U.S. Consumers' Preference and Willingness to Pay for Country-of-Origin-Labeled Beef Steak and Food Safety Enhancements

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ABSTRACT

The mandatory Country of Origin Labeling (COOL) troubles beef exporters to the U.S. This study evaluates the extent that U.S. consumers are receptive to imported steak and their perception of food safety level of beef from various countries. In addition, using conjoint analysis, willingness to pay for strip loin steak from Australia, Canada and the United States is estimated along with several increasingly important food safeties and quality attributes in beef. We find that on average U.S. consumers are willing to pay significantly less for imported steaks.

Key words: beef, consumer preferences, country-of-origin labeling, conjoint experiment, willingness to pay

INTRODUCTION

The Country of Origin Labeling (COOL) provision of the 2002 and 2008 Farm Bill troubles beef and cattle exporters to the United States. In the context of beef, the law mandates only beef derived from cattle born, raised, and processed in the U.S. can be labeled as U.S. origin. The law, in essence, differentiates imported beef from domestic beef at the retail level. COOL has raised concerns about its negative effects on U.S. meat and livestock imports, which prompted the governments of Canada and Mexico to challenge the legitimacy of COOL in accordance with the World Trade Organization's guideline.

The importance of the U.S. market for many beef exporting countries cannot be understated. Notably, exports to the U.S. market account for about 30% of Canada, New Zealand and Nicaragua total beef and veal production. Cattle exports from Canada and Mexico were almost exclusively destined to the U.S. market (USDA, 2010). Stockwell Day, the Canadian International Trade Minster, claimed the law is "devastating the Canadian livestock industry". Canadian representatives of cattle industry also stated that the law has resulted in a "glut of meat on store shelves in Canada" (Wyld, 2009).

Although COOL has been heavily explored in recent literature, much remains to be contemplated at the consumer level. COOL will likely affect consumer choices in addition to its impact on production and trade. For instance, some demand conditions were imposed in Brester et al (2004) and Chung et al (2009) in their investigation on market impacts of COOL. Existing research on consumer-level impacts of COOL, notably Loureiro and Umberger (2007), focused on the difference in willingness to pay (WTP) between U.S.-labeled beef products and products of unknown origin. The question highly relevant to COOL's market implication, i.e. how U.S. consumers perceived imported steak, remains unanswered.

The objective of this research is to investigate the potential implications of COOL on the retail beef steak market. Factors which differentiate U.S. consumers' perception on domestic and imported steak were examined. A conjoint experiment is used to estimate the difference in willingness-to-pay between domestic-labeled beef and imported beef, along with WTP for several increasingly important attributes of beef: tenderness assurance, BSE testing, traceability and natural production (hormone- and antibiotic-free). This study extends the consumer experiment used in Loureiro and Umberger (2007) and Tonsor et al (2009).

LITERATURE REVIEW

Lancaster (1966) proposed that attributes or properties embedded in goods influence utility from consumption. Applying this intuition in context of COOL, consumers achieve higher utility when they consume goods produced from the geographical location they preferred; and vice versa, lower utility when they consume food produced from less desirable origins. Proponents of COOL argue that many U.S. consumers associate domestic products as being safer and higher in quality than imported products and some consumers want to support U.S. foods (Krissoff, et al., 2004).

Beef's sourcing origin is by nature a credence attribute, one that cannot easily be determined by consuming the product (Darby and Karni, 1973). A suboptimal equilibrium occurs when consumers incorrectly discern the true quality of a product due to lack of information. Caswell and Mojduzka (1996) proposed that such a market failure can be addressed by informational labeling.

U.S. consumers prefer domestic beef to imported beef. Mutondo and Henneberry (2007) used the Rotterdam model to assess demand on source-differentiated beef. They found that U.S. grain-fed beef had a competitive advantage in the domestic market over imported beef from Australia, Canada and New Zealand.

Lusk et al (2006) outlined two incentives for consumers to favor country-of-origin labeling. Firstly, the information on country of origin may signal product quality. In the case of beef, consumers perceive U.S. beef as safer than imported beef (Loureiro and Umberger, 2005, Loureiro and Umberger, 2007, Schupp and Gillespie, 2001, Umberger, et al., 2003). Secondly, consumers may be guided by ethnocentrism – consumers' loyalty towards their own country or antipathy toward other countries.

Several studies found that U.S. consumers were willing to pay more for beef labeled as U.S. origin over unlabeled beef (2005, Loureiro and Umberger, 2007, Loureiro and Umberger, 2003, Umberger, et al., 2003). However, the difference in willingness to pay between U.S. beef and imported beef were not addressed in these studies.

Critics of COOL contested the defense of COOL as a food safety measure, but rather as a promotional tool. Ikenson (2004) contended the Food Safety and Inspection Service would not allow importation of any unwholesome foods. In addition, COOL exempts restaurants and 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, implying that suppliers do not believe domestic origin appeals to consumers. Profit maximizing retailers, processors, and producers are motivated to practice voluntary labeling if they deem the benefit derived from country of origin labeling to exceed the cost.

Opponents also questioned COOL's ability to success as a promotion tool for domestic product. Carter et al (2006) argued that COOL will not impose quality control and supply restriction, the two conditions for long term premiums on domestic food products:. Further, they argued even if COOL generated premium in short run, the premium will be dissipated by additional entry or supply.

Some studies suggested that COOL might not be as valuable to consumers as other attributes. Verbeke and Roosen (2009) found *best before date*, *safety guarantee quality label*, and *health benefits* are thought to be of more importance than *country of origin* by Belgian beef consumers. Country of origin, however, is more important than the direct indication of *traceability*. In contrast, Loureiro and Umberger (2007) indicated U.S. consumers are willing to pay a premium of $2.568/pound for steaks labeled with country of origin; but consumers are willing to pay a higher premium for the *food safety inspected* label than for country of origin label.

COOL can be costly to producers and consumers especially if demand is not stimulated. The costs stem from labeling, product and livestock segregation and human resources used in compliance of COOL, are likely to spread across producers, processors and consumers. Jones et al (2009) evaluated the impacts of COOL on the U.S. market using a global static general equilibrium model. Under the assumption of no demand premium on labeled commodities relative to unlabeled commodities, the cost of compliance with COOL would increase the prices of live animals and meats. Contrary to boosting demand for domestic products, Jones et al (2009) projected that production and equilibrium levels of both domestic live animals and meats would decrease as the result. Demand would decrease when higher cost translated into higher prices. Surprisingly, they projected imports of live animals to increase as a result of reductions in domestic production. Regardless of the magnitude, it is crucial to understand consumers' willingness to pay for imported beef of specific origins; the willingness to pay may be used as evidence to assess the implications of COOL.

Chung et al (2009) estimated that COOL will cause a loss of $52.64 million in producers' surplus and a loss of $297.12 million in consumers' surplus. Market power in upstream and downstream markets of processors could further decrease consumers' and producers' surplus. However, producers and consumers could gain from COOL if there was about a 2 percent increase in the demand of beef.

As standards of living and caution toward food safety risk rise, the demand for additional food safety guarantees and non-conventional production practices increases. Thilmany et al (2006) performed a cluster analysis on demand for value-added natural (minimally processed, and antibiotic- and hormone-free) beef products by Colorado consumers. They found those who ranked production attributes such as *no antibiotics*, no *hormones* and *humane treatment* significantly higher, were willing to pay a premium for natural beef.

Lusk et al (2003) found that steak consumers in France, Germany, the United Kingdom and the United States were all willing to pay a positive amount for beef produced free of growth hormones. In a survey conducted with consumers near meat counters in supermarkets in Utah and Idaho, 72% of the respondents stated they were willing to pay 5% extra for beef tested for BSE (Bailey et al 2005).

The demand for beef is ever more dynamic in the midst of evolving preference and policy changes such as COOL. In order to better understand the impact of COOL and the market for new innovations, agribusinesses and policy makers need additional information on consumers' perception on these issues. This research aims to gauge the impact on consumers' demand for beef steak after the implementation of COOL along with consumers' valuation of tenderness assurance, BSE testing, traceability, and natural production practices.

DATA

This study employed a choice experiment to estimate WTP for beef steak attributes. Our sample consists of 1079 responses from consumers from the U.S. We established an internet survey to elicit consumers' preferences and behavior toward beef purchases and general food safety concerns. The surveys were conducted through TNS Global in May 2010. TNS Global is a leading market research company with a vast consumer panel throughout the United States. The panel of consumers were randomly contacted by TNS Global and asked to respond to our survey, which was pre-loaded to the company's server. The target number of responses was set as 1,000. The survey closed with 1079 responses. A total of 83 % of the respondents identified themselves as the primary shopper. The mean household income was a little more than $52,000 and the average education level was some college (including community college or technical training).

Our sample compared closely to the U.S. population in terms of gender, education, income and household size, but it over-represented older consumers. The older population might have been more responsive to the monetary compensation to participate in the survey given their opportunity cost of time. This pattern of an online consumer survey with mean age higher than the population average is not uncommon in the literature. For instance, Hu et al (2005) reported that their online survey had a higher-than-national-average age in a Canadian national survey. Tonsor et al (2009) also found a similar result in their online survey of U.S. consumers. Some desirable characteristics of our sample include high percentages of primary shoppers and beef consumers. Nevertheless as with all surveys, readers should be cautious about the ability of the sample to represent the consumer population. In most respects, our sample is representative.

Some Perception of Beef from Different Origin Statistics

We elicit the sampled consumers' preference for origin of beef. Figure 1 reports the result. As indicated the majority (65.7%) is indifferent between imported and domestic beef. More than one-quarter (27.5%) of the sample stated they would avoid imported beef. After domestic beef, 4.4% of the sample preferred Canadian beef. Beef from Australia, New Zealand and Argentina combined are preferred by 2.4% of the sample. This result largely coincides with Loureiro and Umberger (2005). About 72.5% of sampled indicated they either preferred imported beef or indifferent between domestic and imported beef, this implies that a large portion of the U.S. market is open to imported beef. Nonetheless, COOL could still significantly reduce the demand of imported beef if retailers deem that the profit earned from carrying imported beef outweigh that gained from domestic beef.

As previous literature suggested that consumers may use COOL as a cue for food safety, a question in the survey asked consumers to rate their perceived beef food safety level for various countries. Figure 2 reports the result. As anticipated, domestic beef is perceived to be the safest, almost 60% believe U.S. beef is safe. In contrast, beef of unknown origin is thought to be the most unsafe, 34% rated unlabeled beef unfavorably compare to only 10.3% who consider U.S. beef unsafe. Canadian beef ranked second after U.S. beef by American consumers in perceived safety, follow by beef from Australia, New Zealand and Brazil. A significant portion responded *no opinion* in regards to safety of imported beef, perhaps due to limited experience with imported beef.

Overall, the perceived safety level of beef is evaluated widely across country of origin. Assuming consumers achieve higher utility by consuming beef which is perceived to be safer, COOL will be an effective policy instrument to aid consumers in choosing beef that maximizes utility. Without the mandatory labeling policy in place, consumers may suffer lost utility given that beef from unknown origin is perceived to be the least safe.

Factors in Beef Purchase

The survey also investigated respondents' rating of the importance of a series of factors or concerns in overall beef purchasing decision. From table 2, almost half of the sample considered country of origin a very important attribute. Conversely, 15% of the sample believed source origin is unimportant. Consistent with the finding from Verbeke and Roosen (2009), country of origin is not one of the most important factors. A larger portion of the sample rated thirteen other attributes as being equally or even more important than country of origin. Those attributes included taste attributes (*freshness, flavor, tenderness, leanness,* and *juiciness*), and food safety attributes (*food borne disease, BSE, nutritional info, hormones and antibiotics,* and *traceability*).

Table 3 reflects consumers' rating on a related set of concerns regarding beef safety. Similarly, country of origin is a major concern for about one-third of the respondents. However, more respondents were concerned about antibiotics residue, humane treatment of livestock, livestock disease, and the usage of genetically modified livestock and feed than country of origin.

Food manufacturers and retailers are conceivably hesitant to voluntarily employ marketing resources to label products' origin, given that the willingness to pay for an attribute is likely to diminish as the number of attributes offered increases (Gao and Schroeder, 2009). Rather than mandatory country of origin labeling, these statistics suggest implementations of regulation on BSE testing, traceability, and monitoring the usage of antibiotics, hormones and GM technology could better ease food safety concerns of a larger fraction of the U.S. population. Several of these important factors together with country of origin attribute are analyzed in the conjoint analysis.

Empirical Model

Consumers' preference on country-of-origin labeled beef steak is estimated with Error Component Logit Model (MEL). MEL is an extension of the Mixed Logit estimator. It may allow incorporation of taste heterogeneity, taste heteroskedasticity, flexible alternative correlation structure, and alternative-specific variance heteroskedasticity. Essentially, MEL is a combination of the error component logit (EL) and mixed logit model (ML). EL and MEL estimator is increasingly popular in consumer research; some applications include Hu et al. (2009), Scarpa et al. (2008), and Mørkbak et al. (2010).

Begin with Lancaster's consumer utility and McFadden's (1974) Random Utility Model, consumers' utility can be represented as:

$$U_{njt} = V_{njt} + e_{njt} \tag{1}$$

where subscript n denotes individual, j denotes alternative and t denotes choice sets. The utility function U_{njt} consists of a deterministic component $V_{njt,}$ and a random component ε_{njt}. Assuming linearity and K attributes, the utility function can be rewritten as,

$$V_{njt} = \beta_{1j}X_{1njt} + \beta_{2j}X_{2njt} + \cdots + \beta_{Kj}X_{Knjt} \tag{2}$$

or in a matrix form,

$$U_{njt} = \boldsymbol{\beta}'\boldsymbol{X}_{njt} + e_{njt} \tag{3}$$

Under random utility model, consumers choose the alternative within choice set t that provides the highest utility. Assuming the error term, ε_{njt}, is distributed extreme value type 1 distribution, the estimation will follow the familiar conditional logit model (CL).

The mixed logit estimator relaxes the restriction independent of irrelevant alternatives (IIA) properties in the CL model. In addition, ML provides a way to elicit the unobserved heterogeneity in the model (Train, 2003). The ML model specifies **β** as random, such that

$$\boldsymbol{\beta}_n \sim F(\boldsymbol{\alpha_0} + \boldsymbol{D_n}\boldsymbol{\alpha}, \boldsymbol{\Omega_n}) \quad \textbf{(4)}$$

$\boldsymbol{\beta}_n$ is individual-specific, random variables to be estimated that follows joint distribution *F*. The mean of $\boldsymbol{\beta}_n$ consist of $\boldsymbol{\alpha}_0$ **,** a constant term; and $\mathbf{D}_n\boldsymbol{\alpha}$, where $\mathbf{D}_n$ is a vector of observed variables that may offer explanation on the heterogeneous mean of $\boldsymbol{\beta}_n$ and $\boldsymbol{\alpha}$ is the parameter to be estimated. $\boldsymbol{\Omega}_n$ is the covariance matrix of random coefficients $\boldsymbol{\beta}_n$ which can be heteroskedastic. In this application, $\boldsymbol{\beta}_n$'s are permitted to be correlated across alternatives and choice sets, these correlations are embodied in the off-diagonal elements in the matrix $\boldsymbol{\Omega}_n$. One way to restate this is that each individual evaluates each alternative and each choice set with the same preference, thus random preferences induce correlation over alternatives and choice situations (Hensher, et al., 2005).

Brownstone and Train (1998) proposed the error component logit (EL) model which provides a structural approach to capture the correlation between choice alternatives. The specification of EL model is formally equivalent to the random-coefficient specifications in ML model, EL model provides a more realistic substitution pattern than the ML model but does not allow correlation between $\boldsymbol{\beta}$'s (Train, 2003). Greene and Hensher (2007) introduced the MEL which fused ML and EL model.

Following the notations of Hu et al. (2009), the MEL decomposes the error term in the utility function into two segments. Stacking up the alternatives in the *t*-th choice set, the error term is written as

$$e_{nt} = \boldsymbol{\gamma}_n \boldsymbol{\eta}_n + \boldsymbol{\varepsilon}_{nt} \quad \textbf{(5)}$$

Subsequently, the utility function can be rewritten as,

$$\boldsymbol{U_{nt}} = \boldsymbol{X}_{\boldsymbol{nt}}\boldsymbol{\beta}_{\boldsymbol{n}} + \gamma_n \boldsymbol{\eta}_{\boldsymbol{n}} + \boldsymbol{\varepsilon}_{nt} \quad \textbf{(6)}$$

ε_{nt} is an iid error term which distributed as standard maximum extreme value type I. $\boldsymbol{\eta}_n$ is a vector of normally distributed random variables with zero means. The vector $\boldsymbol{\gamma}_n$, the parameter associate with $\boldsymbol{\eta}_n$

to be estimated, captures the correlation across the alternatives. The identification method of EL model is discussed in Walker et al. (2007), the basic rule of thumb is that the number of elements in $\boldsymbol{\gamma}_n$ should be less than the number of alternatives in a choice set. In this study, the respondent is presented with choice sets each containing two alternatives and a last alternative providing option not to buy. Hence, the vector $\boldsymbol{\gamma}_n$ can be appropriately specified such that the alternatives one and two are correlated but both are uncorrelated to third alternative, that is, $\boldsymbol{\gamma}_n = [\gamma, \gamma, 0]$ (Greene and Hensher, 2007, Hu, et al., 2009). The utility functions can be written as the following:

$$\begin{aligned} \boldsymbol{U_{n1t}} &= \boldsymbol{X}_{\boldsymbol{n1t}}\boldsymbol{\beta}_{\boldsymbol{n}} + \gamma_{n12}\boldsymbol{\eta}_{\boldsymbol{n}} + \boldsymbol{\varepsilon}_{n1t} \\ \boldsymbol{U_{n2t}} &= \boldsymbol{X}_{\boldsymbol{n2t}}\boldsymbol{\beta}_{\boldsymbol{n}} + \gamma_{n12}\boldsymbol{\eta}_{\boldsymbol{n}} + \boldsymbol{\varepsilon}_{n2t} \\ \boldsymbol{U_{n3t}} &= \boldsymbol{X}_{\boldsymbol{n3t}}\boldsymbol{\beta}_{\boldsymbol{n}} + \gamma_{n3}\boldsymbol{\eta}_{\boldsymbol{n}} + \boldsymbol{\varepsilon}_{n3t} \end{aligned} \quad \textbf{(7)}$$

In this application, a MEL choice model is used to capture the US consumers beef preference. The random parameters includes country of origin (*Canada and Australia*), BSE tested beef (*BSE*), Traceable Beef (*Trace*), jointly BSE tested and traceable (*BSE_TRC*) tenderness assurance (*Tender*), beef produced without antibiotics and growth hormone (*Natural*). Age, education, and income are included to explain the observed heterogeneity in preference of country of origin. In addition, country of origin is interacted with food safety and production attributes. This allows the model to capture potential difference in perceived value of these attributes based on country of origin. [1] The result is presented in table 4.

Estimation Results

The Chi-Squared score suggest the model is significant in explaining consumers' preference. The McFadden R^2 of the model is 0.347, which is relatively high in the context of choice analysis. The

[1] In theory, all attributes examined in this model could be interacted with demographic variables, nevertheless, to do so would detract readers from the objective of our analysis on country of origin. Thus for brevity, only country of origin, which is the focus of this study, is interacted with demographic variables.

estimated parameter γ is statistically significant which justify the use of Mixed Error Component Logit in estimation.

All of the standard deviations of random parameters are statistically significant. These indicate there are substantial unobserved heterogeneity present in preference of country of origin and other tested attributes. The price parameter is negative as predicted by theory, and is statistically significant. All other primary attributes tested are statistically significant with expected signs besides natural beef.

The coefficient on *BSE, Traceable, BSE_TRC,* are positive as expected. These results suggest that these attributes are sought after by consumers. The parameter on natural beef is not significant; however, the significant estimated standard deviation suggests that approximately 50% of the market prefers natural beef.

The random variable, *chooseno*, represents the third alternative which respondents indicate they would rather not to choose from the first two alternatives offered. The significant negative estimated value suggests that utility would be significantly reduced if consumers are not able to purchase steak. The estimated standard deviation of *chooseno* is also significant, which suggest that significant unobserved heterogeneity exist on preference of strip loin beef steak.

Estimates of interaction terms between *country of origin* and *tenderness assurance*, *traceability, BSE tested*, and *natural* are not statistically significant. This means that no significant difference is perceived between domestic and imported steak marketed in the attributes considered in the survey. However, the interaction term between Canadian and jointly traceable and BSE tested beef is positive and marginally significant at 10%, this suggest that a premium might exist for Canadian beef which marketed with traceability and BSE testing.

Several demographic interaction variables are statistically significant in explaining U.S. consumers' choices of beef steaks with different country of origin[2]. When considering beef steak from Canada and Australia versus the U.S., individuals with higher education appear to be more likely to tolerate Canadian and Australian steaks. Conversely, older consumers are less receptive to Canadian and Australian steak compared to U.S. steak. The magnitude of the impacts of these demographic variables to the country of origin attribute, as well as the considered product attributes themselves can be best understood in the context of consumer willingness to pay.

Willingness-to-Pay Estimatations

The WTP values can be interpreted as the amount of compensation or discount necessary to make consumers indifferent between two levels of utility. WTP for an attribute is calculated as the negative of the ratio between the coefficient of an attribute variable and the coefficient of price, the WTP for an attribute is such that:

$$WTP = -\frac{\beta_{attribute} + \beta_{attribute*D}D}{\beta_{price}} \qquad \textbf{(8)}$$

where $\beta_{attribute}$ and β_{price} are estimated coefficients of a given attribute and price respectively. $\beta_{attribute*D}$ is the estimated coefficient of interaction terms between demographic variables and attributes. D is a vector representing the demographic information of individuals.

The relative willingness to pay for Canadian and Australian strip loin steak over U.S. strip loin steak is calculated for consumers with various demographic characteristics. The result is presented in table 5. As the MEL results suggested, age and education are significant factors in the preference of origin. Since level of education is positively correlated with income level, education and income are grouped for brevity. Nine profiles are selected based on three education/income levels and three age levels.

[2] U.S. steak is the base case, thus not included in the estimation

Imported meat products could sell at a discount rather than domestic products commanding a premium, since the majority of beef consumed in the U.S. is of domestic origin (Brester, et al., 2004). The negative willingness to pay suggests that on average, consumers need to be compensated for choosing Canadian or Australian strip loin steak over U.S. strip loin steak. Canadian strip loin steak is preferred over Australian strip loin steak as indicated by the magnitude of the discount. Older consumers, in comparison to younger population, are willing to pay less for imported steak. The magnitudes of the discount also decrease as education and income level of the shopper increases. For example, on average, the discount on the Canadian steak is $3.46 for a 35.3 year old shopper with household income of USD80, 000 college degree holders. The discount increases 54% to $5.35 for a same-aged female shopper with household income of USD30, 000 whose highest education level completed is high school.

The food safety attributes examined in the model are likely to add value to steaks, the estimated willingness to pay for these attributes is presented in table 6. Strip loin steak that is traceable from farm to point of purchase is estimated to have an estimated premium in willingness to pay of $6.13 per pound. Steak derived from animals that were tested for BSE is estimated to increase the willingness to pay by $5.60 per pound. Steak with both attributes of traceability and BSE testing garner an estimated premium of $7.75 per pound. In addition, tenderness assurance is estimated to generate additional $4.30 per pound of willingness to pay on average.

Premiums and discount of this size are unlikely in practice. One reason is that the WTP estimates calculated in this study represent the marginal values of the attributes and these values do not reflect a sustained premium over a long period of time. In addition, various factors such as demand and supply elasticity, market power, trade and other factors determines the equilibrium retail price (Chung et al, 2009).

The WTP estimates for country of origin strongly suggest consumers strongly prefer U.S. steak over Canadian and Australian steak in general. This means that consumers would require reduction in price to choose imported steak, which could limit the chance of imported steak being sold in some retail markets. Further, given the magnitude of the discount, the market share of imported beef are likely to be decrease in the retail level. Supply of imported beef at retail level could be diverted into food processing sector or restaurants where COOL is not required.

Governments of beef exporting countries can adopt suitable policies to increase the competitiveness of their products. Given that the sample average discount for beef labeled as Canadian is on average \$5.55/lb and the premium for BSE testing and traceability is \$7.75/lb, the discount Canadian beef suffered as a consequence of COOL can be mitigated by incorporating BSE testing and traceability.

CONCLUSION

How consumers substitute between domestic and imported beef is an important empirical following the introduction of COOL. Some Canadian, Mexican and other food exporters to the U.S. are concerned with the negative impacts of COOL, and have requested WTO intervention. Consumers' preference of beef steak of domestic and selected foreign origins, along with other quality and food safety attributes was investigated in this research.

We found that consumers' perception of the food safety level of beef is directly associated with country of origin. This supports proponents' argument that mandatory country of origin labeling policies could be valuable for consumers. Origin of beef plays a deciding factor for more than one-third of the sample. Accordingly, 27.5% of the sample would purchase only domestic beef when given the choice; and only 7% of the sample preferred imported beef over domestic beef. Two-thirds of the sample was indifferent between imported beef and domestic beef. COOL would exclude a significant portion of the U.S. beef market from imported beef. Overall, the majority of the U.S. market is receptive to imported beef.

The conjoint analysis suggested that U.S. beef consumers are willing to pay significantly less on average for Canadian and Australian strip loin steak than for similar steak of U.S. origin. Preference for domestic-origin steak is stronger among older consumer segments, but more moderate among consumers with higher education levels.

The discount for foreign-origin beef steak might be alleviated by the final rules of COOL which allowed certain imported products to be labeled as mixed-origin. The willingness-to-pay for mixed-origin steak was not analyzed in this study, but is a worthwhile investigation for future research.

We also find that in general, U.S. consumers put a premium on beef with traceability, BSE-testing attributes, and tenderness guarantee. The results underlined the potential for imported and domestic beef to be marketed with such additional attributes. A more detailed cost and benefit analysis might be conducted to evaluate the feasibility of incorporating these features into Canadian beef destined for the U.S. market.

Reference

Brester, G.W., J. Marsh, and J. Jimmerson. "Distributional Impacts of Country-of-Origin Labeling in the U.S. Meat Industry." Montana State University, Department of Agricultural Economics and Economics.

Brownstone, D., and K. Train. 1998. "Forecasting new product penetration with flexible substitution patterns." *Journal of econometrics* 89(1-2):109-129.

Caswell, J.A., and E.M. Mojduszka. 1996. "Using Informational Labeling to Influence the Market for Quality in Food Products." *American Journal of Agricultural Economics* 78(5):1248-1253.

Chung, C., T. Zhang, and D.S. Peel. 2009. "Effects of Country of Origin Labeling in the U.S. Meat Industry with Imperfectly Competitive Processors." *Agricultural and Resource Economics Review* 38(3).

Darby, M., and E. Karni. 1973. "Free competition and the optimal amount of fraud." *Journal of law and economics* 16(1):67-88.

Gao, Z., and T.C. Schroeder. 2009. "Effects of Label Information on Consumer Willingness-to-Pay for Food Attributes." *American Journal of Agricultural Economics* 91(3):795-809.

Greene, W.H., and D.A. Hensher. 2007. "Heteroscedastic control for random coefficients and error components in mixed logit." *Transportation Research Part E: Logistics and Transportation Review* 43(5):610-623.

Hensher, D.A., J.M. Rose, and W.H. Greene. 2005. *Applied choice analysis: a primer*: Cambridge Univ Pr.

Hu, W., K. Boehle, L.J. Cox, and M. Pan. 2009. "Economic values of dolphin excursions in Hawaii: A stated choice analysis." *Marine Resource Economics* 24(1).

Hu, W., M. Veeman, and W. Adamowicz. 2005. "Labelling genetically modified food: Heterogeneous consumer preferences and the value of information." *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie* 53(1):83-102.

Ikenson, D.J. (2004) Uncool Rules: Second Thoughts on Mandatory country of Origin Labeling, vol. 7, January 16, 2004 Edition, The Cato Institute.

Jones, K.G., A. Somwaru, and J.B. Whitaker. 2009. "Country of Origin Labeling: Evaluating the Impacts on U.S. and World Markets." *Agricultural and Resource Economics Review* 38(3).

Krissoff, B., F. Kuchler, K. Nelson, J. Perry, and A. Somwaru. 2004. "Country-of-origin labeling: theory and observation." *USDA, ERS, WRS–04–02*.

Lancaster, K.J. 1966. "A New Approach to Consumer Theory." *The Journal of Political Economy* 74(2):132-157.

Loureiro, M.L., and W.J. Umberger. 2005. "Assessing Consumer Preferences for Country-of-Origin Labeling." *Journal of Agricultural and Applied Economics* 37(01).

Loureiro, M.L., and W.J. Umberger. 2007. "A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability." *Food Policy* 32(4):496-514.

Loureiro, M.L., and W.J. Umberger. 2003. "Estimating Consumer Willingness to Pay for Country-of-Origin Labeling." *Journal of Agricultural and Resource Economics* 28(02).

Lusk, J., J. Roosen, and J. Fox. 2003. "Demand for beef from cattle administered growth hormones or fed genetically modified corn: A comparison of consumers in France, Germany, the United Kingdom, and the United States." *American Journal of Agricultural Economics* 85(1):16-29.

Lusk, J.L., J. Brown, T. Mark, I. Proseku, R. Thompson, and J. Welsh. 2006. "Consumer Behavior, Public Policy, and Country-of-Origin Labeling." *Applied Economic Perspectives and Policy* 28(2):284-292.

Mørkbak, M.R., T. Christensen, and D. Gyrd-Hansen. 2010. "Consumer preferences for safety characteristics in pork." *British Food Journal* 112(7):775-791.

Mutondo, J.E., and S.R. Henneberry. 2007. "A Source-Differentiated Analysis of U.S. Meat Demand." *Journal of Agricultural and Resource Economics* 32(03).

Scarpa, R., M. Thiene, and F. Marangon. 2008. "Using flexible taste distributions to value collective reputation for environmentally friendly production methods." *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie* 56(2):145-162.

Schupp, A., and J. Gillespie. 2001. "Consumer Attitudes Toward Potential Country-Of-Origin Labeling Of Fresh Or Frozen Beef." *Journal of Food Distribution Research* 32(03).

Thilmany, D.D., W.J. Umberger, and A.R. Ziehl. 2006. "Strategic market planning for value-added natural beef products: A cluster analysis of Colorado consumers." *Renewable Agriculture and Food Systems* 21(03):192-203.

Tonsor, G., T. Schroeder, J. Pennings, and J. Mintert. 2009. "Consumer Valuation of Beef Steak Food Safety and Quality Assurances in Canada, Japan, Mexico, and the United States." *Canadian Journal of Agricultural Economics* 57:395-416.

Train, K. 2003. *Discrete choice methods with simulation*: Cambridge Univ Pr.

Umberger, W.J., D.M. Feuz, C.R. Calkins, and B.M. Sitz. 2003. "Country-Of-Origin Labeling Of Beef Products: U.S. Consumers' Perceptions." *Journal of Food Distribution Research* 34(03).

USDA, F. (2010) Production, Supply and Distribution Online, United States Department of Agriculture Foreign Agriculture Service, www.fas.usda.gov/psdonline/psdQuery.aspx.

Verbeke, W., and J. Roosen. 2009. "Market Differentiation Potential of Country-of-origin, Quality and Traceability Labeling." *Estey Centre Journal of International Law and Trade Policy* 10(1).

Walker, J.L., M. Ben Akiva, and D. Bolduc. 2007. "Identification of parameters in normal error component logit mixture (NECLM) models." *Journal of Applied Econometrics* 22(6):1095-1125.

Wyld, A. (2009) Canada Launches Complaint Over U.S. Meat Labelling Law.

Table 1. Sample Descriptive Statistics		
Variable	**Group**	**Percent**
Age	15-19	0.93%
	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%
	Female	52.46%
Education	<High School	1.11%
	High School	23.08%
	Some College	39.39%
	4 year Degree	24.28%
	Graduate	12.14%
Household Income ($)	<25k	24.10%
	25k-40k	23.54%
	40k-65k	23.82%
	65k-80k	9.55%
	80k-100k	7.32%
	100k-120k	6.12%
	>120k	5.56%
Freq. shopping grocery	Never	1.85%
	Sometimes	14.74%
	Frequently	83.42%
No. of Child Living in HH	0	81.09%
	1	8.80%
	2	6.39%
	3 or more	3.70%

Table 2. Importance of Desirable Factors in Beef Purchase			
Factors	Very Important	Somewhat Important	Unimportant
Freshness	82.76%	15.11%	2.13%
Flavor	73.86%	21.69%	4.45%
Food Borne Disease	73.03%	21.32%	5.65%
BSE	72.85%	20.39%	6.77%
Tenderness	62.93%	32.25%	4.82%
Leanness	62.28%	33.09%	4.63%
Price	59.31%	35.40%	5.28%
Color	58.02%	36.52%	5.47%
Use of Hormones	56.81%	33.36%	9.82%
Use of Antibiotics	55.79%	35.22%	8.99%
Nutritional Info	54.31%	38.00%	7.69%
Juiciness	50.42%	41.71%	7.88%
Traceability Back to Farm	49.49%	39.02%	11.49%
Country of Origin	45.78%	38.46%	15.76%
Labeled Natural	40.04%	39.76%	20.20%
Preparation Ease	38.18%	45.51%	16.31%
Preparation Time	35.31%	44.95%	19.74%
Labeled Organic	30.40%	38.28%	31.33%

Table 3. Level of Concerns on Meat and Livestock

Type of Concerns	Extreme Concern	Major Concern	Some Concern	Minor Concern	Not At All Concerned
Animal diseases	19.56%	24.28%	32.72%	16.13%	7.32%
Genetically modified livestock and dairy cow	18.72%	24.84%	30.49%	16.13%	9.82%
Genetically modified animal feeds	18.26%	22.43%	30.21%	17.42%	11.68%
Conditions in which food animals are raised	17.98%	25.95%	33.36%	16.40%	6.30%
Antibiotics in meat	17.89%	26.60%	29.84%	17.15%	8.53%
The feed given to livestock	14.09%	22.52%	36.14%	18.54%	8.71%
The origin of products/ animals	13.25%	22.52%	36.61%	19.09%	8.53%
BSE and Creutzfeldt Jakob Disease(vCJD)	11.96%	17.98%	34.85%	17.61%	17.61%

Table 4: Mixed Error-Component Logit Estimations Result

	Coefficient	S.E.	t-value	p-value	
Parameter Estimates					
CHOOSENO	-1.7227	0.1048	-16.431	<0.0001	***
Australia	-3.2119	0.4828	-6.653	<0.0001	***
Canada	-2.0639	0.4021	-5.133	<0.0001	***
BSE	1.4068	0.0890	15.808	<0.0001	***
Traceable	1.5415	0.0979	15.739	<0.0001	***
BSE_TRC	1.9494	0.1014	19.228	<0.0001	***
Tender	1.0823	0.0639	16.946	<0.0001	***
Natural	0.0102	0.0709	0.144	0.8855	
Price	-0.2514	0.0039	-64.001	<0.0001	***
Heterogeneity in Mean					
Australia * Age	-0.0148	0.0046	-3.211	0.0013	***
Australia * Education	0.1372	0.0328	4.186	<0.0001	***
Australia * Income	0.0039	0.0022	1.794	0.0728	*
Australia * BSE	-0.0781	0.1152	-0.678	0.4978	
Australia * Traceable	-0.1575	0.1267	-1.243	0.2138	
Australia * BSE_TRC	0.1035	0.1179	0.877	0.3803	
Australia * Tender	-0.0253	0.0858	-0.294	0.7685	
Australia * Natural	0.0920	0.1006	0.915	0.3602	
Canada * Age	-0.0159	0.0038	-4.165	<0.0001	***
Canada * Education	0.1025	0.0265	3.860	0.0001	***
Canada * Income	0.0015	0.0019	0.779	0.4358	
Canada * BSE	0.0486	0.1274	0.381	0.7030	
Canada * Traceable	-0.0932	0.1183	-0.788	0.4309	
Canada * BSE_TRC	0.2127	0.1249	1.703	0.0886	*
Canada * Tender	0.0038	0.0951	0.040	0.9680	
Canada * Natural	0.0620	0.0941	0.659	0.5102	
Standard Deviation of Random Parameter					
CHOOSENO	1.86208088	0.1179913	15.782	<0.0001	***
Australia	1.89323006	0.07449513	25.414	<0.0001	***
Canada	1.4590551	0.06377272	22.879	<0.0001	***
BSE	1.27151687	0.08926521	14.244	<0.0001	***
Traceable	1.35952908	0.09730077	13.972	<0.0001	***
Traceable * BSE	1.78834884	0.09663853	18.506	<0.0001	***
Tender	0.81564208	0.07426312	10.983	<0.0001	***
Natural	0.78775248	0.09152702	8.607	<0.0001	***
Error Component					
γ	2.3555	0.0825	28.546	<0.0001	***
Log-likelihood Score	-10557.12				
McFadden Pseudo R-squared	0.347				
P(Chi-squared)	<0.0001				

Table 5. Willingness to Pay Estimates for Canadian and Australia Strip Loin Steaks over U.S. Strip Loin Steaks

	Canadian Steak ($/lb)	Australian Steak ($/lb)
<u>Higher Income, Higher Education</u>		
Income= $80K, Education = 16yrs		
Age=35.3	-3.46	-4.87
Age=45.0	-4.07	-5.44
Age=56.62	-5.79	-7.66
<u>Sample average Income and Education</u>		
Income= $52.37K, Education = 14.58yrs		
Age=35.3	-4.20	-6.08
Age=45.0	-4.81	-6.65
Age=56.62	-5.55	-7.34
<u>Lower Income, Lower Education</u>		
Income= $30k, Education= 12yrs		
Age=35.3	-5.35	-7.75
Age=45.0	-5.96	-8.32
Age=56.62	-6.70	-9.01

Table 6. Willingness to Pay Estimates for Food Safety and Quality Attributes	
	WTP ($/lb)
Chooseno	-6.85
BSE Tested	5.60
Traceability	6.13
Traceable and BSE Tested	7.75
Tenderness Assurance	4.30
Natural	0.04

Figure 1. U.S. Consumers Preference on Origin of Beef

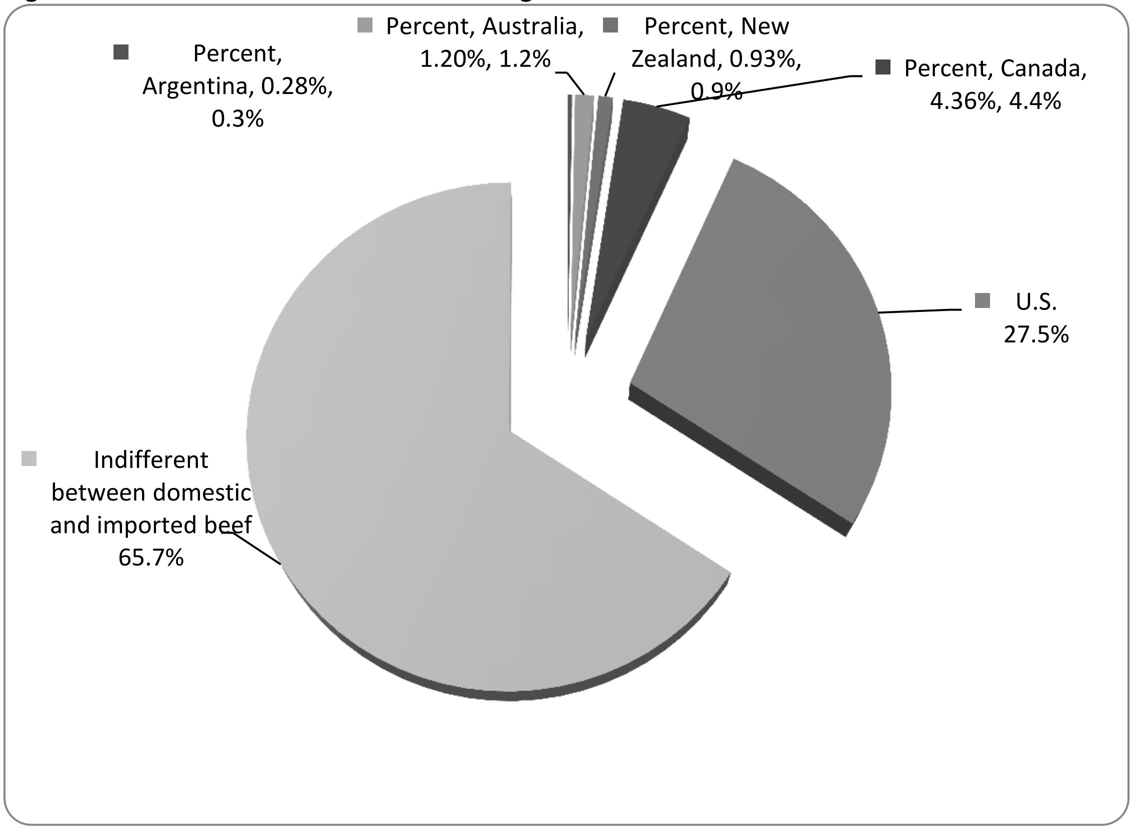

Figure 2. U.S. Consumers Perceived Food Safety Level on Beef by Country

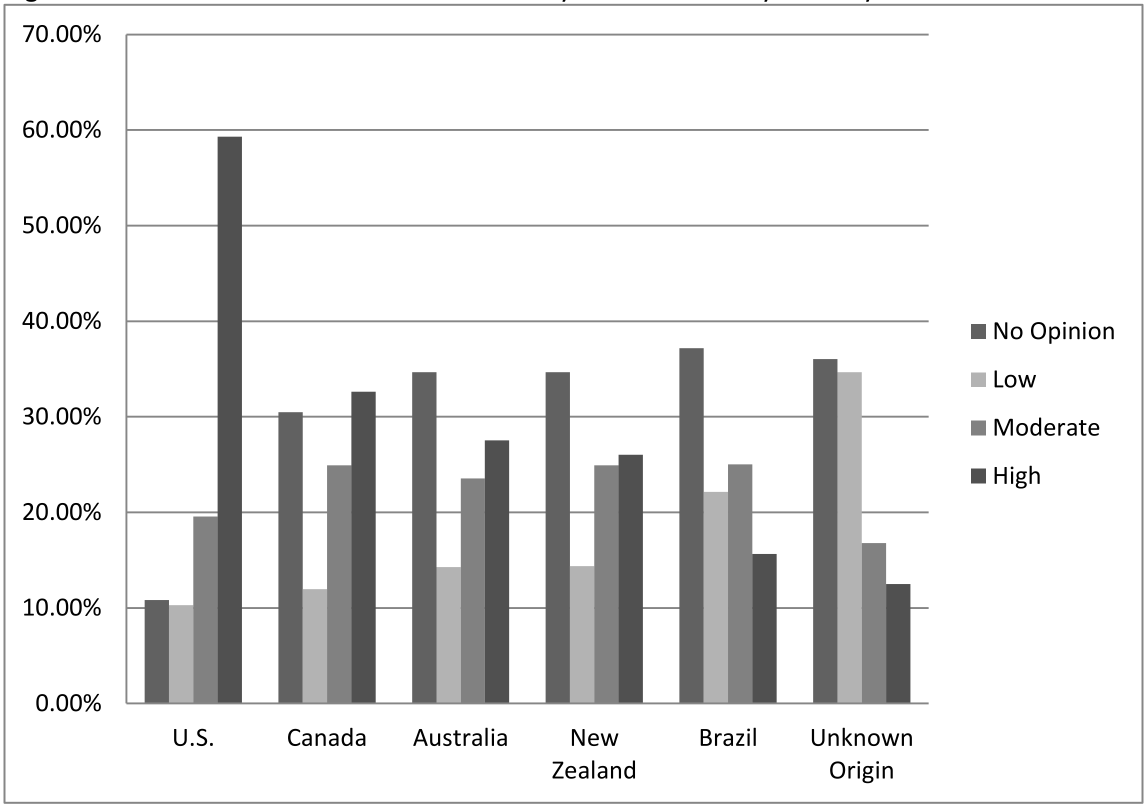

Figure 3. An Example Choice Set

Steak Attribute	A	B	C
Price ($/lb.)	$9.00	$16.00	I would not purchase any of these products
Country of Origin	USA	Canada	
Production Practice	Natural	Natural	
Tenderness	Uncertain	Uncertain	
Food Safety Assurance	Traceable	Animal Tested	
I would choose . . .	○	○	○

Figure 4. Attributes Levels

Attributes	Level 1	Level 2	Level 3	Level 4
Price ($/lb)	5.5	9	12.5	16
Country of Origin	USA	Canada	Australia	
Production Practices	Approved Standards	Natural		
Food Safety Assurance	None	BSE Tested	Traceability	BSE Tested and Traceability
Tenderness	None	Assured Tenderness		