WILLINGNESS TO PAY FOR IMPORTED BEEF AND RISK PERCEPTION: AN APPLICATION OF INDIVIDUAL-LEVEL PARAMETER

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Abstract

The controversy surrounding the Mandatory Country-of-Origin Labeling (COOL) has attracted research attentions. A number of studies have reported consumers are willing to pay more for beef labeled with U.S. origin versus beef from unknown or other origins. Despite that, relatively little is known about what motivates consumers' preference for origin-labeled food products (Lusk et al 2006). Using Individual-Level Parameters following a mixed logit model, we found that U.S. consumers were willing to pay significantly less for imported steak from Australia and Canada compare to U.S. steak. Further, we found that the negative willingness to pay is associated strongly with consumers' perception of food safety on the exporting country.

Keywords: beef, country of origin, mixed logit, individual-level parameters, stated choice experiment

JEL Code: Q13, Q18

Introduction

The controversy surrounding the Mandatory Country-of-Origin Labeling (COOL) has attracted research attentions. A number of studies have reported consumers are willing to pay more for beef labeled with U.S. origin versus beef from unknown or other origins. Despite that, relatively little is known about what motivates consumers' preference for origin-labeled food products (Lusk et al 2006).

Background on COOL

The Country-of-Origin-Labeling provision of the 2002 and 2008 Farm Bill caused a stir in food exporting nations to the United States. The final ruling effective on March 16, 2009, requires information regarding country of origin to be labeled on a number of fresh food including vegetables, fruits and meat. On beef, the law mandates only products derived from cattle born, raised, and processed in the U.S. can be labeled as U.S. origin (USDA 2009). The law, in essence, differentiates imported beef from domestic beef at the retail level, which could have widespread consequences on demand of imported food. This prompted the governments of Canada and Mexico to challenge the legitimacy of COOL in accordance with the World Trade Organization's principle of *national treatment* (Suppan 2009).

The importance of the U.S. market for many beef exporting countries cannot be understated. The exports to the U.S. market account for about 30% total beef and veal production of Canada, New Zealand and Nicaragua. Cattle exports from Canada and Mexico were almost exclusively destined to the U.S. market (USDA 2010). Trade representatives of Canadian cattle and beef industry claimed the law is "devastating the Canadian livestock industry" and could result in a "glut of meat on store shelves in Canada" (Wyld 2009). The probable adverse effects of COOL are paramount to the welfare of Canadian ranchers and beef exporters.

Proponents of COOL argue that consumers have a right to know where food comes from. With COOL, consumer can use the information to infer quality and safety of the products. Some domestic producers also maintain that COOL may reduce search cost of those preferred or wanted to support domestic food products (Lusk et al 2006). Because origin of food products is a credence attribute, without COOL, supports contended that consumers who wish to consume domestic food products could not do so, because they lack the necessary information regarding the origin of the product. Under these conditions, the absence of a country-of-origin labeling law could be made a case for market failure (Caswell 1998; Darby and Karni 1973).

Critics of COOL contested the role of COOL as a food safety measure. Ikenson (2004) contended the Food Safety and Inspection Service would not allow importation of any unsafe foods; COOL also exempts restaurants and smaller butcher shops, which diminishes the effectiveness of COOL's role as a food safety measure. Further, Krissoff et al (2004) noted that foods are rarely voluntarily labeled with sources of origin, which cast doubt on the true appeal of domestic origin to consumers; they argued, profit maximizing retailers, processors, and producers would voluntarily indicate products origin with labels if they deem the benefits exceed the cost.

Whether COOL is warranted depends heavily on consumers' preference, as well as the extent that COOL might penalize imported food. By examining consumer preference for origin-differentiated beef, this study contributes to the debate on COOL.

PREVIOUS RESEARCH AND OBJECTIVES OF THIS STUDY

Previous studies suggested consumers may use country-of-origin as an extrinsic cue in evaluation of the quality of the product (Grunert 2005; Hoffmann 2000; Lusk et al 2006; Northen 2000). Country of origin may invoke consumers' knowledge and beliefs regarding the place of production of the products. Additionally, in cases of repeated purchase on products without a strong brand, as with most fresh food, consumers may use the origin to re-identify the quality that they have found appealing.

Increased international competition from trade liberalization incentivized producers to use country-of-origin information to differentiate their products. Marette et al (2008) argued that with imperfect information and imperfect competition, domestic producers may gain from geographical-indication labels. When faced with the choice of familiar domestic products and unfamiliar imported products, domestic products inevitably emerge as the choice when the lack of knowledge or information regarding the quality of the imported products could induce uncertainty in consumers.

The country-of-origin effects gained research attention following introductions of mandatory origin-labeling law in the European Union, and more recently in the United States. Studies conducted on European consumers reveal consumers used country of origin to predict the eating quality and safety of beef (Becker 2000; Davidson et al 2003). In its U.S. counterpart, Schupp and Gillespie (2001) found a vast majority of the surveyed indicated support for mandatory labeling of origin on fresh and frozen beef sold in retail market. Further, 83% of the respondents rated U.S. beef higher quality and safer than imported beef. Multiple studies indicated European consumers are willing to pay more for domestic meat than imported meat (Alfnes 2004; Alfnes and Rickertsen 2003; Mørkbak et al 2010).

In an U.S. nation-wide survey, Loureiro and Umberger (2007) found a positive WTP for beef labeled as U.S. products compare to unlabeled products. Further, they suggested that the WTP for USDA food-safety-inspection certifications is higher than U.S.-labeled beef, but the WTP for tenderness assurance and traceability is lower than U.S.-labeled beef. However, the difference in WTP for domestic versus imported beef is absent. In addition, the rankings of the attributes, which were estimated through a Conditional Logit framework[1], could be further scrutinized using estimators capable of discerning unobserved taste heterogeneity.

Consumers' perception of food safety risk, or any risk in general, is inherently subjective. The perception depends on a wide array of factors. Although the actual risk may be of interest to policymakers, it is often not the dominant factor in consumers' behaviors (Schroeder et al 2007; Slovic 1987; Yeung and Morris 2006). Instead, consumers' risk perception for food products are found be greater in product they have little control over the exposure to the risk (Zepeda et al 2003). Consumers' perceive food safety risk is also found to be influenced by socioeconomic characteristics, trust in various sources of information, knowledge, previous family history of food safety events and culture (Baker 2003; Dosman et al 2001).

Previous studies point strongly to the connection between consumers' perception and country-of-origin effect. As such, we explore the linkage between perception of food safety and willingness to pay for imported beefsteaks. This is achieved by utilizing Individual-Level willingness to pay in a SUR model.

SUMMARY STATISTICS AND RESEARCH DESIGN

[1] Loureiro and Umberger (2007) attempted Mixed Logit but found the model failed to detect significant unobserved heterogeneity.

We conducted an online survey through TNS Global in May 2010. The sample was randomly selected through the vast panelist network of TNS Global. Respondents below age 17 were restricted from participation[2]; We designed and tested the survey following general guidelines given in Dillman (2007). The survey is divided into two sections; the first part included questions pointed to consumers preference on beef adapted from related literature and demographic information; the second section included a choice experiment to assess consumer WTP for imported beef and the aforementioned attributes. Consistent with previous literature (e.g., Tonsor et al 2009), the target responses were set as 1,000. The online survey closed with 1079 responses. We did not pursue mail survey after taking into account the challenges in targeting and obtaining a national sample. Nonetheless, Olsen (2009) suggested that internet surveys are viable alternative to mail surveys in estimation of consumer WTP.

The validity of stated preference analysis, such as choice experiments, is debated for its potential downfall of *hypothetical bias*- where the lack of incentive-compatibility in the experimental nature of stated preference may lead to overstatement of WTP. Nonetheless, for new or hypothetical attributes such as the attributes examined in our study, the lack of reveal preference data necessitate the use of stated preference method. Other stated WTP elicitation methods, such as contingent valuation may be used, but a choice experiment is well-suited for multiple-attributes setting as in this study (Adamowicz et al 1998). In an overview, Loomis (2011) concluded that no widely accepted methodology exists to control for hypothetical bias. Additionally, Lusk and Schroeder (2004) and List et al (2006) suggest that the marginal WTP on private goods produced by choice experiments is comparable to WTP measures from experimental auctions, which are revealed preference alternatives to choice experiments and are often used to investigate the behavior of a small group of consumers. Nevertheless, readers should be aware of the contentions on the WTP elicitation methods.

[2] The respondents were not limited to only meat consumers.

Table 1 presents the summary statistics. Eighty-three percent of the respondents identified themselves as the primary shopper in their household. The mean household income was a little over $52,000 and the median education level of the respondents was some college (including community college or technical training). Our sample compared closely to the U.S. population in terms of gender, education, and income, but it heavily represented older consumers; the higher portion of older respondents could be due to the length of the survey deterring participation of younger age groups who may have more time constraints. Heavy representation of older population in online consumer surveys is not uncommon in the literature. For instance, Hu et al (2005) and Loureiro and Umberger (2007) reported mean age of higher than national average in their surveys. Nevertheless as with all surveys, readers should be cautious about the ability of the sample to represent the entire consumer population.

As in Tonsor et al (2009), we chose strip loin steak as the representative product for its well-defined and relatively homogenous properties. The choice profiles consisted of attributes from five categories: *price*, *country of origin*, *production practices*, *tenderness*, and *food-safety assurance*. Table 2 provides the description of these attributes. Four levels of prices were chosen ranging from $5.50 to $16.00, which reflected the low-end and high-end prices that could be observed in actual grocery store settings for steak at the time of the this study.

In conjunction with domestic beef, Australian and Canadian beef were used, as these two nations are the biggest volume exporters of beef to the United States. Canadian beef is noted for its similarity to US beef in terms of breed, marbling and feed. In contrast, Australian beef are typically grass-fed, which differs in eating quality to U.S. and Canadian beef (Brester et al 2004; Mutondo and Henneberry 2007). While there may be notable difference in characteristics and eating quality between U.S., Canadian and Australian steak, it is not clear how much typical consumers in the U.S. are aware of these differences especially given the lack of clear indication of origin prior to COOL.

Levels of all other attributes were determined by examining the related literature as well as discussing with beef experts and focus group members. The phrase *natural* steak refers to steak derived from cows raised without synthetic growth hormones and antibiotics, as opposed to *approved standards*, which means the cow is raised using government-approved growth hormones and antibiotics. In the choice experiment, steak may be "assured tender" or not specified. In the food-safety-assurance category, a steak can be traceable, meaning that steak products on the market can be traced back to an animal from a specific farm/producer. A steak can be BSE-tested which suggests that the cattle where the steak is from was tested and verified free of BSE by the appropriate government agency. A steak can also be both BSE-tested and traceable. Notice that for these quality attributes, no specific agency was indicated as the organization who may issue the guarantees/assurances. This is to avoid consumers attaching specific values/disvalues associated with various agencies. Although consumer response to quality assurance issued by various organizations can be an interesting area of research, it is beyond the scope of this current study. All attributes were explained to the respondents in an information sheet (attached in appendix) before they were asked to complete the choice experiment. Readers may also refer to the informational sheet in the attached appendix for a view of the choice sets given to survey our respondents.

A full-factorial orthogonal design was used to generate the choice tasks. Full-factorial design maintains some useful statistical properties; in particular, all attribute effects of interest are designed to be independent which allows for identification of own-price, cross-price and alternative-specific effects (Louviere et al 2000). In total, 192 choice profiles including the *would-not-buy* option were produced by the experimental design. The choice sets were distributed as 14 versions of the questionnaire. To balance between respondent fatigue and degrees of freedom, each respondent was randomly assigned to one of the 14 versions each containing 10-14 choice sets.[3] Each choice set presents choices of two steaks bundled

[3] Past studies employing choice experiments assigned different numbers of choice sets to each individual. Hu et al. (2005) asked each respondent to complete eight choice set while Tonsor et al. (2009) assigned 21 choice scenarios to each respondent. Although there has been discussion in the literature on the impact

with various attributes and prices (see appendix for a sample choice set); if neither steak appeals to them, the third choice of not buying (*would-not-buy* option) could be chosen.

(Hensher et al 2005) noted omitting the *would-not-buy* alternative constrained decision makers into making a choice from the listed alternatives, which are effectively *conditional choices* and may not reflect all options available to decision makers in the real word. The inclusion of the *would-not-buy option* reflects a more realistic choice environment, where respondents were allowed to delay or decline to make a choice if the options presented are not appealing.

Estimation Method

This paper investigates consumers' preference of imported steaks with the use of Individual-Level Parameter in the context of mixed logit. Mixed logit is capable of capturing unobserved taste heterogeneity within a population, such that variation in taste of sampled individuals is mapped to a taste distribution (Hensher and Greene 2003; Train 2003). Building upon mixed logit, Revelt and Train (2000) described a method to ascertain where in the taste distribution of does a particular consumers lies. Individual-level parameters are suitable for differentiate consumers for marketing purpose (Hensher et al 2006) . Greene et al (2005) showed that willingness-to-pay values derived from Individual-Level estimation are less prone to extreme values, thus produces more behavioral and practical appealing interpretation.

Derivation of Individual-Level Parameters

The central concept of individual-level parameter lies in distinction between global distributions and conditional distributions. Revelt and Train (2000) described the method to derived conditional

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of scenario complexity on choices, this is not the focus of this research. A total of 10-14 choice sets per person are in line with the past literature.

distribution based on Bayesian theorem. The conditional distribution is tighter than unconditional population distribution. thus allowing researchers to gather more precise information regarding a person's taste (Train 2003).

Individual-level parameter can be derived from any behavioral model that specifies random coefficient (Train 2003). In this application, the parameters are derived from a mixed logit framework, which allows unobserved taste heterogeneity to be captured with distribution specification on coefficients. Mixed logit model build on Random Utility Model (McFadden, 1974), which allows the utility (U) associate with individual *i* for alternative *j* under choice situation *t* to be denoted as:

$$\mathrm{U}_{ijt} = \boldsymbol{\beta}'_i \mathbf{x}_{ijt} + \varepsilon_{ijt} \qquad \textbf{(1)}$$

where $\mathbf{x}_{ijt}$ is a Kx1 vector of explanatory variables, which describe the alternative *j* in choice set *t*, where K is the number of attributes. The error term ε_{ijt} signals the randomness of the utility. The Kx1 vector $\boldsymbol{\beta}_{\boldsymbol{i}}$ is specified as random coefficient in a mixed logit model that induces individual heterogeneity. Let $\boldsymbol{\beta}_{\boldsymbol{ik}}$ denotes the parameter associate with attribute k, $\boldsymbol{\beta}_{\boldsymbol{ik}}$ can be expressed as:

$$\boldsymbol{\beta}_{ik} = \boldsymbol{\beta}_{\boldsymbol{k}} + \boldsymbol{\gamma}' \boldsymbol{v}_{\boldsymbol{ik}}$$
$$\boldsymbol{\beta} \sim \mathrm{g}(\boldsymbol{\beta}_{\boldsymbol{k}}, \boldsymbol{\Omega}) \qquad \textbf{(2)}$$

where $\boldsymbol{\beta}_k$**a mean coefficient associated with attribute k, and vik is** is an IID error term. The mixed logit model estimates $\boldsymbol{\beta}_{\boldsymbol{k}}$ and $\boldsymbol{\gamma}$ **--** the coefficient associate with $\mathbf{v}_{\mathbf{ik}}$ and $\boldsymbol{\Omega}$ **–** covariance matrix of $\boldsymbol{\beta}$. The mixing distribution g(.) can take on any appropriate distribution that reflect behavior of subject.

McFadden (1974) showed that if the error term, ε_{ijt},follows an IID maximum extreme value Type I distribution, the resulting choice probability is the conditional logit choice probability. Given the parameter $\boldsymbol{\beta}$, the probability is denoted as:

$$L_{it}(y_{it}|\boldsymbol{\beta}) = \frac{\boldsymbol{exp}(\boldsymbol{x_{ijt}\beta})}{\sum_{\boldsymbol{k=1}}^{\boldsymbol{J}} \boldsymbol{exp}(\boldsymbol{x_{ikt}\beta})} \quad \textbf{(3)}$$

where y_{it} represent the choice individual *i* made under choice set *t*. Let $\mathbf{y}_i$ denotes sequence of choices individual *i* made, such that $y_i =< y_{i1}, \ldots, y_{iT} >$. The probability of the sequence of choices is a product of logit:

$$\mathrm{P}(y_i|x_i, \boldsymbol{\beta}) = \prod_{t=1}^{T} L_{it}(y_{it}|\boldsymbol{\beta}) \quad \textbf{(4)}$$

however in mixed logit setting, since $\boldsymbol{\beta}$ is random. The probability $\mathbf{y}_i$ is derived by integrating $\boldsymbol{\beta}$ with respect to its mixing distribution $g(\boldsymbol{\beta}|\boldsymbol{\beta_k}, \boldsymbol{\Omega})$, specifically:

$$P(y_i|x_i, \boldsymbol{\beta_k}, \boldsymbol{\Omega}) = \int \mathrm{P}(y_i|x_i, \boldsymbol{\beta})\, g(\boldsymbol{\beta}|\boldsymbol{\beta_k}, \boldsymbol{\Omega})\boldsymbol{\partial\beta} \quad \textbf{(5)}$$

Train (2003) showed that using Bayes' rule, the conditional density that represents the group of individuals who made the sequence of choice y_i under choice situation x_i is given as:

$$h(\boldsymbol{\beta}|\boldsymbol{y_i}, \boldsymbol{x_i}, \boldsymbol{\beta_k}, \boldsymbol{\Omega}) = \frac{\boldsymbol{P}(\boldsymbol{y_i}|\boldsymbol{x_i}, \boldsymbol{\beta})\boldsymbol{g}(\boldsymbol{\beta}|\boldsymbol{\beta_k}, \boldsymbol{\Omega})}{\boldsymbol{P}(\boldsymbol{y_i}|\boldsymbol{x_i}, \boldsymbol{\beta_k}, \boldsymbol{\Omega})} \quad \textbf{(6)}$$

Individual-level parameter, which is also the mean coefficient in the subpopulation that chooses $\mathbf{y}_i$ given $\mathbf{x}_i$, can be derived using the conditional density, specifically:

$$\begin{aligned} \overline{\beta_i} &= \int \beta \cdot h(\boldsymbol{\beta}|\boldsymbol{y_i}, \boldsymbol{x_i}, \boldsymbol{\beta_k}, \boldsymbol{\Omega})\boldsymbol{\partial\beta} \\ &= \frac{\int \beta \cdot \boldsymbol{P}(\boldsymbol{y_i}|\boldsymbol{x_i}, \boldsymbol{\beta})\boldsymbol{g}(\boldsymbol{\beta}|\boldsymbol{\beta_k}, \boldsymbol{\Omega})\boldsymbol{\partial\beta}}{\int \boldsymbol{P}(\boldsymbol{y_i}|\boldsymbol{x_i}, \boldsymbol{\beta})\boldsymbol{g}(\boldsymbol{\beta}|\boldsymbol{\beta_k}, \boldsymbol{\Omega})\, \boldsymbol{\partial\beta}} \end{aligned} \quad \textbf{(7)}$$

The integrals in equation 7 do not have close forms. Simulation is required to solve for the individual parameter (Train (2003, chapter 11); Greene et al. (2005)).

Our specification of the mixed logit is as following:

$$U_{ijt} = \alpha' c_{ijt} + \boldsymbol{\beta}'_i \boldsymbol{x}_{ijt} + \varepsilon_{ijt}$$

$$\mathbf{x}_{jt} = [\text{WOULD-NOT-BUY, AUS, CAN, BSE, TRACE, BSE\_TRC, TENDER, NAT}]_{jt} \quad \textbf{(8)}$$

Two components made up the deterministic part of the utility: first, the price scalar (c_{ijt}) along with its fixed parameter α; the price coefficient is specified as a fixed coefficient to avoid an unrealistic positive coefficient associated with price (Meijer and Rouwendal 2006; Olsen 2009). Second, the 8x1 vector $\mathbf{x}_{jt}$ represents steak attributes with dummy variables, where the base cases are *USA* in origin labeling, *Approved Standards* in production practices, *None* in food safety assurance and *Not Specified* in tenderness respectively. Moreover, the random parameter **β** is specified to have normal distribution and correlated attributes, the model produced an 8x8 covariance matrix with non-zero off diagonal elements reflecting the correlation.

Of particular interest are the individual-level parameters of the country-of-origin attributes, which describe the utility/disutility an individual associated with steak from a given country of origin. The derivation of individual-level parameters requires simulation. The individual-level parameters are weighted average of draws of **β** from the population density $g(\boldsymbol{\beta} | \boldsymbol{\beta}_k, \Omega)$. The individual-level coefficient is calculated as follow:

$$\check{\beta}_{q,i} = \sum_{r=1}^{R} w_r \beta_{q,r} \quad \textbf{(9)}$$

where the weights, w_r, which also equals to the contribution of each draw towards the likelihood function (Greene et al 2005), are:

$$w_r = \frac{\mathrm{P}(y_i | x_i, \beta_{q,r})}{\sum_{r=1}^{R} \mathrm{P}(y_i | x_i, \beta_{q,r})} \quad \textbf{(10)}$$

The country-of-origin specific individual-level willingness to pay (WTP) is derived by taking ratio of the coefficient associate with a COOL attribute and the price coefficient, that is substituting $\beta_{q,i}$ as $\frac{\beta_{country,i}}{\alpha_{price}}$ in equation 9.

Results

The conditional logit model (Table 3) recorded a McFadden R^2 of 0.147. In comparison, the mixed logit model (Table 4) recorded a McFadden R^2 of 0.326, a significant improvement over the conditional logit model. The improvements in explanatory power of Mixed Logit model could be attributed to the inclusion of unobserved heterogeneity in the model, the standard deviation statistics of all the random coefficient are significant, which indicated significant present of taste heterogeneity for all the random parameters.

All coefficient tested were significant at 1% level except for natural beef. However, the significant standard deviation associated with natural beef suggests that half of the sample prefers natural beef. These coefficients are readily transformed into context of (population/unconditional) willingness to pay estimates, which is a measure of compensation variation for a given attributes (Sillano and Ortuzar 2005; Zhao and Kling 2004). The WTP are calculated as:

$$WTP_{attribute} = -\frac{\beta_{attribute}}{\alpha_{price}} \qquad \textbf{(11)}$$

The standard errors of the WTP estimates were produced using Krinsky and Robb (1986) simulation procedure with 2,000 replications (Hensher and Greene 2003). Table 5 presents the results. The negative WTP for imported steaks suggests that holding other factors constant, most consumers need to be compensated, either in price or in favorable attributes, for choosing Canadian or Australian strip loin steak over U.S. strip loin steak. Specifically, the estimated WTP associated with Australian and Canadian beef in comparison to US beef were -$7.35/lb and -$5.41/lb. Sizeable premium was found on the non-COOL attributes as well. On average, the marginal WTP for BSE tested beef, traceable beef or with both attributes combined were $5.08, $5.26, and $7.51 per pound respectively; the WTP for these food-safety enhancements eclipse a large portion of the discount associated with Australian and Canadian beef. In addition, the tenderness-assured steaks garner a premium of $3.97 on average. Although *natural* steak was not found to be associated with significant WTP, overall, the food-safety and eating-quality attributes provide a viable way to differentiate imported steak from domestic products.

Individual Parameter Analysis

We derived the individual-level WTP associated with steak labeled as Australian origin (WTPaus) and Canadian origin (WTPcan). The mean values of WTPaus and WTPcan are comparable to those found in the population WTP in previous section. Train (2003, pg. 269) suggested that individual-specific parameters derived from a correctly specified model should mirror closely to the unconditional parameters.

We analyze WTPaus and WTPcan with a box plot presented as Figure 1. We observed that a small number of the sample were willing to pay more for the imported steaks than similar domestic-originated steak. Although the median value of WTPcan is higher than WTPaus, the range between 75th percentile and upper adjacent value of WTPaus is wider than the similar range of WTPcan. This suggests that Australia steak has more potential as a niche product than Canadian beef, which perhaps are due to grass-fed nature of Australian beef.

Next, WTPaus and WTPcan enter as dependent variables in a seemingly unrelated model (SUR). Examples of ex-post analysis of individual-level parameters can be found in Hu et al. (2004) and Hu et al. (2006). The explanatory variables of the SUR model were *age*, *income*, *education*, *gender* and *number of children*, and Likert-scale variables regarding food safety opinion and purchase behavior. The specific questions used in the survey and descriptions for the Likert-scale variables are presented on Table 6. The specification of the SUR model was:

$$WTPaus_i = \alpha_{aus} + \boldsymbol{\beta}_{aus,1}\boldsymbol{d}_i + \boldsymbol{\beta}_{aus,2}\boldsymbol{fsaus}_i + \beta_{aus,3}cool_i + \beta_{aus,4}price_i + \beta_{aus,5}risk_i + \beta_{aus,6}accept_i + \varepsilon_{aus,i}$$

$$WTPcan_i = \alpha_{can} + \boldsymbol{\beta}_{can,1}\boldsymbol{d}_i + \boldsymbol{\beta}_{can,2}\boldsymbol{fscan}_i + \beta_{can,3}cool_i + \beta_{can,4}price_i + \beta_{can,5}risk_i + \beta_{can,6}accept_i + \varepsilon_{can,i} \quad \textbf{(12)}$$

$$\boldsymbol{d}=[age, edu, inc, male, child]$$

The SUR model estimated two sets of coefficients; each belongs to WTP equation of Australian steak and WTP of Canadian steak respectively. The results from the SUR model are presented on Table 7. The R^2 were 0.1073 and 0.066 respectively for the Australian and Canadian model. The robust standard errors were calculated using bootstrapping method with 400 repetitions to account for potential heteroskedasticity in the data. Breusch-Pagan test (Table 8) rejected null hypothesis that the two error terms were independent, thus justifying the use of SUR model.

On parameters associated with demographic variables, *age* and *edu* were significant and consistent in sign for both the Australian and Canadian model; the coefficients indicated that ceteris paribus, older consumers were, on average, willing to pay less for imported Australian and Canadian steak, and the WTP for the imported steak increase with education level.

We elicited the respondent's opinion on food safety level of beef originated from Australia (*fsaus*) and Canada (*fscan*) with a five-point Likert-scale question with options of *no opinion*; the rating of *1* corresponds to *very-low* opinion and the rating of *5* corresponds to a *very-high* rating. From Table 6, considerable large group of respondents answered no opinion on the rating for Australia (34.7%) and Canada (30.5%). We transformed the ratings into dummy variables, and used the groups who answered no opinion as base categories in the SUR model. We found that those who rated the safety of imported beef as *very low* were willing to pay less for the imported beef on average than those who rated *no* *opinion*; this observation is consistent across the Australian and Canadian model. However, the WTP for the imported beef were statistically equivalent for those who rated *no opinion* and a rating of *2*, which suggest that those who rated *no opinion* holds some reservation about the safety of imported steak. The WTP were found to be higher on average for respondent who rated *3* or above on the rating. From these, we see that most U.S. consumers are unfamiliar with imported beef, possibly due the lack of clear indication of origin prior to COOL. Consumers who were unfamiliar with safety of imported beef were, on average, willing to pay less than those who have rated the safety level of imported beef as moderate of safe. In addition, we observed that those who have higher tolerance to food safety risk in beef (*accept*) were willing to pay more for the imported steak, which reinforce the link between risk perception and willingness to pay for imported beef. These findings suggest that foreign beef producers could benefit from risk communication campaign that seek to increase product familiarity.

The negative coefficient on *COOL* suggests that respondents who rated country of origin as an important consideration in beef purchase were willing to pay less for the imported steaks. In contrast, the discounts on the imported steaks were lower on those who emphasize price, as indicated by the positive coefficient on *price*. From Table 6, we observed that 44% of the sampled disagree they purchase beef based on country of origin, and more 42% indicated that price is important factor in beef-purchase decision. This suggests that considerable consumer population is willing to make the country of origin and price trade-off.

Conclusion and Implication

Despite recent interest in country of origin, little is known about the underlying factors on willingness to pay for imported food products. Using the individual-level parameters method suggested in Revelt and Train (2000), we derived individual-level WTP for imported Australian and Canadian steak. We found significant negative WTP is associated with these imported steak.

Upon further analysis, we observed significant taste heterogeneity exist on consumers' preference of the imported steaks. The taste heterogeneity underlines potential for these imported steaks to be marketed as niche products.

In addition, we observed that perception on food safety level of the exporting countries significantly affect consumers' willingness to pay. Evidence from our study suggests that a significant portion of U.S. consumers are either uncertain or hold low opinion about food safety level of imported beef. This points to a need of risk and information communication may relieve concerns about the safety of imported beef.

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Table 1. Sample Descriptive Statistics

Variable	Group	Percent	Sample Mean/Median	US Census Data
Age	15-19	0.93%	56.62	36.8[a]
	20-24	3.52%		
	25-29	2.22%		
	30-39	7.78%		
	40-49	12.70%		
	50-64	32.25%		
	65+	40.59%		
Gender	Male	47.54%		49.20%
	Female	52.46%		50.80%
Education	<High School	1.11%	14[a]	12[a]
	High School	23.08%		
	Some College	39.39%		
	4 year Degree	24.28%		
	Graduate	12.14%		
Household Income ($)	<25k	24.10%	52.37k	51.42k
	25k-40k	23.54%		
	40k-65k	23.82%		
	65k-80k	9.55%		
	80k-100k	7.32%		
	100k-120k	6.12%		
	>120k	5.56%		
No. of Children			0.3420	
Freq. shopping grocery	Never	1.85%		
	Sometimes	14.74%		
	Frequently	83.42%		

[a]Median values.

Table 2. Attributes Levels and Descriptions

Categories	Levels	Abbr.	Descriptions
Price ($/lb)			Refers to steak price in retail grocery store or butcher where the respondent typically shops.
	5.50		
	9.00		
	12.50		
	16.00		
Country of Origin			Refers to country in which the cattle were raised
	USA		
	Canada	CAN	
	Australia	AUS	
Production Practices			Refers to the method used in production.
	Approved Standards		**Approved Standards** means production involved government-approved synthetic growth hormones and antibiotics.
	Natural	NAT	**Natural** means animal was raised without the use of synthetic growth hormones or antibiotics
Food Safety Assurance			Refers to the food safety assurance offered with the steak
	None		
	BSE-Tested	BSE	**BSE-Tested** means that cattle are tested for BSE prior to slaughtering process
	Traceable	TRC	**Traceable** means the product is fully traceable back to farm of origin from the point of purchase
	BSE-Tested and Traceable	BSE_TRC	**BSE-Tested and Traceable** were offered in combination
Tenderness			Refers to the softness in the steak's eating quality
	Not Specified		**Not Specified** means there are no guarantees on tenderness level of the steak
	Assured Tender	TENDER	**Assured Tender** means the steak is guaranteed tender by testing the steak using a tenderness measuring instrument

Table 3. Conditional Logit Model Results

Variable	Coefficient Estimates		Stand Error	t-value	95% Confidence Interval	
PRICE	-0.1616	***	0.0039	-41.8	-0.1692	-0.1540
CHOOSENO	-0.8071	***	0.0575	-14.03	-0.9198	-0.6944
AUS	-1.0841	***	0.0351	-30.91	-1.1529	-1.0154
CAN	-0.8435	***	0.0335	-25.15	-0.9093	-0.7778
BSE	0.9030	***	0.0428	21.08	0.8191	0.9870
TRACE	0.9244	***	0.0429	21.57	0.8404	1.0084
TRC_BSE	1.3461	***	0.0424	31.78	1.2631	1.4291
TENDER	0.6748	***	0.0284	23.79	0.6192	0.7304
NAT	0.0242		0.0289	0.84	-0.0324	0.0807
Log likelihood Score			-13705			
McFadden R2			0.1475			

Notes: ***, **, and * indicate significant at the 1%, 5%, and 10% significance levels.
Results produced with NLOGIT 4.0.

Table 4. Mixed Logit Model Results

Variable		Coefficient Estimates		Stand Error	t-value	95% Confidence Interval	
PRICE	mean	-0.2405	***	0.0058	-41.77	-0.2518	-0.2292
CHOOSENO	mean	-1.7396	***	0.1088	-15.99	-1.9527	-1.5264
	std dev	2.6436	***	0.0904	29.24	2.4664	2.8208
AUS	mean	-1.7665	***	0.0713	-24.79	-1.9061	-1.6268
	std dev	1.4594	***	0.0752	19.41	1.3120	1.6067
CAN	mean	-1.3029	***	0.0574	-22.70	-1.4154	-1.1904
	std dev	1.0363	***	0.0719	14.41	0.8954	1.1773
BSE	mean	1.2235	***	0.0597	20.51	1.1066	1.3404
	std dev	0.5943	***	0.0844	7.04	0.4288	0.7597
TRACE	mean	1.2670	***	0.0606	20.91	1.1483	1.3857
	std dev	0.6477	***	0.0859	7.54	0.4793	0.8162
TRC_BSE	mean	1.8065	***	0.0625	28.92	1.6841	1.9289
	std dev	0.7841	***	0.0749	10.47	0.6373	0.9310
TENDER	mean	0.9562	***	0.0455	21.02	0.8670	1.0453
	std dev	0.7518	***	0.0614	12.24	0.6314	0.8722
NAT	mean	0.0047		0.0440	0.11	-0.0816	0.0909
	std dev	0.6605	***	0.0629	10.49	0.5371	0.7838
Log Likelihood Score		-10902					
McFadden R2		0.326					

Notes: ***, **, and * indicate significant at the 1%, 5%, and 10% significance levels.
Results produced with NLOGIT 4.0, 250 Halton draws.

Table 5. Population Mean WTP Estimates

Variable	WTP $/lb		Standard Error	95% Confidence Interval	
CAN	-7.3476	***	0.3125	-7.9601	-6.7352
AUS	-5.4112	***	0.2517	-5.9045	-4.9179
WOULD-NOT-BUY	-7.2321	***	0.3856	-7.9878	-6.4764
BSE	5.0818	***	0.2576	4.5769	5.5867
TRACE	5.2642	***	0.2572	4.7601	5.7683
BSE_TRC	7.5096	***	0.2795	6.9618	8.0575
TENDER	3.9716	***	0.1979	3.5838	4.3595
NAT	0.0207		0.1825	-0.3369	0.3782

Notes: ***, **, and * indicate significant at the 1%, 5%, and 10% significance levels.

Table 6. Tabulation and Description of Variables Entering the SUR Model

Variable	Ratings	Percentage	Question/ Description
COOL			I purchase meat based on country of origin
	1	16.03	Strongly disagree
	2	28.08	Disagree
	3	31.97	Neither agree nor disagree
	4	19.00	Agree
	5	4.91	Strongly agree
Price			I purchase meat based on price
	1	6.49	Strongly disagree
	2	16.96	Disagree
	3	34.01	Neither agree nor disagree
	4	34.20	Agree
	5	8.34	Strongly agree
Risk			When eating beef, I am expose to …
	1	17.90	Very little risk
	2	26.44	
	3	38.22	
	4	12.99	
	5	4.45	A great deal of risk
Accept			I accept the risk of eating beef
	1	5.47	Strongly disagree
	2	8.44	Disagree
	3	29.13	Neither agree nor disagree
	4	35.16	Agree
	5	21.80	Strongly agree
			What is your perception of the level of food safety of beef by country of origin?
fsaus (Australia)	1	6.21	Very low
	2	8.06	Low
	3	23.54	Moderate
	4	18.91	High
	5	8.62	Very high
	No Opinion	34.66	
fscan (Canada)	1	4.82	Very low
	2	7.14	Low
	3	24.93	Moderate
	4	20.85	High
	5	11.77	Very high
	No Opinion	30.49	

Notes: Fsaus and Fscan are transformed into dummy variables
All variables above are based on 5-point Likert scale

Table 7. SUR Model Results

	Coefficient		Std. Err.	95% Confidence Interval	
WTPaus					
age	-0.0204	**	0.0090	-0.0380	-0.0028
inc	0.0042		0.0041	-0.0037	0.0122
edu	0.1762	***	0.0611	0.0564	0.2960
male	-0.1065		0.2580	-0.6123	0.3992
child	-0.0775		0.1549	-0.3812	0.2262
fsaus1	-1.8302	***	0.5180	-2.8454	-0.8150
fsaus2	-0.5532		0.4963	-1.5259	0.4194
fsaus3	-0.5532	**	0.3392	0.1715	1.5012
fsaus4	1.6859	***	0.3269	1.0453	2.3265
fsaus5	1.2294	***	0.5065	0.2365	2.2222
COOL	-0.4504	***	0.1192	-0.6840	-0.2169
price	0.3354	***	0.1178	0.1045	0.5662
risk	0.0106		0.1326	-0.2492	0.2704
accept	0.2798	**	0.1290	0.0269	0.5326
constant	-12.0970	***	1.2915	-14.6283	-9.5657
WTPcan					
age	-0.0198	***	0.0059	-0.0313	-0.0082
inc	-0.0005		0.0024	-0.0052	0.0042
edu	0.0695	*	0.0386	-0.0061	0.1451
male	0.0300		0.1440	-0.2523	0.3123
child	0.0220		0.0923	-0.1589	0.2030
fscan1	-0.9819	***	0.3484	-1.6646	-0.2991
fscan2	-0.0901		0.3652	-0.8060	0.6257
fscan3	0.4903		0.2211	0.0570	0.9235
fscan4	0.9822	***	0.2079	0.5747	1.3897
fscan5	1.0512	***	0.2343	0.5920	1.5104
COOL	-0.1938	***	0.0724	-0.3356	-0.0520
price	0.1404	*	0.0825	-0.0213	0.3021
risk	0.1540	*	0.0810	-0.0046	0.3127
accept	0.1174		0.0811	-0.0415	0.2764
constant	-6.4759	***	0.8553	-8.1523	-4.7995
R^2 for WTPaus		0.0695			
R^2 for WTPcan		0.1074			

Notes: ***, **, and * indicate significant at the 1%, 5%, and 10% significance levels.
Results produced with SUREG and Bootstrap procedure in STATA 10

Table 8. Bruesch- Pagan Test for SUR Model

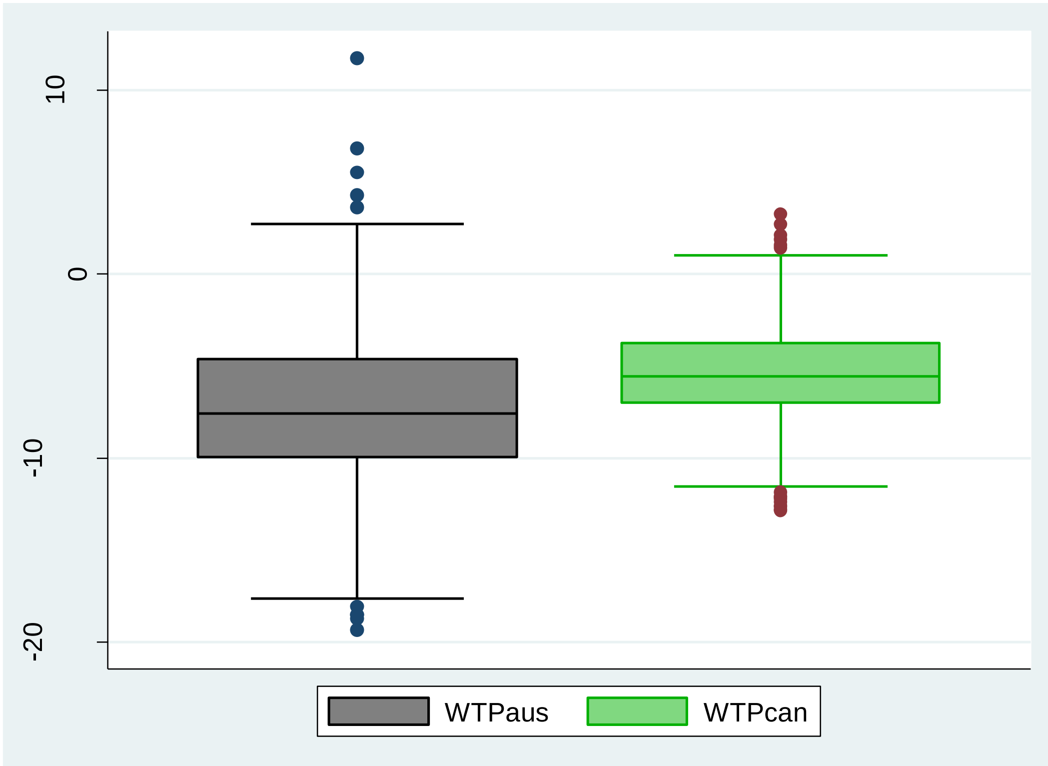
Correlation matrix of residuals:

	WTPcan	WTPaus
WTPcan	1.0000	
WTPaus	0.2366	1.0000

Breusch-Pagan test of independence:

$Chi^2(1)$ = 60.324 Pr = 0.000

Figure 1. Box Plot of Individual WTPs



	Median	75th Percentile	Upper Adjacent Value
WTPaus ($/lb)	-7.5670	-4.6040	3.3715
WTPcan ($/lb)	-5.5484	-3.7508	1.0864