FS represents BSE, E. coli, C. Perfringens and L. monocytogenes depending on which column you are examining).

Table 6. German Beef RPL Models Continued

	Specific Food Safety Scales				
	BSE	**E. coli**	**C. perfringens**	**L. monoctogenes**	**Composite**
S.D. of Estimates					
G.B.	1.338***	1.433***	1.399***	1.394***	0.204
QS	0.433**	0.477***	0.508***	0.519***	0.671***
Gourmet	0.457***	0.374**	0.364*	0.45758***	0.543***
Hormone-Free	1.452***	1.566***	1.563***	1.463***	1.549***
FS*France	0.091*	0.148	0.165**	0.017	0.045
FS*USA	0.051	0.187***	0.203***	0.304***	0.273***
FS*Canada	0.005	0.032	0.036	0.074	0.159
FS*G.B.	0.017	0.075	0.072	0.051	0.359***
FS*Argentina	0.005	0.118**	0.081	0.014	0.086
None	4.161***	4.210***	4.184***	4.348***	4.046***
Observations	6036	6036	6036	6036	6036
Log-likelihood(LL)	-4028.39	-4030.88	-4029.77	-4026.73	-4029.01
McFaddens' R^2	0.3925	0.3921	0.3923	0.3928	0.3924

Note: ***, **, * = Significance at 1%, 5%, 10% level. FS represents specific food safety scales which are labeled on the top of this table (e.g., FS represents BSE, E. coli, C. Perfringens and L.monocytogenes depending on which column you are examining).

Figures

Alternative A	Alternative B	Alternative C
		None of these
I choose __	I choose __	I choose __

Figure 1. Example Choice Set for the British sample