Consumer Response to the Country-of-Origin Labeling Program in the Context of Heterogeneous Preferences

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Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003

(Paper *forthcoming* in the *Journal of Agricultural and Resource Economics*, August 2003).

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Consumer willingness to pay for a mandatory country-of-origin labeling program is assessed. A consumer survey was conducted during 2002 in several grocery stores in Boulder, Denver, and Fort Collins, Colorado. Econometric results indicate that surveyed consumers are willing to pay an average of $184 per household annually for a mandatory country-of-origin labeling program. Respondents were also willing to pay an average of $1.53 and $0.70 per pound more for steak and hamburger labeled as "U.S. Certified Steak" and "U.S. Certified Hamburger," which is equivalent to a 38% and 58%, respectively, over the initial given price.

Key Words: beef, consumer preferences, country-of-origin labeling, dichotomous choice, willingness-to-pay.

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Introduction

The recent food safety scares in Europe and Japan, as well as increasing standards of living in the United States have raised U.S. consumers' interests in information about the safety, origin, and production processes used to produce their food. Food retailers, processors, and producers are exploring various labeling options to provide consumers with information about the safety, origin and process attributes of food products (Caswell). Both producer and consumer groups have considered country-of-origin labeling of beef products sold in the United States to be an alternative that would enable consumers to choose U.S. produced beef (Brester and Smith).

The Tariff Act of 1930 requires labels indicating the country-of-origin on all fresh and frozen beef products imported into the United States. However, under the existing system, the label does not need to accompany the product after it has been repackaged (Becker). Therefore, beef handlers are not required to specify to subsequent buyers whether the beef (fresh or frozen) is a U.S.-produced or an imported product. The implementation of a more stringent, mandatory country-of-origin labeling system for all meat products sold in the United States has been debated for several years by agricultural producers, meat industry organizations, and consumer advocacy groups (USDA-FSIS).

A number of arguments exist for and against country-of-origin labeling of fresh and frozen beef products. According to Becker, arguments in favor include the idea that country-of-origin labeling would give U.S. producers the opportunity to create a competitive niche market, as long as consumers select U.S. beef over imported beef. As in the debate over genetically

modified foods, labeling advocates believe consumers have "the right to know" where their meat products originate. For example, a national survey sponsored by the National Cattleman's Beef Association found that 78% of the 1,000 American consumers polled support country-of-origin labeling (Supermarket News). Finally, proponents of a mandatory labeling policy argue that the costs associated with this labeling policy, as Becker pointed out, are minimal.

On the other hand, arguments against country-of origin labeling include the concern that a label is an unnecessary trade barrier. Some trade officials worry that other countries would retaliate against the United States if country-of-origin labeling were implemented, and that U.S. meat exports could suffer a large reduction. Other opponents of labeling believe that a country-of-origin labeling program would be difficult to implement because many beef products are processed by combining beef originating from various countries. A recent U.S. Congressional study determined that the potential costs associated with implementation of a country-of-origin labeling system would outweigh the potential benefits, because approximately 15% of the beef sold in the United States is imported (USDA-FSIS). Therefore, industry compliance costs could be high with consumers bearing the additional costs of mandatory labeling. Finally, labeling adversaries argue that many U.S. consumers may develop a taste for international, imported beef (as happened with Japanese cars in the 1980's), resulting in a reduction of the U.S. beef market share.

Regardless of the debate surrounding country-of-origin labeling, Title X, Section 10816 of the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) includes a program mandating the U.S. Secretary of Agriculture to provide guidelines for voluntary labeling of meat, fruits and vegetables, fish, and peanuts by September 30, 2002. Furthermore, the 2002 Farm Bill requires this voluntary program to become mandatory by 2004. The bill states, "…for a

commodity to be labeled a USA product, it must be born, raised and processed in the United States (Farm Bill Conference Framework)."

While the new Farm Bill mandates country-of-origin labels on all perishable products, very little research has been conducted to assess the economic impact of country-of-origin labels. Given the currently unanswered questions surrounding country-of-origin labeling for beef and other perishable products, the objectives of this paper are twofold: (1) to determine consumers' preferences for country-of-origin labels on beef products, and (2) to calculate the market premium (if any), for U.S. labeled beef versus non-labeled or imported beef. The testable hypotheses are whether the premiums for the mandatory-country-of-origin program, "U.S. Certified Steak," and "U.S. Certified Hamburger" are statistically different from zero. The premiums may also vary statistically among beef products. Finally, the socio-demographic characteristics of consumers willing to pay a premium for the U.S. labeled steaks may differ from those who are willing to pay a premium for U.S. labeled ground beef or hamburger.

Previous Studies

Previous marketing research has examined the effect of country-of origin labels on consumers' behavior toward non-food products. Erickson, Johansson, and Chao conducted research to determine whether country-of-origin affected consumers' beliefs when evaluating cars. Their results suggest that an image variable does affect belief formation rather than attitude. American consumers' images of foreign products were also studied by Howard to determine how "made in" stereotypes were formed. He concluded that consumers' attitudes in relation to the quality of an automobile manufactured in a specific country produced a "halo effect" for all products originating from that country. A similar "halo effect" was found when

examining the role of country image on consumers' preferences for television sets and automobiles (Han). Another study looked at Southeast Asian consumers to determine their perceptions regarding American and Japanese Imports (Strutton and Pelton). Using discriminate analysis, Strutton and Pelton found that consumers had different perceptions of U.S. and Japanese imports. Thus, in an international context, a factor to consider when evaluating country-of-origin labels is the image of the country itself. For example, consumers often "statistically discriminate" against imports, such as textiles or electronics from developing countries (Chiang and Masson). Location choice may act as a signal for product quality, in the sense that high country specific costs (minimum wages, environmental taxes, lay-off plans, and others) signal high product quality (Haucap, Wey and Barmbold). Country-of origin effects have significant implications for international trade and consumer's perception of quality products.

While the studies discussed above analyze consumers' behavior toward country-of-origin labels, few studies have examined consumers' perceptions associated with country-of-origin labels on agricultural products. Schupp and Gillespie (2001a) sampled beef processors, retailers, and restaurants in Louisiana to identify why beef-handling firms would either support or reject a mandatory country-of-origin labeling policy. They found that supporters of the policy felt that their consumers would find the label valuable, while opponents of the policy thought that mandatory labeling simply meant more government intervention. In another study by Schupp and Gillespie (2001b), Louisiana households were surveyed to find consumers' degree of support for mandatory country-of-origin labeling of beef in grocery stores and restaurants. Over 80% of the respondents supported a compulsory labeling program. While these studies show beef handlers' and consumers' support of mandatory labeling, they do not shed light on whether

consumers would be willing to pay the additional costs associated with the mandatory labeling policy.

In the consumer economics literature, a willingness-to-pay study by Quagrainie, Unterschultz, and Veeman compared a popular beef product from Alberta with a similar product produced elsewhere in Canada. They found that the price of the non-Alberta meat product had to be reduced by 15% so that consumers would be indifferent between the two sources. In another study, Loureiro and McCluskey found that Spanish consumers were willing to pay a premium for fresh meat products labeled with a Protected Geographical Identification (PGI) label, "Galician Veal," which is regulated by the European Union. While consumers were willing to pay a premium for the beef with a "Galician Veal" label, the premium varied depending upon the cut and quality of beef. Using blind taste tests, Umberger et al. found that consumers could taste differences and were willing to pay a significant premium of $0.70 per pound on average for corn-fed beef raised in the United States versus grass-fed beef raised in and imported from Argentina. However, 23% of the consumers preferred and were willing to pay a $1.36 per pound premium for the Argentine, grass-fed beef. While these studies indicate that consumers are willing-to-pay a premium for geographically labeled products, they are likely not representative of local consumers' preferences for country-of-origin labels. This current research will resolve questions regarding consumers' preferences and willingness-to-pay for country-of-origin labeling of beef.

Theoretical Background

The consumer's decision process is modeled using a random utility approach. Consumer utility, $U(y, x, m)$, is assumed to have three arguments: whether the beef product has a label

denoting country-of-origin, *y*, other product attributes as well as consumer characteristics that may affect consumer choice, *x*, and the income level, *m*. The variable *y* is an indicator variable, which equals one if the product carries a label, and zero otherwise. The consumer is willing to pay *c* dollars to switch to a labeled product, which will make utility at least as great as it would be without a label. Mathematically, *c* is represented as

(1) $$U(0, x_0, m) \leq U(1, x_1, m - c),$$

where the 0 and 1 subscripts denote the choice of non-labeled and country-of-origin labeled products, respectively. The consumer's utility function is unknown since some components are unobservable and thus, can be considered random variables from the researcher's standpoint. Therefore, utility is decomposed into an unobservable part and an error term, ε_j. Mathematically, $U(y, x_j, m) = V(y, x_j, m) + \varepsilon_j$. The random error term ε_j is assumed to be independently and identically distributed with a mean of zero. The consumer's decision to pay *c* dollars in terms of utility can be represented as:

(2) $$V(0, x_0, m) + \varepsilon_0 \leq V(1, x_1, m - c) + \varepsilon_1,$$

which can be expressed in a probability framework as:

(3) $$P(WTP \geq c) = P(V_0 + \varepsilon_0 \leq V_1 + \varepsilon_1) = P(\varepsilon_0 - \varepsilon_1 \leq V_1 - V_0).$$

This theoretical model sets the groundwork for the specific empirical models that follow. In the current study, a binary choice model approach is chosen to analyze the decision of paying for a

mandatory country-of-origin labeling for all beef products, and for two individual beef products that are labeled as "U.S. certified."

Methods

In assessing consumers' willingness to pay (WTP) for a mandatory labeling program, and for "U.S. Certified Steak," and "U.S. Certified Hamburger," survey respondents provided "Yes"/ "No" answers to the valuation questions at hand. To analyze these dichotomous choices, we used separate logit models based on the following logistic probability function:

$$(4) \qquad P_i = F(WTP_i) = \frac{1}{1+e^{-WTP_i}} = \frac{1}{1+e^{-(\mathbf{X}_i'\boldsymbol{\beta})}}, \qquad i = 1,...,n,$$

where P_i is the probability that the i^{th} consumer will make a certain choice (answer = "Yes"), given the observed level of socio-demographic characteristics, food safety attitudes, and information conditions contained in $\mathbf{X}_i$, and $\boldsymbol{\beta}$ is a conformable vector of parameters. Therefore, if (1) represents the probability that a consumer will answer "Yes" to the question regarding whether he or she will be paying a premium for mandatory country-of-origin labeling, then $1\text{-}P_i$ will be the probability associated with answering "No."

Thus,

$$(5) \qquad 1 - P_i = \frac{1}{1+e^{WTP_i}}$$

To estimate the odds ratio in favor of answering "Yes" versus "No," the ratio of both probabilities must be calculated.

(6) $$\frac{P_i}{1-P_i} = \frac{1+e^{WTP_i}}{1+e^{-WTP_i}} = e^{WTP_i} = e^{\mathbf{X}_i'\beta}$$

By taking the natural log of (6), the odds ratio in favor of those respondents answering "Yes" becomes a linear function of $\mathbf{X}_i$, where $\mathbf{X}_i$ is a vector of subjective consumer preferences when buying beef, and socio-demographic characteristics. This can be shown as:

(7) $$Log\left(\frac{P_i}{1-P_i}\right) = WTP_i = \mathbf{X_i'\beta},$$

The parameter vector $\boldsymbol{\beta}$ cannot be interpreted as the direct effects on the probability of supporting mandatory labeling; rather, they measure the change in the odds ratio for a change in a unit of an explanatory variable. In order to estimate the effects on the probabilities directly, the marginal effects must be estimated (Maddala).

The underlying statistical model is based on a latent and continuous unobservable (WTP_i^*) variable, which in the context of the labeling analysis could be interpreted as consumers' concerns about source verification. The observable variable, which is modeled by the researcher, is the response to the dichotomous choice. Thus, the latent model is represented by:

(8) $$WTP_i = I_{(0,\infty)}(WTP_i^*),$$

where $I_{(0,\infty)}$ is an indicator variable that restricts the observable WTP to the positive domain, and $WTP_i^* = \mathbf{X}_i'\boldsymbol{\beta} + \varepsilon_i$.

Therefore,

(9) $$WTP_i = \begin{Bmatrix} 1 \\ 0 \end{Bmatrix} \quad \text{iff} \quad \text{WTP}_\text{i}^* = \mathbf{X_i'\beta} + \varepsilon_i \begin{Bmatrix} > \\ \leq \end{Bmatrix} 0.$$

The ε_i are *iid* unobservable random variables, following a logistic distribution with mean 0 and variance of $\pi^2/3$. A "Yes" response is observed if and only if the latent variable is greater than zero. Conversely, a "No" response is observed when the latent variable (consumers' concerns) is less than or equal to zero.

Data

A consumer survey was pre-tested with focus groups in early March 2002 and conducted in late Spring 2002 in grocery stores located in Denver, Fort Collins, and Boulder, Colorado**.** Customers entering the grocery stores were randomly selected; soliciting every third customer entering the store. In order to collect a representative sample, including multiple segments of the shopping population, the survey was conducted in different supermarket chains and during both weekends and weekdays. Consumers were interviewed in eight different stores in the three mentioned towns. In order to increase consumer participation, interviewers were instructed to wear Colorado State University T-shirts.

As in Lusk et al. survey data were collected in grocery stores. Therefore, data were obtained directly from the actual decision-makers. In total, 243 consumers were surveyed. Sixty-five percent of the individuals who were approached and asked by the interviewers to fill-out a survey were willing to complete it. The majority of respondents were the primary food shoppers of the household (89%), Caucasian (89%), and female (65%). The respondents' average age was about 40 years, and 40% of all respondents had children under the age of 18 years old living in their household. The mean income of the sample was calculated to be between $50,000 to $60,000 per household for 2001, and average education was a junior college degree. Summary statistics and variable descriptions are presented in Table 1. The survey sample is comparable to

the Colorado population (U.S. Census Bureau) in terms of education, number of children per household, and household size. However, this sample includes fewer minorities and a higher percentage of female respondents. The high proportion of females is desirable because they are the primary food shoppers in most households.

As with all surveys, the ability of the sample to represent the population is a concern, and the effect of sample choice on the results concerning willingness-to-pay for country-of-origin labels is impossible to measure. There may also be some degree of sample selection bias, implying that people who were more concerned with food safety and source assurance labels, or more willing to support University research projects, elected to participate in the survey.

The survey solicited information regarding respondents' purchasing behavior and attitudes about beef products, beef qualities that consumers find most desirable, food safety attitudes, whether or not respondents would be willing to pay a certain amount a year in taxes to support a mandatory country-of-origin labeling program, and whether they would pay a given premium for steak and hamburger labeled as "Certified U.S. beef." Also, socio-demographic characteristics were elicited in the last part of the survey.

Regarding beef attributes important to consumers, Table 2 shows that freshness, food safety inspection, and a high quality grade are the three attributes ranked the highest on a Likert scale. The importance of beef being raised locally ranks as one of the least important attributes. Additionally, in the sample (See Table 3), 23% of the consumers indicate that price is the main driving force of their shopping decisions, while for 41% of the consumers, the driving force of shopping decisions is quality, and for the rest of the sample (25%) health and food safety issues are the primary driving forces. Thus, overall our sample has a majority of consumers who are quality and food safety seekers.

Following the NOAA 1993 panel recommendations (Arrow et al., 1993), a dichotomous question (DC) was used to elicit the WTP for the mandatory country-of-origin labeling program, as well as the individual premiums for steaks and hamburgers labeled as "Certified U.S. Beef." Yet, we acknowledge that controversy exists surrounding the accuracy of different elicitation or referendum formats. In particular, recent literature explores whether the dichotomous choice suffers from anchoring and yea-saying. Anchoring, or starting point bias, may occur when respondents "anchor" their stated WTP value to the bid if it represents a reasonable value. Nevertheless, following Frykblom and Shogren's conclusions that problems with the dichotomous choice might be due to how the survey is framed, and not to the dichotomous choice itself, we implement a DC voting question that was supposed to elicit true preferences. In particular, consumers were asked the following valuation questions:

"Suppose that you could vote in a referendum regarding "country-of-origin" labeling. If implementation of this mandatory country-of-origin labeling program for beef would cost your household $[bid]/year. What would your position be with respect to this mandatory labeling program?

a. *In favor of a mandatory program*
b. *Against a mandatory labeling program.*

In this question the random bids assigned to consumers ranged from $10/year up to $250/year. The next questions elicited consumer WTP for steak and hamburger labeled as "Certified U.S. Beef." The interviewer read: *Now, assume that the costs of traceability required to label a steak as "Certified U. S. Beef" is $[bid]/lb of steak in addition to the traditional $4.00/lb price, would you be willing to pay this premium to guarantee that your beef is "Certified U.S. Beef"?*

a. *Yes*

b. No

A similar question was presented to the customer to elicit WTP for a "Certified U.S. Beef" hamburger; however, the regular price was set at $1.20/lb of hamburger. In both cases, the bid amounts were percent values in increments of 5% over the initial value of the product, adding up to a maximum premium of 75%. The mean initial prices for both steak and hamburger correspond with the retail mean prices of different qualities of steak and hamburger sold in several supermarkets in the area at the time the survey was conducted.

Empirical Specification

In order to simplify the comparison of the results among models, a set of common explanatory variables was used to explain the three independent decisions. The following logit model was estimated to model the consumers' desire for mandatory country-of-origin labeling of beef products, as well as their willingness to pay a premium for "Certified U.S. Steak," and "Certified U.S. Hamburger":

(10)

$$WTP_i^* = \alpha_0 + \beta_1 Bid_i + \beta_2 BeefShopper_i + \beta_3 Female_i + \beta_4 Income_i + \beta_5 Education_i + \beta_6 Kids_i + \beta_7 FoodSafety_i + \varepsilon_i,$$

where Bid_i represents the random amount the consumer was asked to pay; $BeefShopper_i$ is a cross product variable indicating whether the respondent is the main shopper of the household and the number of times per week beef is consumed at home; $Female_i$ is an indicator variable denoting whether the respondent is a female; $Income_i$ indicates the respondent's household level of income; $Education_i$ denotes the level of education; $Kids_i$ indicates whether there are children under eighteen years of age living in the household, and $FoodSafety_i$ represents the respondent's subjective importance of food safety and quality assurance when buying beef with respect to the

price paid[1]. Finally, ε_i is the error term that follows a logistic distribution. Notice that all variables enter the model in their linear form, since non-linear transformations were not statistically significant in any of the logit models.

Econometric Results

Before estimating the three logit models, preliminary tests of specifications were conducted on each logit equation.[2] In order to select between a logit or a probit functional form, both nonlinear regressions were run with the same index functions. As indicated by Davidson and MacKinnon (p. 522), a likelihood-ratio test with one degree of freedom was conducted. In the three cases, the likelihood ratio tests did not provide enough statistical evidence to select one model over the other. Therefore, the logit functional form was selected because of the simple interpretation of the odds-ratio.

Furthermore, following Davidson and MacKinnon (pp. 526-527) several tests for multiplicative heteroskedasticity were conducted. It was assumed that the heteroskedasticity was a function of a set of variables **w**, which were chosen from the explanatory variables included in the logit model. The intuition of this test is that if the homoskedastic specification is correct, then any additional regressor w_i has no explanatory power. Each of the individual t-tests associated with the new estimates were examined, as well as the likelihood ratio test between the homoskedastic and heteroskedastic logits. In particular, assuming $Var[\varepsilon_i] = \lfloor \exp(\boldsymbol{\gamma}'(\mathbf{w}_i)^2) \rfloor$, where $\mathbf{w_i} = (income_i, education_i, foodsafety_i)$, the $\boldsymbol{\gamma}$ vector was not statistically different from zero in any of the three estimated logit models. The likelihood ratio statistic for testing the homoskedasticity assumption in the context of the first logit (that models annual WTP for the mandatory labeling program) was $\chi^2 = 3.25$, while the 95% critical $\chi^2_{(3)}$ value is 7.82. The

likelihood ratio statistics for the second and third logits (that model WTP for the "U.S. Certified Steak" and WTP for "U.S. Certified Hamburger," respectively) were 8.34[3] and 6.84. Consequently, no evidence was found to confirm the presence of this form of multiplicative heteroskedasticity. Since the exact form of heteroskedasticity is seldom known, other potential forms of heteroskedasticity were also tested, and no statistical evidence supported the presence of heteroskedastic variances.

An additional concern was that some of the explanatory variables included in the model were endogenous. In particular, the variable *FoodSafety,* may be subject to the same influences as the response variable. In order to test whether *FoodSafety* is an endogenous variable, the Rivers and Vuong (1988) two-step endogeneity test was conducted in the each of the three logit models. (See details in Wooldridge (pp.472-478)). In order to implement this test, the reduced form residuals were obtained by regressing *FoodSafety* on all explanatory variables; as well as some proxies or instrumental variables that capture the effect of the variable *FoodSafety*. The instrumental variables used to represent the variable *FoodSafety* were a subset of attitudinal variables, in particular, the importance of food safety certification, and the importance of nutritional value (both Likert-scale variables from 1 to 5). When the residuals obtained from the OLS regression were added as an explanatory variable in the original logit model, the t-test on the residuals was 0.93 for the first logit, 0.24 for the second logit, and 0.68 for the third logit. Therefore, results from this test indicated that the variable *FoodSafety* passed the Rivers and Vuong (1988) two-step endogeneity test for the three logits, and *FoodSafety* could be considered as an exogenous explanatory variable.

The coefficients and the marginal effects for the willingness-to-pay equations used to model the consumer's desire to pay (a) for a mandatory country-of-origin labeling program; (b) a

premium for "Certified U.S. Steak;" and (c) a premium for "Certified U.S. Hamburger" are presented in Tables 4 and 5. Marginal effects were calculated by evaluating and estimating the changes in the probabilities of paying a premium when an indicator or Likert-scale variable passes from one integer to the next, holding the rest of the variables at their mean levels. For the Likert-scale variables, there exist different ways of reporting the results. Given that all marginal effects obtained from a given Likert-scale variable were monotonic, increasing or decreasing at an almost constant rate, the mean of the marginal effects was calculated by adding up each of the individual marginal effects from passing from one integer value to the next (holding the rest of the variables at their mean levels), and dividing by the total number of integers of each of the Likert-scale variables. Asymptotic variance-covariance or standard deviations have been calculated employing the delta method (See Greene, p.124).

Overall, the models fit reasonably well, and all three provide percentages of correct predictions above 60%. Additionally, the corresponding likelihood ratio tests indicate the overall significance of the coefficients in the three models. All coefficients and marginal effects carry the expected sign, except *Income* in all three equations, and *Education* in the hamburger equation. We expected that consumers with higher education and income would be more willing to support a mandatory country-of-origin labeling program, and would be more likely to pay a premium for "Certified U.S" meat products. Negative marginal effects of income may suggest that wealthier consumers already consider their meat supply safe, and do not place much value on labeling of origin**.** In particular, the reduction on the average probability of a consumer paying a premium for each increment on the income level for the "U.S. Certified Hamburger" equation is about 0.019. The variable *Education* has only a positive and statistically significant marginal effect for the "Certified U.S. Steak" equation. Thus, an increment of one level of

education increases on average the probability of paying a premium for "U.S. Certified Steak" by 0.047. Thompson reported similar results in a review of studies about organic products, in which the education variable had a negative effect.

As expected, the bid or randomly assigned amount (price for the program or the particular good) carries a negative and statistically significant marginal effect. As demand theory predicts, the higher the premium or amount requested to pay, the lower the probability that a consumer would be willing to pay such a premium. Thus, if the bid amount goes up by one dollar, the probability of the respondent paying for the "U.S. Mandatory Labeling" program decreases by 0.001. Similar reductions in participants' WTP occur when the premiums for the "U.S Certified" steak and hamburger are increased. For the "U.S. Certified Steak," if the bid amount increases by $0.01/lb, the probability of paying the premium decreases by 0.094, while the probability of paying $0.01/lb extra for "U.S. Certified Hamburger" decreases by 0.161. Thus, the impact of increasing the premium on participants' WTP is largest for "U.S. certified Hamburger," which was the lowest priced item.

The effects of the socio-demographic variables are as expected. The fact that the respondent is the main shopper of the household who additionally eats beef at home during a given week increases in a statistically significant way the probability that he/she will be willing to pay a premium for the "U.S. Mandatory Labeling Program" and for the "U.S. Certified Steak," by about 0.022 and 0.032, respectively. Moreover, if the respondent is a female, the probability of paying a premium for the mandatory country-of-origin labeling program, as for the individual labeled products increases by 0.212, 0.125 and 0.186, respectively; and is statistically significant for the three equations. The presence of children in the household carries a negative and statistically significant marginal effect when modeling the WTP equation for "U.S. Mandatory

Country of Origin Labeling." In particular, the probability of paying a premium for "U.S. Mandatory Country of Origin Labeling" decreases by 0.042.

With regard to the variables denoting the importance of food safety and quality assurance with respect to the price paid $(FoodSafety)$, consumers who are concerned about food safety are more likely to pay for a general mandatory labeling program and for the "U.S. Certified Steak." Thus, *FoodSafety* carries a positive statistically significant marginal effect for the "U.S. Mandatory Country of Origin Labeling Program," and for the "U.S. Certified Steak." As reported in Table 5, the average probability of paying a premium for both increases by 0.026, and by 0.031 when the variable *FoodSafety* increases from one integer to the next (in the range from 1 to 10).

Willingness-to-Pay Estimates

Willingness-to-pay estimates (Hanemann) for the mandatory country-of-origin labeling program, as well as for the two individual "U.S. Certified" meat products were obtained from:

$$(11)\quad E(WTP) = \frac{1}{\hat{\beta}_1}\ln\left(\frac{1+e^{\hat{\alpha}}}{1+e^{\hat{\alpha}-\hat{\beta}_1 Bid_{MAX}}}\right).$$

In this expression $\hat{\alpha}$ denotes the grand constant, which is the sum of all the products of the estimated coefficients (except the one corresponding to the bid amount) times the mean values of their corresponding explanatory variables. Bid_{MAX} is the highest bid amount, and $\hat{\beta}_1$ is the coefficient associated with the bid amount. Results from the logit model were used to generate the confidence intervals of the welfare estimates calculated in (11) by a bootstrapping technique (Park, Loomis and Creel). This technique employs the estimates of the parameter

vector, denoted by $\hat{\boldsymbol{\beta}}$, and the estimated variance-covariance matrix, denoted by $\hat{\boldsymbol{\Sigma}}_{\beta}$. Multiple random draws to create a new parameter vector $\hat{\hat{\boldsymbol{\beta}}}$ are made from a multivariate normal distribution with variance covariance $\hat{\boldsymbol{\Sigma}}_{\beta}$ and mean $\hat{\boldsymbol{\beta}}$. For each of these draws the WTP is calculated using equation (11). Mean WTP values and their respective confidence intervals are presented in Table 6. Confidence intervals are constructed based on 4,000 draws.

In the three cases, the mean WTP estimates are statistically different from zero; implying consumers in this sample are very receptive toward country-of-origin labeling. The mean WTP estimate for the mandatory country-of-origin labeling program has been calculated as $183.77/ year. Although this estimate is fairly large, it reflects the fact that many respondents were willing to pay for the program even when bids were as high as $200 and $250/year.[4] The premium for "U.S. Certified Steak" was calculated as $1.53/lb over the original base price of $4.00/lb, while the premium for hamburger certified as "U.S. Certified Hamburger" was estimated as $0.70/lb over the $1.20/lb regular price. In percentage terms, the premium for "U.S Certified Steak" is about 38.3% of the initial value, while for "U.S. Certified Hamburger" it is about 58.3%. The higher percentage premium for "U.S. Certified Hamburger" may occur because the initial price of hamburger is set lower than that of steak.

Conclusions

In this paper consumer response and consumer willingness to pay for a mandatory country-of-origin labeling program were studied, as well as for steak and hamburger labeled as "U.S. Certified Beef." A consumer survey was conducted in several grocery stores and in different locations in Colorado in 2002. Socio-demographic differences between the consumers

that are willing to pay a premium for "U.S. Certified Steak" versus those that are willing to pay for "U.S. Certified Hamburger" are readily observable. Results indicate respondents in this study were very concerned about source verification and labeling issues, and as a consequence, they are willing to pay a high premium for the mandatory country-of-origin labeling program. Respondents were also willing to pay an average of 38 to 58% more for individual products labeled as "U.S. Certified Steak" and "U.S. Certified Hamburger."

Logit results suggest females, who are the primary shoppers in their household, and those who are concerned about food quality and food safety issues, are more likely to support mandatory country-of-origin labeling. Respondents who are also the main shoppers and additionally eat beef in their household are also more likely to pay for this mandatory labeling program. Additionally, wealthier consumers are less likely to pay for mandatory country-of-origin labeling for hamburger.

Ongoing research focuses on comparing consumer perceptions toward different country-of-origin labels in the context of heterogeneous preferences. It will be interesting to find out whether the current findings hold in a more diverse and larger population (a U.S. sample), and at a different point in time. Additional results will be presented at the AAEA meetings.

Endnotes

[1] Trade-off questions were used to elicit consumer preferences about food safety and quality assurance with respect to price. These types of questions allow researchers to obtain a better approximation of the latent consumer preferences, because without the trade-off most consumers tend to indicate that food safety is very important to them. The question used in the survey that corresponds with this variable is:

"When you are purchasing beef and other beef products, what is the importance of food safety and quality assurance versus price on a scale from 1 to 10, where 1 means price is most important, and 10 means food safety and quality assurance is most important?"

1 2 3 4 5 6 7 8 9 10

[2] The possibility that the error terms were correlated across the individual WTP equations was investigated (in particular those from the WTP for individual labeled beef products). In order to test this conjecture, a bivarite probit for the WTP questions related to the labeling of the particular products was estimated, but unfortunately convergence of the algorithm was not achieved. Although different sets of starting values were used, such as those from ordinary least squares and also individual probit estimates, the optimization procedure failed to converge because the correlation coefficient was outside of the range of –1 and 1. Given that the bivariate specification did not converge, the trivariate specification was not estimated. Therefore, the estimation of the different WTP regressions was done individually (choosing a logit versus a probit model). In any case, and independent of whether or not the error terms are correlated, the estimates are still consistent.

[3] Although the likelihood ratio test slightly overpasses the critical value, the individual t-tests associated with the heteroskedastic parameters are not statistically significant at any conventional level.

[4] Another approach to representing the mean WTP for the mandatory labeling program is to translate the cost of a mandatory labeling program to a weekly basis of $3.53/week ($183.77/year divided by 52 weeks). The $3.53/week cost would imply that a consumer would need to purchase 2.3 pounds of steak or 5 pounds of hamburger and be willing to pay a $1.53/lb premium for their steak purchases or a $.70/lb premium for their hamburger purchases to achieve the annual payment of $183.77.

References

Arrow, K., J. Solow, P. Portney, E. Leamer, R. Radner, and E.H. Schuman. *Report of the NOAA Panel on Contingent Valuation*. Federal Register, 58(10)(1993):4601-14.

Becker, G. S. "Country-of-Origin Labeling for Foods: Current Law and Proposed Changes." The Committee for the National Institute for the Environment, 1725 K. Street, NW, Suite 212, Washington DC, October 21, 1999.

Brester, G.W. and V. H. Smith "Here is the Beef." *Choices*, Second Quarter, 2000:28-32.

Caswell, J.A. "How Labeling of Safety and Process Attributes Affects Markets for Food." *Agricultural and Resource Economics Review*. 27(October 1998): 151-158.

Chiang, S. and R.T. Masson. "Domestic Industrial Structure and Export Quality." *International Economic Review.* 29(1988): 261-269.

Davidson, R. and J. MacKinnon. "Estimation and Inference in Econometrics." New York, Oxford. Oxford University Press, 1993.

Farm Bill Conference Framework. "Farm Bill Conference Summary." April 30, 2002. http://www.senate.gov/~agriculture/Briefs/2001FarmBill/conframe.htm.

Frykblom, P. and J. F. Shogren. " An Experimental Testing of Anchoring Effects in Discrete Choice Questions." *Environmental and Resource Economics.* 16(3)(July 2000):329-41.

Greene, W.H. Econometric Analysis. (Third Edition). Prentice-Hall International, Inc.(1997).

Han, C.M. "Country Image: Halo or Summary Construct?" *Journal of Marketing Research*. 26 (1989):222-229.

Hanemann, W.M. "Welfare Evaluations in Contingent Valuation Experiments with Discrete Response Data: Reply." *American Journal of Agricultural and Resource Economics*. 71(1989): 1057-1061.

Haucap, J., C. Wey, and J.F. Barmbold. "Location Choice as a Signal for Product Quality: The Economics of Made in Germany." *Journal of Institutional and Theoretical Economics.* 153(1997): 510-531.

Howard, D.G. "Understanding How American Consumers Formulate Their Attitudes About Foreign Products." *Journal of International Consumer Marketing.* 2(1989):7-24.

Loureiro, M.L. and J.J. McCluskey. "Assessing Consumer's Response to Protected Geographical Identification Labeling," *Agribusiness: An International Journal.* 16(3) (2000): 309-320.

Lusk, J.L. J.A. Fox, T.C. Schroeder, J. Mintert, M. Koohmariaie. "In-Store Valuation of Steak Tenderness." *American Journal of Agricultural Economics.* 83(August 2001): 539-550.

Lusk, J. "Branded Beef. Is it "What's for Dinner?" *Choices*, Second Quarter, 2001:27-30.

Maddala, G.S. *Limited-Dependent and Quantitative Variables in Econometrics.* Econometric Society Monographs, 3. Cambridge University Press. 1997.

Park, T., J. B. Loomis, and M. Creel. "Confidence Intervals for Evaluating Benefits Estimates from Dichotomous Choice Contingent Valuation Studies." *Land Economics.* 67 (1991):64-73.

Quagrainie, K., J. Unterschultz and M. Veeman. "Effects of Product Origin and Selected Demographics on Consumer Choice of Read Meats," *Canadian Journal of Agricultural Economics.* 46 (1998): 201-219.

Rivers, D. and Q. H. Vuong. "Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models." *Journal of Econometrics*, 39(1988):347-366.

Schupp, A. and J. Gillespie. "Handler Reactions to Potential Compulsory Country-of-Origin Labeling of Fresh or Frozen Beef." *Journal of Agricultural and Applied Economics.* 33(April 2001): 161-171.

Schupp, A. and J. Gillespie. "Consumer Attitudes Toward Potential Country-of-Origin Labeling of Fresh or Frozen Beef." *Journal of Food Distribution Research.* 33(November 2001): 34-44.

Strutton, D. and L.E. Pelton. "Southeast Asian Consumer Perceptions of American and Japanese Imports: The Influence of Country-of-Origin Effects," *Journal of International Consumer Marketing.* 6(1993): 67-86.

Supermarket News. "National Cattleman's Beef Association sponsors survey that indicates that most Americans approve of country-of-origin labeling on beef products," in *Supermarket News,* 1999 49(8) (February 22):37.

Thompson, G. "Consumer Demand for Organic Foods: What We Know and What We Need to Know," *American Journal of Agricultural Economics.* 80(5) (December 1998):1113-1118.

Umberger, W.J., D.M. Feuz, C.R. Calkins, and K. Killinger. "U.S. Consumer Preference and Willingness-to-Pay for Domestic Corn-fed versus International Grass-Fed Beef Measured through and Experimental Auction." *Agribusiness: An International Journal*. 18(Autumn 2002).

U.S. Census Bureau. "United States Census, 2000." http://www.census.gov. Retrieved July 2002.

USDA-FSIS, USDA Food Safety and Inspection Service, United States Department of Agriculture. Communications to Congress. "Mandatory Country of Origin Labeling of

Imported Fresh Muscle Cuts of Beef and Lamb." January 2000. pp.1-39. http://www.fsis.usda.gov/oa/congress/cool.htm. Retrieved July 2002.

Wall, M., J. Liefeld, L.A. Heslop. "Impact of Country-of-Origin Cues on Consumer Judgments in Multi-Cue Situations: a Covariance Analysis." *Journal of Academy of Marketing Science.* 19(1991): 105-113.

Wooldridge, J. Econometric Analysis of Cross Section and Panel Data. The MIT Press. Cambridge, Massachusetts, London, England (2002).

Table 1. Summary Statistics for the Demographic Variables

Variable Name	Description (Coding)	Mean	Standard Deviation.
Age	1 = 18 to 21 2 = 22 to 24 3 = 25 to 29 4 = 30 to 34 5 = 35 to 39 6 = 40 to 44 7 = 45 to 49 8 = 50 to 54 9 = 55 to 59 10 = 60+ years	5.98	2.78
Gender	1 if female, 0 if male	0.65	0.53
BeefShopper	Cross product of the indicator variable that presents whether the respondent is a main shopper, and how many times he/she eats beef per week	2.49	2.72
Education	1 = Elementary, 2 = Some High School, 3 = HS Diploma, 4 = Some College, 5 = Junior College, 6 = B.A. or B.S., 7 = Graduate School	5.48	1.52
Children	1 if children <18 living in the household, 0 otherwise	0.40	0.50
Family Size	Number of family members living in the household	2.11	1.13
Income	2001 annual household income: 1 = <$20,000 2 = $20,000-$29,999 3 = $30, 000-$39,999 4 = $40, 000-$49,999 5 = $50, 000- $59,999 6 = $60, 000- $69,999 7 = >=70,000	5.54	3.05
Race	1 if Caucasian, 0 otherwise	0.89	0.32

Table 2. Summary Statistics for Consumer Information and Perception Variables (All variables -except the last one- are measured on a Likert Scale where 1=not at all desirable; 5=extremely desirable)

Attribute	Description	Mean	Std. Dev.
Local	Importance of the beef being raised locally	2.35	1.296
Source Assurance	Importance of knowing who produced your beef	3.84	1.30
Brand	Importance of carrying a premium brand	3.54	1.26
Fresh	Importance of freshness	4.74	0.67
Lean	Importance of beef being lean	4.27	0.95
High Quality	Importance of beef products carrying a high quality grade	4.40	0.87
Tenderness Assurance	Importance of knowing that the meat is tender	3.99	1.11
Nutritional Value	Importance of carrying a label about the nutritional value of the beef product	1.93	1.07
Food Safety	Importance of beef being food safety inspected	4.61	0.84
Organic	Importance of the use of organic practices when raising beef	3.44	1.34
Visual Presentation	Importance of good visual presentation of beef	4.12	1.00
Trade-off for food safety vs. price variable	Price is most important=1 Food safety is most important=10	7.09	2.85

Table 3. Consumer Profile: Driving Forces of Shopping Decisions and Knowledge about the Origin of Beef

Characteristic	Description	Percentages(*)
Price[a]	Consumers who consider price as the primary driving force of their shopping decisions	22.6
Quality	Consumers who consider quality as the primary driving force of their shopping decisions	41.2
Health	Consumers who consider food safety and health related issues to be the driving force of their shopping decisions	25.1

(*)Percentages do not add up to 100% because only the most relevant driving forces of respondents' shopping decisions are presented.
[a] All three characteristics were measured with binary variables

Table 4. Logit Estimates, WTP equations for (a) a mandatory labeling program for beef; (b) "U.S. Certified Steak;" and (c) "U.S. Certified Hamburger".

	Mandatory Labeling Program		"U.S. Certified Steak"		"U.S. Certified Hamburger"	
	a)Coefficients	a)T-values	b)Coefficients	b)T-values	c)Coefficients	c)T-values
Constant	-0.222	-0.239	-1.754***	-2.112	0.700	0.412
Bid	-0.007***	-2.837	-0.383**	-1.884	-0.765*	-1.841
BeefShopper	0.146*	1.811	0.143**	2.009	0.130*	1.709
Female	1.052**	2.960	0.503*	1.671	0.838**	2.572
Income	-0.052	-0.803	-0.094*	-1.677	-0.105*	1.709
Education	0.108	0.931	0.228**	2.193	-0.040	-0.369
Kids	-0.229	-1.195	0.136**	0.777	0.266	1.341
Food Safety	0.143**	2.305	0.144**	2.471	0.040	0.495
Log. Likelihood	-100.74		-121.64		-111.84	
Restricted. Log. Likelihood	-116.24		-133.97		-122.30	
Likelihood. Ratio Test						
$\chi^2_{(7)}$	31.00		24.66		20.91	
% of Correct Predictions	75.6%		62. 6%		68.6%	

(*) denotes statistical significance at least at $\alpha = .10$

(**) denotes statistical significance at least at $\alpha = 0.05$

(***) denotes statistical significance at least at $\alpha = 0.001$

Table 5. Marginal Effects for WTP equations for a) a Mandatory Labeling Program for Beef; b) "U.S. Certified Steak;" and c) "U.S. Certified Hamburger".

	Mandatory Labeling Program		"U.S. Certified Steak"		"U.S. Certified Hamburger"	
	a)Coefficients	a)T-values	b)Coefficients	b)T-values	c)Coefficients	c)T-values
Constant	-0.039	-0.370[a]	-0.332	-1.606	0.165	0.918
Bid	-0.001***	-3.125	-0.094*	-1.862	-0.161*	-1.756
BeefShopper	0.022**	2.316	0.032*	1.808	0.024	1.437
Female	0.212***	4.647	0.125*	1.671	0.186**	2.551
Income	-0.008	-1.082	-0.020	-1.424	-0.019*	-1.731
Education	0.018	1.341	0.047**	1.816	-0.007	-0.303
Kids	-0.042*	1.900	0.034	0.777	0.058	1.397
FoodSafety	0.026***	3.430	0.031**	2.134	0.008	0.629

(*) denotes statistical significance at least at $\alpha = .10$
(**) denotes statistical significance at least at $\alpha = 0.05$
(***) denotes statistical significance at least at $\alpha = 0.001$
[a] Standard errors were calculated using the delta method.

Table 6. Willingness-to-Pay Estimates and Confidence Intervals

Program	Mean WTP	90% Confidence Interval
Mandatory Country-of-Origin Labeling Program	$183.77/year	($138.30, $591.20)
Premium for Steak labeled as "U.S. Certified Beef"	$1.53/pound	($1.32, $6.44)
Premium for Hamburger Labeled as "U.S. Certified Beef"	$0.70/pound	($0.53, $2.40)