A Choice Experiment Model For Beef Attributes:

What Consumer Preferences Tell Us

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A Choice Experiment Model For Beef Attributes: U.S. Consumers' Relative Value of Food Safety, Country-of-Origin Labeling, Traceability and Tenderness

Abstract: This paper reports the main findings obtained from a U.S. consumer choice experiment regarding perceptions of food safety and meat attributes, and to the extent to which these attitudes translate into willingness-to-pay (WTP) for labeled ribeye steaks. The results indicate that USDA food safety inspection labels, labels indicating that the steak is tender, or the ability to trace back the animal to the farm are more important to consumers than country of origin labeling.

Keywords: beef, choice modeling, food safety, stated preferences

JEL Classifications: C25, D12, Q18

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Food safety concerns, threats of bioterrorism, and increasing per capita income have all played an important role in escalating consumer demand for source-verification of food (Caswell; McCluskey and Loureiro; Shiptsova, Thomsen, and Goodwin). For example, the December 23, 2003 isolated U.S. incidence in Washington state of Bovine Spongiform Encephalopathy (BSE or Mad Cow Disease) and the May 20, 2003 single BSE case in Alberta, Canada have both increased discussions about the need for origin-labeling and the development of a U.S. beef traceability systems (Golan et al., Ishmael). Proponents of the 2002 U.S. Farm Bill's mandatory country-of-origin labeling (COOL) provision argue that the impact of BSE on the U.S. beef and cattle industries would have been lessened if a country-of-origin or regional labeling system had been in place when the BSE incidence occurred.[1] This is because some believe COOL would provide a traceability system that would increase food safety and consumer demand for beef by allowing both domestic and international consumers to discriminate between BSE and BSE-free regions (Jin, Skrinpnitchenko and Koo; Ray; Ikenson).

Others have argued the ability of COOL to provide a detailed enough record-keeping system to increase the safety of beef is limited because the 2002 COOL law prohibits the USDA from implementing a mandatory individual animal identification or traceback system (Ray; Ikenson; Umberger et. al.). Therefore, COOL (as stated in the current law) would only allow meat to be traced-back to the country in which it was produced (USDA-AMS, 2002; USDA-AMS, 2003). Opponents of COOL argue that labels denoting country of origin will be meaningless to consumers unless meat can be traced-back to the farm or animal of origin. Traceability systems designed to track the flow of a beef product throughout the entire supply chain are now being explored and discussed in the United States by both industry and lawmakers. Smith et al. define meat traceability as the ability to identify the origin of animals or meat as far back in the production sequence as necessary to ascertain ownership, identify parentage, assure safety and determine compliance in branded or source-verified beef programs.

In December 2003, soon after the discovery of BSE in the United States, Agriculture Secretary Veneman announced that a verifiable national tracking system for animals would be immediately implemented in order to enhance the United States' ability to respond to disease outbreaks and to increase the country's BSE protection system. The debate over whether the animal identification program should be mandatory versus voluntary is ongoing. This dispute is based on disagreements over the level of traceability needed in the U.S. livestock sector.

The necessary level of traceability depends upon the goal (public or private) of the traceability system.[2] Representatives for consumer advocacy groups such as the Consumer Federation of America, emphasize the need for a mandatory animal identification and traceback system to restore consumer confidence in beef, to protect humans from animal disease and food borne illnesses, and for producers to be accountable in the public (Tucker Foreman). Many beef producers have expressed concerns with the additional producer costs and potential liabilities associated with implementation of a mandatory U.S. national animal identification plan and question the additional benefits of traceability to their industry over source-of-origin labeling programs such as the 2002 Farm Bill's COOL provision (Ishmael).

Given the current discussion surrounding both beef traceability and country-of-origin labeling, it is important to evaluate the relative importance of these attributes and food safety certification to U.S. consumers. Krissoff et al. contend that U.S. suppliers would have little difficulty providing country-of-origin labeled products if domestic consumers would be willing to pay a premium for them. Thus, this research uses a unique data set to determine the relative value consumers place on several beef attributes, which include: traceability, country-of-origin, food safety inspection, and tenderness. These attributes were selected based on the results obtained from several previous consumer research studies regarding the preferred attributes by meat eaters and willingness-to-pay for these attributes (See Dickinson and Bailey; Loureiro and Umberger; Lusk et al.).

Additionally, we analyze whether different socio-demographic groups have different preferences regarding the previously mentioned attributes. The data come from a recent mail survey, and as far as we know this is the only study employing a sample of U.S. consumers to address the relative importance of the cited attributes.

Literature Review

Recent studies have explored consumers' preferences for mandatory and voluntary beef labeling programs associated with credence attributes (Alfnes and Rickersten; Lusk et al.; Roosen, Lusk and Fox). The recent food safety scares in the U.S. have prompted questions regarding the role of COOL, traceability, and food safety inspections in order to control the magnitudes and proliferations of such food safety scares. However, relatively little consumer research assessing U.S. consumer preferences has been conducted in this area of food marketing. From a policy-making perspective, it is necessary to understand whether proposed public policies in the area of COOL and traceability may pass a cost-benefit analysis. Additionally, it is important for policy-makers to understand the relative value of various food labels and certifications in order to compare alternative policies.

Until now, all of the previous studies have been regional in scope. For example, Schupp and Gillespie surveyed Louisiana households to analyze consumers' degree of support for mandatory COOL of beef in grocery stores and restaurants. Over eighty-percent of their respondents supported a compulsory labeling program. Loureiro and Umberger surveyed a sample of Colorado consumers concluding consumers on average were willing to pay large premiums to obtain "Certified U.S. beef." Furthermore, they also conclude that high food safety perceptions associated with U.S. beef were one of the primary driving forces for the premiums. In another COOL study by Umberger et al., experimental methods were used to determine Chicago and Denver consumers' preferences for steak after visually evaluating and bidding on two steaks, which differed only in package labels. They also found a majority of their respondents were willing to pay average premiums of about 20% for the U.S. labeled steak. Experimental auctions were also used to assess Utah consumers' preferences and WTP for traceability, additional food safety assurance, and animal treatment (animals were produced using humane treatment procedures and with no added growth hormones) in beef and ham products (Dickinson and Bailey). Consumers in this study were willing to pay a positive premium for traceability assurances; however the premiums were larger for additional food safety assurances and combinations of the other attributes, which only could be verified through traceability. Dickinson and Bailey's results were consistent with those found by Hobbs in a companion experimental consumer study conducted in Canada.

Roosen, Lusk and Fox and Verbeke and Ward have recently investigated the importance of origin and traceability attributes in Europe. Consumers in France, Germany, and the United Kingdom were surveyed to determine European consumers' preferences for beef labeling strategies associated with origin-labeling, private brands, and mandatory labeling of beef from cattle fed genetically modified corn (Roosen, Lusk, and Fox). In this study, consumers in France and Germany indicated that the origin of their beef was more important than any other product attributes such as brand, price, marbling, or fat content. In the UK, however, consumers ranked origin labeling as more important than brand labeling, but steak color, price and fat content were most important (Roosen, Lusk, and Fox). Verbeke and Ward conducted a survey to explore the importance of traceability, country of origin and several beef quality cues to Belgium consumers. They asked consumers to rate these particular labeling cues in order to determine the need for mandatory government labeling programs and the ability of these labels to generate economic rents. The Belgium consumers participating in the study expressed more interest in labeling cues denoting quality and quality standards than in labeling cues related to traceability and origin. Based on this finding, Verbeke and Ward recommend traceability as a means to "back-up" quality labeling cues.

The previous studies cannot be directly applied to the U.S. population. Thus, this paper adds to the literature on beef labeling and food safety assurance employing a U.S. sample of consumers and assessing the relative importance of different meat and certification attributes. Furthermore, many of these previous studies employed contingent valuation methods to look at the value of these attributes. A concern stated by researchers working with contingent valuation methodology is that the method in its simplest form is only able to attribute a value to a particular good, or resource, without assigning a particular monetary value to each of the multi-attributes that the individual values (Adamowicz et al., 1998).

In order to overcome this difficulty and to broaden the understanding and the "scope" in which a particular good is being valued, other techniques involving choice modeling alternatives were developed. As Adamowicz et al. (1998) indicate, in contrast to the contingent valuation scenario, the choice modeling approach attempts to understand the respondents' preferences over the attributes of the scenario rather than a single specific scenario. Both, the choice experiment method, and the contingent valuation method are based on stated preference analysis. This implies that the responses are based on hypothetical choices rather than actual choices. However, in the case of choice experiments there is a large body of literature indicating that results obtained from a choice modeling framework correspond quite well with actual behavior or revealed preferences (Adamowicz, Louviere, and Williams; Adamowicz et al. (1997); Adamowicz et al. (1998)).

In this paper we compare consumer attitudes and willingness-to-pay (WTP) for different food safety and quality assurance labels, while taking into consideration the potential trade-offs between attributes which play a key role in consumer preferences. Thus, the main objectives of this paper are: a) to analyze and to compare the relative importance of consumer WTP for all of the attributes indicated above; and b) to test the role played by consumer socio-demographics on preference for each of the attributes. Our results obtained from a continental U.S. household survey indicate the importance of different attributes when selecting beef ribeye steaks. While there is a premium for COOL, the premium is relatively small compared to the other beef steak attributes examined: USDA food safety inspection labels, USDA tenderness certification, and traceability labels. The results obtained from this study may help policy makers in the debate over the need for COOL versus animal traceability based on consumer interests.

Methodology: Choice Modeling

In order to elicit consumers' preferences we use a choice modeling framework, which allows individuals to select between two alternative options (two types of beef ribeye steaks) that contain a number of attributes at different levels. As recommended by Adamowicz, Louviere and Swait a non-choice option was also presented to participants, since this is an obvious element of choice behavior. Similar exercises were employed in other food marketing, transportation, and environmental economics studies (see for example, Adamowicz, Louviere and Swait; Adamowicz et al.; Burton et al., James and Burton). Thus, instead of asking consumers whether they would be willing to pay a certain amount of money for a given attribute of a beef steak, in this application they were asked to select their preferred alternative between the two ribeye steaks.

Formally, this attribute-based choice method is based on Lancastrian consumer theory (Lancaster), which proposes that utilities for goods can be decomposed into separate utilities for their component characteristics or attributes, and random utility theory (see McFadden; Hanemann and Kanninen). The basic assumption of random utility theory is based on the premise that individuals act rationally, selecting the alternative that yields the highest utility. Consequently, the probability of selecting a given alternative will be higher if the utility provided by such alternative is the highest among the different choices.

Thus, we can represent an individual i 's utility associated with the choice of an alternative j as,

(1) $$U_{ij} = \hat{U}_{ij} + e_{ij}$$

such that $\hat{U}_{ij}$ is the utility function that the researcher models, and ε_{ij} is a random error component, implying from the researcher's view point, that the true utility remains unobservable.

From the consumer's viewpoint, the process of maximization of utility consists of selecting an alternative that yields the highest utility. Thus, if the i^{th} consumer selects type j, then U_{ij} is the highest utility obtainable from among the J possible choices. Hence, the statistical model of the probability that alternative j is chosen by individual i is given by

(2) $$Prob_{ij} = \Pr ob(U_{ij} > U_{ia}; a = 1, 2, \ldots, J, a \neq j) =$$

$$Prob(\varepsilon_{ij} - \varepsilon_{ia} > \hat{U}_{ia} - \hat{U}_{ij}; a = 1, 2, ..., J, a \neq j),$$

where $\hat{U}_{ij} = \mathbf{X}_{ij}\boldsymbol{\beta}$. Maddala shows that when the residuals are independently and identically distributed following a Type I Extreme Value distribution, such as:

(3) $$F(\varepsilon_{ij}) = e^{\left(-e^{-\varepsilon_{ij}}\right)},$$

then it follows that the difference in error terms, displayed in equation (2), has a logistic distribution. Therefore, a multinomial (conditional) logit model can represent the i^{th} consumer's probability of selecting the j^{th} steak choice:

(4) $$\Pr ob(y_i = j) = \frac{e^{\mathbf{x}_{ij}\boldsymbol{\beta}}}{\sum_{j=1}^{J} e^{\mathbf{x}_{ij}\boldsymbol{\beta}}} \quad for \quad j = 1, ..., J.$$

where $\boldsymbol{\beta}$ refers to parameters that weight exogenous variables in determining the utility; and $\boldsymbol{X}_{ij}$ is a row vector of exogenous variable values corresponding to the steak characteristics, and socio-demographics of the i^{th} consumer.

The log likelihood of the multinomial conditional logit is given by:

(5) $$L = \prod_{i=1}^{n} \prod_{j=1}^{J} \Pr ob(y_i = j)^{y_{ij}},$$

where $y_{ij} = 1$ if alternative j is chosen by the i^{th} individual, and zero otherwise.

Data

During early summer of 2003, data were gathered using a mail survey sent to households in the continental United States. A representative sample of 5,000 participant households was drawn from a mail listing purchased from Survey Sampling, Inc., a leader in the science of sampling methodology and research quality. This listing is compiled from the white page directories, and supplemented with a variety of other sources such as Department of Motor Vehicles information, voter information, and census data. Thus, the listing is expected to be representative of the current U.S. Census. Before the survey was mailed, a pretest was conducted interviewing consumers in different supermarkets. After using the information gathered in the pre-test to make slight modifications, the final survey was sent out in a seven-page, booklet format, with a signed cover letter explaining the project, and a postage-paid return envelope. A second survey was mailed out to the households who did not respond in the first attempt. Survey design and data collection procedures followed the *Tailored Design* method proposed by Dillman (1999).

The survey solicited information regarding respondents' purchasing behavior and attitudes about beef products, beef qualities that consumers find most desirable, food safety attitudes, questions involving a choice modeling experiment, and socio-demographics. In this choice modeling experiment consumers were asked to select between two types of ribeye steaks with different attribute levels. Information regarding the meaning of each of the considered attributes was presented to participants right before the choice experiment. (See example of employed definitions in Appendix). Finally, socio-demographic characteristics were elicited in the last part of the survey.

In the choice-modeling experiments, participants were given the opportunity to select between two ribeye steak types (Option A and Option B) carrying different prices and different extrinsic attributes. Ribeye steak was the product of choice, since it is commonly available in supermarkets and shops around the country, and consumers are familiar with this high quality meat cut. In each choice experiment question, consumers were also given a third option of choosing to purchase neither Option A nor Option B.

The selected steak attributes were: price per pound, country-of-origin labeled (the product carries a label identifying the country from which it was produced), guaranteed tender, food safety inspected (the steak carries a label guaranteeing to have been inspected by the USDA), and traceable to the farm (label guaranteeing the product is traceable to the farm of origin).[3] All of the mentioned attributes entered the choice set with two levels. For the price variable, a baseline price scenario was selected that corresponded with the mean price of ribeye steak published by the USDA in May 2003, and above this, a mark-up price based on the WTP denoted in the survey pre-test and previous studies. The rest of the dichotomous variables entered the choice sets with the two possible alternatives (labeled versus non-labeled).

Participants were informed that both of the steaks were USDA Choice grade and were given a definition of USDA quality grades. The USDA steak quality grades are primarily determined by the amount of marbling (intramuscular fat) found in a steak. A Ribeye steak with a USDA Choice grade is moderately marbled.

The choice set design was created employing fractional factorial design generation. Specifically, we generated full factorial design for 10 variables, each with two attributes levels. The procedure called *proc optex* in SAS was used to find a design that maximizes the D-Efficiency and A-Efficiency scores. The goal of D-optimality is to maximize the determinant of the information matrix, while A-optimality attempts to minimize the sum of the variances of estimated coefficients. The DETMAX algorithm of Mitchell was performed to search for this design, where the starting point was determined by random seeds. Thus, the final design was selected based on the optimal combination of high D-Efficiency (91.008) and A-Efficiency (81.576), less choice sets (12 choice sets), and minimal correlation between factors. In order to ensure that earlier questions did not affect consumers' responses to later questions in a systematic way, the order of the choice sets was randomized. The correlation of the factors was calculated to assess estimateability of the main effects.

Empirical Specification

The empirical specifications of the utility levels underlying the multinomial conditional logit make references at the attributes of each choice and were formulated as follows:

(6) $$\mathrm{U}_{\mathrm{ij}} = \mathbf{x}_{\mathrm{ij}}\boldsymbol{\beta} + \varepsilon_{\mathrm{ij}}.$$

Since U_{ij} is the latent unobservable utility level that the i^{th} consumer obtains from choosing the j^{th} ribeye steak type, the observed choice is a reflection of this latent unobservable utility. Note that $\mathbf{x}_{ij}$ represents explicitly the vector of intrinsic ribeye steak attributes, with $\boldsymbol{\beta}$ being the parameter vector to be estimated. The model described in (6) was formulated given the attribute levels and the responses to the choice experiment survey.

It is interesting to determine the impact of the respondents' socio-demographic variables on the steak choice, and thus, additional specifications including variables such as respondents' age, gender, income and education were estimated. Interacting the steak attributes included in the choice set with the respondent's socio-demographic variables, allows testing whether consumers are more or less likely to select a ribeye steak given the presence of a given attribute. In particular, an empirical specification of the following form has been estimated:

(7) $$U_{ij} = \mathbf{x}_{ij}\boldsymbol{\beta} + (\mathbf{z}_i * \mathbf{x}_{ij})\boldsymbol{\alpha} + \varepsilon_{ij}$$

where $\mathbf{z}_i$ is the vector of the socio-demographic characteristics of individual *i*, which is interacted with the different attributes of each choice *j* that any given participant i faces , with $\boldsymbol{\alpha}$ being the associated parameter vector to be estimated. The conditional multinomial logit models based on (6-7) were estimated within a maximum likelihood framework to analyze consumer choice behavior under the condition that different steak choices had different attributes.

Results

From the 5,000 surveys mailed, 216 were returned because of insufficient information in the address, and 632 were returned completed and analyzed, which contributes to a response rate of about 13%.[4] The majority of respondents were the primary food shoppers of the household (85%), Caucasian (91%), and female (54%). The respondents' average age was about 55 years, and 35% of all respondents had children under the age of 18 years old living in their household. The mean household income of the sample was calculated to be about $50,000 for the 2002 calendar year, and their average education included a junior college degree. Summary statistics and variable descriptions are presented in Table 1. Our sample is comparable to the United States Census (U.S. Census 2000) in terms of gender, education, income, number of children per household and household size. However, this sample includes fewer minorities and participants are a slightly older than the mean age reported by U.S. Census. These are features common to many other surveys.

As in all surveys, sample representativeness is always of concern to the researcher. The effect of sample selection on our results concerning the relative value of beef attributes is indeterminate. There could be some degree of sample selection bias, in which the people who were more interested in the labeling programs or had more time available elected to participate in the survey. Given the preceding observations, we acknowledge that results may not be fully generalizable to broader samples.

Each participant was asked to select between the two different ribeye steaks, A and B in repeated choice occasions, providing a total of 3,786 responses. However, because some participants selected Option C, the non-purchase option, the total data points for analysis were reduced to 2,319.[5] The appendix contains an example of one of the multiple-choice sets that participants evaluated.

Results obtained from the empirical specification of (6) are reported in Table 2. All coefficients are statistically significant at conventional critical levels, and the relationship with the utility function is as expected. Thus, increments on the price decrease the associated utility level provided by the choice, whereas increments on any of the other considered attributes increases the utility. The highest utility increment occurs due to the presence of food safety certification labeling, followed by the presence of labels indicating that the steak is tender, and then traceability labeling. An interesting finding is that among all labeling attributes considered, the utility provided by the steak choice is increased the least by the presence of a country-of-origin label.

Table 3 reports the results obtained with specification (7). Results indicate that when the socio-demographic characteristics are included, the country-of-origin label (*COOL*) attribute is not statistically significant in the selection of ribeye steaks, while the rest of the choice specific attributes remain statistically significant. When looking at the role of the socio-demographic variables, the interaction term between gender (gender = 1 if respondent is a female) and food safety (*FoodSafety*Gender*) is statistically significant. Thus, female shoppers are more likely to be concerned about food safety issues. Further, the variable *Age*, which represents the age of the respondent, has a negative and statistically significant effect when interacted with the attributes denoting food safety inspection and tenderness *(FoodSafety*Age, Tenderness*Age).* This is expected since older consumers are in general less responsive towards food safety and quality certification. It is also interesting to note that high education is only statistically significant (with a negative sign) when interacted with the attribute tenderness (*Tenderness*HighEdu*). Thus, ceteris paribus, individuals with higher levels of education are less likely to choose steaks certified as tender. The variable *Income* also carries a negative effect when interacted with the choice attributes, except in the case of traceability (*Traceable*Income*).[6] Consequently, wealthier individuals are more likely to select a steak in which a traceability label is present, while at the same time are less likely to select a steak with a country-of-origin label. Previous studies, such as Loureiro and Umberger, reported similar results with regards to the behavior of the socio-demographic variable income.

Estimating WTP for steak attributes

As expressed above, in the multinomial conditional logit the coefficients cannot be directly interpreted as the direct effects of the respective explanatory variables on the probability of choosing each particular steak type. Rather, they represent the direct effects associated with each of the explanatory variables on the (unobservable) utility function, which can be used to calculate the mean willingness-to-pay estimates (WTP) for each of the attributes. Following Hanemann (1989), each of the estimates is calculated as the ratio of the coefficient associated with the attribute of interest over the *Price* coefficient (see Burton et al., James and Burton, Layton and Brown for different applications). Therefore, in order to calculate the mean WTP for each attribute, we estimate the corresponding ratios $\frac{-\beta_{\text{atribute}}}{\beta_1}$. Each of these ratios is understood as a price change associated with a unit increase in a given attribute.

For comparison purposes, these mean WTP estimates obtained with the coefficients reported in Table (2) and asymptotic standard errors for each attribute are reported in Table 4. Results indicate that although the country-of-origin label carries a positive premium ($0.562 per pound of steak), this is the smallest premium among the considered attributes. This implies that, on average, $0.562 per pound is the premium that makes consumers indifferent between the two levels of utility, associated with no country-of-origin labeling of the steak, and the payment of $0.562 per pound and the presence of a label denoting the country of origin. The label that certifies that the steak has been inspected by USDA food safety inspectors *(FoodSafety)* carries the highest premium of $3.894 per pound of steak. The other remaining attributes indicating that the product is traceable to the farm where the animal was produced on *(Traceable)*, and that it is guaranteed tender *(Tenderness)*, carry premiums about $1.031 per pound, and $1.138 per pound, respectively.

These results are intuitive and according to expectations and previous results. Similar to the results obtained in this study, Dickinson and Bailey and Hobbs found consumers placed the highest relative value on food safety certification. In understanding the current study's results, it is necessary to indicate that country-of-origin labeling in this choice set experiment was described as a generic labeling program that identifies a particular country in which the product was produced. Consequently, the attribute *COOL* was exclusively a signal of origin, and did not carry any particular reputation of quality. Thus, our results reinforce that food safety assurance is the main driving force for consumer willingness-to-pay, rather than geographical origin. These results correspond with previous studies, which highlight the link between consumer acceptance of U.S. domestic beef products and an associated perception of food safety standards (Loureiro and Umberger, Umberger et al.).

Conclusions and Policy Implications

Recent consumer studies indicate U.S. consumers are willing to pay for country-of-origin labeling of meat products, particularly if these are U.S. certified products. Nevertheless, the previous studies used a dichotomous choice question format, which provides limited information about the relative value that U.S. consumers assign to each independent attribute that makes up a product. A more reliable benefit-cost analysis of COOL and livestock traceability can be conducted by comparing consumer choices and trade-offs when analyzing country-of-origin and traceability in a multi-attribute context with other important meat attributes.

We surveyed a representative sample of U.S. households to obtain information regarding consumer preferences and attitudes toward source-of-origin labeling and traceability programs. Using a choice set experimental design, and an associated modeling framework, we provide further information about the relative importance of food safety certification versus country-of-origin labeling and traceability. In particular, we elicit consumer willingness-to-pay for these different origin and food safety-related labeling programs, and include an additional meat attribute (likely not to be associated with food safety), tenderness, which previous research has shown to be of value.

We conclude that when country-of-origin labeling is simply presented as a generic labeling program, and is not associated with a particular country (such as "Certified U.S. beef"), consumers' WTP for this attribute in ribeye steak is fairly low, being $0.562 per pound. However, a label denoting that the steak has been USDA food safety inspected, carries a much larger premium of approximately $3.894 per pound; while a label denoting the product is traceable to the farm of origin carries a premium of $1.031 per pound, which is nearly twice the amount of the COOL premium. It is also interesting to note that the value of the premium for guaranteed tender is also double the COOL premium. Thus, although the presence of a country-of-origin label increases in a positive and statistically significant way the likelihood of a consumer selecting a given ribeye steak, the effect provided by the other labeling attributes is much larger in the final consumer choice.

Our findings have clear policy implications. In spite of the fact that COOL is a very polemic labeling program, it seems consumers place little value on the indication of country of origin *per se*. Relatively speaking, consumers value food safety inspection certification the most. While proponents of the COOL provision believe consumers value country-of-origin enough to increase beef demand, and cite previous research studies which show a premium for COOL, it is likely consumers were interpreting COOL to provide additional food safety assurances. Under the current guidelines established for the 2002 Farm Bill's COOL provision, country-of-origin labels will only provide information on the country of origin. Conversely, traceback systems, which allow meat products to be traced through the entire food supply chain, may be able to provide consumers with additional food safety assurances, this may explain the reasons why the value of "traceable to the farm" was higher than the value of "country-of-origin." Consequently, when consumers are provided with additional information related to the safety of a given meat product (food safety inspection certification and traceability), country-of-origin labels garner much smaller premiums on average. As a result, origin labeling alone may play a very small role in consumer choices.

Indication of origin may become a good quality signal if the source of origin is associated with a higher food safety or food quality perception. Products labeled with a country-of-origin from a geographical location linked to a particular reputation for food safety or food quality may be able to garner premiums. This point is important to consider given the recent isolated BSE case in the United States and the USDA-AMS's (2003) estimates that mandatory COOL would cost the industry $1.9 billion in the first year to develop the required record keeping system. In this context, the perceived safety of U.S. meat by consumers may play a crucial role when assessing the benefits versus the costs associated with a country-of-origin labeling program.

These lower consumers' WTP estimates for the COOL program versus the premiums for traceback certification extend the information available for the debate of whether or not a policy providing only country-of-origin information rather than traceability will have net benefits to either beef producers or consumers.

Footnotes

[1] Title X, Section 10816 of the Farm Security and Rural Investment Act of 2002 (the 2002 Farm Bill) amended the Agricultural Marketing Act of 1946 and required retailers to inform consumers of the country of origin of agricultural commodities such as ground meat and muscle cuts from beef, lamb and pork. According to the 2002 Farm Bill's COOL provision guidelines, for a beef product to be labeled as a "Product of U.S.A.," the beef animal must be born, raised and processed in the United States (USDA-AMS, 2003). The COOL program is currently a voluntary program. In January 2004, President Bush signed Public Law 208-199 postponing implementation of mandatory COOL for all commodities except wild and farm-raised fish and shellfish from September 30, 2004 until September 30, 2006. However, proponents of COOL are continually lobbying for reinstatement of mandatory COOL.

[2] The public sector's traceability objectives are to provide consumers with information in the case of a market failure, to tracing food-borne illness, and to maintain adequate records for animal disease control, surveillance and monitoring. On the other hand, supply-chain management, quality control, preservation and marketing of credence food attributes (food characteristics that are not observable even after consumption of the product) are the three primary incentives for private firms to implement traceability systems (Golan et al.).

[3] The definitions for "guaranteed tender" and "traceable to the farm" are similar to those used by Lusk et al. and Dickinson and Bailey, respectively.

[4] Similar and inferior response rates were obtained in comparable studies in which no monetary inducement was given to participants.

[5] In order to keep the survey manageable, each participant was provided with 6 repeated choice occasions.

[6] The variable *Income* has been recoded employing the mid-point value of the interval (in thousands of dollars), and the upper and lower bound, respectively for the lower and higher interval presented to participants.

[7] Asymptotic standard errors were calculated via the delta method (Kanninen, 1993).

References

Adamowicz, W., J. Louviere, and J. Swait. An Introduction to Stated Choice Methods for Resources Based Compensation. Prepared by Advanis Inc. for the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation." *American Journal of Agricultural Economics,* 80 (1998):64-75.

Adamowicz, W., J. Swait, P. Boxall, J. Louviere, and M. Williams. "Perceptions versus Objective Measures of Environmental Quality in Combined Revealed and Stated Preference Models of Environmental Valuation." *Journal of Environmental Economics and Management*, 32 (January 1997):271-292.

Adamowicz, W., J. Louviere, and M. Williams. "Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities." *Journal of Environmental Economics and Management*, 26(May 1994):271-292.

Alfnes, F. and K. Rickertsen. "European Consumer's Willingness to Pay for U.S. Beef in Experimental Auction Markets." *American Journal of Agricultural Economics*, 85(2003):396-405.

Burton, M., D. Rigby, T. Young, and S. James. "Consumer Attitudes to Genetically Modified Organisms in Food in the UK. " *European Review of Agricultural Economics*, 28(4)(2001):479-498.

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

Dickinson, D.L. and D. Bailey. "Meat Traceability: Are U.S. Consumers Willing to Pay for It?" Journal of Agricultural and Resource Economics. 27(2) (2002):348-364.

Dillman, D.A. *Mail and Internet Surveys: The Tailored Design* Method, 2nd Edition. Published by the John Wiley Company, New York: NY, December 1999.

Golan, E., B. Krissoff, F. Kuchler, L. Calvin, K. Nelson, and G. Price. *Traceability in the U.S. Food Supply: Economic Theory and Industry Studies*. Washington DC: U.S. Department of Agriculture, ERS. Agr. Econ. Report No. 830, March 2004.

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.

Hanemann, W.M. and B. Kanninen. The Statistical Analysis of Discrete-Response Data. In: Valuing the Environment Preferences: Theory and Practice of the Contingent Valuation Method in the US, EC and Developing Countries, I. Bateman and K. Willis, eds. Oxford University Press. 1999.

Hobbs, J.E. "Consumer Demand for Traceability." Working Paper 03-01. International Agricultural Trade and Research Consortium. ISSN 1098-9218. April 2003.

Ikenson, D. "Uncool Rules: Second Thoughts on Mandatory Country of Origin Labeling." *Free Trade Bulletin* No. 7 Center for Trade Policy Studies. January 16, 2004. Internet address: http://www.freetrade.org/pubs/FTBs/FTB-007.pdf Accessed March 31, 2004.

Ishmael, W. "Raining Regulations." *Beef Magazine.* Feb 2004 http://beef-mag.com/ar/beef_raining_regulations/index.htm

James, S. and M. Burton. "Consumer Preferences for GM Food and other Attributes of the Food System" *The Australian Journal of Agricultural and Resource Economics*, 47(4):501-518.

Jin, H.J., A. Skripnitchenko, and W.W. Koo. "The Effects of the BSE Outbreak in the United States on the Beef and Cattle Industry." Special Report 03-4, Center for Agricultural Policy and Trade Studies, Department of Agribusiness and Applied Economics. North Dakota State University, Fargo, ND. January 2004.

Kanninen, B. J. "Optimal Experimental Design for Double-Bounded Dichotomous Choice Contingent Valuation." *Land Economics*, 69 (1993):138-46.

Krissoff, B., F. Kuchler, K. Nelson, J. Perry, A. Somwaru. "Country of Origin Labeling: Theory and Observations." Electronic Outlook Report Number WRS04-02 from the Economic Research Service, USDA. January 2004.

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

Layton, D.F. and G. Brown. "Heterogenous Preferences Regarding Global Climate Change." *The Review of Economics and Statistics*, 82(4)(2000):616-624.

Loureiro, M.L. and W.J. Umberger. "Estimating Consumer Willingness to Pay for Country-of-Origin Labeling." *Journal of Agricultural and Resource Economics.* 28(August 2003): 287-301

Lusk, J.L. J.A. Fox, T.C. Schroeder, J. Mintert, and M. Koohmaraie. "In-Store Valuation of Steak Tenderness." *American Journal of Agricultural Economics*. 83(3)(August 2001):539-550.

Maddala, G.S. Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press, 1997.

McCluskey, J. and M. L. Loureiro. "Consumer Preferences and Willingness to Pay for Food Labeling: A Discussion of Empirical Studies." *Journal of Food Distribution Research*. 34(3 2003): 85-102.

McFadden, D. (1974). Conditional Logit Analysis of Qualitative Choice Behavior. In P. Zarembka (ed.), *Frontiers in Econometrics*, New York: Academic Press, 105-142.

Mitchell, T.J. An Algorithm for the Construction of “D-optimal” Experimental Designs. *Technometrics*, 16(2) (May 1974)-210.

Ray, D.E. “COOL and the Canadian BSE Incident.” *MidAmerica Farmer Grower*. Vol.21, NO.20, May 30, 2003. available online at http://apacweb.ag.utk.edu/weekpdf/147.pdf.

Roosen, J., J.L Lusk and J.A. Fox. “Consumer Demand for and Attitudes Toward Alternative Beef Labeling Strategies in France, Germany, and the UK.” *Agribusiness: An International Journal* 19(1) (2003): 77-90.

Shiptsova, R., M.R. Thomsen, and H.L. Goodwin. “Producer Welfare Changes from Meat and Poultry Recalls.” *Journal of Food Distribution Research* 33(2)(2002): 25-33.

Smith, G.C., K.E. Belk, J.A. Scanga, J.N. Sofos and J.D. Tatum. “Traceaback, Traceabilty and Source Verification in the U.S. Beef Industry.” Department of Animal Sciences Research Report, Colorado State University and Paper presented at the XXI World Buiatrics Congress, Punta del Este, Uruguay. December 5, 2000. Internet address: http://ansci.colostate.edu/dp/msfs/gcs001.pdf

Tucker Foreman, C. “Animal ID Should Protect Humans As Well as Animals.” *Food Traceability Report.* 4(February 2004): 18.

Umberger, W.J., D.M. Feuz, C.R. Calkins, and B.M. Sitz. “Country-of-Origin Labeling of Beef Products: U.S. Consumers’ Perceptions.” *Journal of Food Distribution Research*. 34(3 2003): 103-116.

U.S. Census Bureau. “United States Census, 2000.” http://www.census.gov.

USDA-AMS, United States Department of Agriculture Agricultural Marketing Service. 2002 Farm Bill Provisions, Subtitle D-Country of Origin Labeling. May 2002. Internet address: http://www.ams.usda.gov/cool/subtitled.htm. Retrieved May 28, 2003.

USDA-AMS, United States Department of Agriculture Agricultural Marketing Service. *Federal Register*. “Mandatory Country of Origin Labeling of Beef, Lamb, Pork, Fish, Perishable Agricultural Commodities and Peanuts.” Vol. 68, No 210. October 2003. Internet address: http://www.ams.usda.gov/cool/ls0304.pdf. Retrieved October 31, 2003.

Verbeke, W. and R. W. Ward. “Importance of EU Label Requirements: An Application of Ordered Probit Models to Belgium Beef Labels.” Paper presented at the American Agricultural Economics Association Annual Meetings. Montreal, Canada. July 2003.

Table 1. Summary Statistics for the Demographic Variables

Variable Name	Description (Coding)	Mean	Standard Deviation.
Age	In years	55.118	21.182
Gender	1 if female, 0 if male	0.532	0.511
Shopper	1 if primary household shopper, 0 if otherwise	0.857	0.349
LowEducation	1 if received less than a high school diploma, 0 if otherwise	0.217	0.412
MidEducation	1 if received more than a high school diploma and less than graduate school, 0 if otherwise	0.475	0.499
HighEducation	1 if finished graduate school, 0 if otherwise	0.306	0.461
Children	1 if children <18 living in the household, 0 if otherwise	0.346	0.501
Family Size	Number of family members living in the household	1.904	0.745
Income	2001 annual household income: 1 = <$20,000 2 = $20,000-$29,999 4 = $30, 000-$39,999 5 = $40, 000-$49,999 6 = $50, 000- $59,999 7 = $60, 000- $69,999 8 = >=70,000	6.134	2.789
Race	1 if Caucasian, 0 if otherwise	0.912	0.283

Table 2: Discrete Choice Conditional Multinomial Logit Results (Equation 6)

	Coefficient	Standard Error	T-ratio	P-value
Price	-0.664	0.036	-18.471	0.000
COOL	0.373	0.117	3.181	0.001
Traceable	0.684	0.099	6.939	0.000
FoodSafety	2.583	0.107	24.095	0.000
Tenderness	0.756	0.118	6.430	0.000
Log-Likelihood Value	-793.648			
Pseudo R-squared	0.518			

Table 3: Discrete Choice Conditional Multinomial Logit Results (Equation 7)

	Coefficient.	Standard Error.	t-ratio	P-value
Price	-0.687	0.038	-18.012	0.000
COOL	0.559	0.476	1.175	0.240
Traceable	0.642	0.381	1.684	0.092
FoodSafety	3.138	0.483	6.492	0.000
Tenderness	2.407	0.588	4.096	0.000
COOL*Gender	-0.143	0.240	-0.593	0.554
FoodSafety*Gender	0.399	0.212	1.884	0.060
Traceable*Gender	-0.049	0.204	-0.240	0.810
Tenderness*Gender	-0.183	0.229	-0.798	0.425
COOL*Age	-0.002	0.005	-0.394	0.695
FoodSafety*Age	-0.016	0.006	-2.841	0.005
Traceable*Age	-0.003	0.004	-0.565	0.572
Tenderness*Age	-0.015	0.007	-2.231	0.026
COOL*MidEdu	0.534	0.378	1.415	0.157
COOL*HighEdu	0.157	0.383	0.410	0.682
FoodSafety*MidEdu	-0.103	0.313	-0.330	0.741
FoodSafety*HighEdu	0.026	0.317	0.082	0.935
Traceable *MidEdu	0.043	0.259	0.166	0.868
Traceable*HighEdu	-0.233	0.299	-0.778	0.437
Tenderness *MidEdu	0.005	0.304	0.016	0.987
Tenderness *HighEdu	-1.009	0.362	-2.792	0.005
COOL*Income	-0.768	0.371	-2.067	0.039
FoodSafety*Income	-0.338	0.270	-1.253	0.210
Traceable*Income	0.491	0.240	2.065	0.039
Tenderness*Income	-0.340	0.229	-1.483	0.138
Log-likelihood	-747.330			
Pseudo R-squared	0.533			

Table 4: Mean WTP (dollars per pound of steak) for each Steak Attribute

Attribute	Mean WTP (dollars/lb. of steak) (Asymptotic Standard Errors)[7]
COOL	0.562 (0.005)
Traceable	1.031 (0.006)
FoodSafety	3.894 (0.192)
Tenderness	1.138 (0.019)

Appendix: Choice Set Example

Suppose that when you visit the meat case in your supermarket during a given month you are presented with two choices of beef ribeye steaks (Option A and Option B). Steak A and Steak B have different attributes that we have described below for you. While many attributes vary from Steak A to Steak B, both of the steaks are USDA Choice quality grade. The USDA steak quality grades are primarily determined by the amount of marbling (intramuscular fat) found in a steak. A ribeye steak with a USDA Choice grade is moderately marbled.

The following are descriptions of the attributes that may vary from Steak A to Steak B:

Price = The price is expressed in dollars per pound; and is the price ($/pound) that you would pay for the steak you choose.
Traceable to the Farm = The beef steak carries a label guaranteeing that the meat is traceable to the farm that the animal was produced on (farm of origin).
Country-of-Origin Labeled = The beef product carries a label identifying the country in which it was produced (label would indicate where the animal was born, raised and processed).
Food Safety Inspected = The steak carries a label guaranteeing to have been inspected by the United States Department of Agriculture, Food Safety Inspection Service (USDA-FSIS). Imported beef is also inspected by the USDA-FSIS.
Guaranteed Tender = The USDA has developed a technology to categorize the tenderness of a steak using shear force. Shear force values allow steaks to be guaranteed tender. A steak that is *"guaranteed tender"* carries a label verifying that the steak is tender according to shear force. A steak that does not carry the label has not been tested for tenderness, and is not guaranteed to be tender.

Consider each of the following 6 boxes (20.1 through 20.6) as separate sets of choices. In each of the 6 boxes on the next two pages please select the <u>beef steak choice</u> (Option A, Option B, or Option C) that best matches your preferences:

20.1	**Option A**	**Option B**	**Option C**
Price	6.75	9.45	Neither Option A nor B Is Preferred
Country of Origin Labeled	No	Yes	
Traceable to the Farm	Yes	No	
Food Safety Inspected	No	Yes	
Guaranteed Tender	No	Yes	
I would choose: (Please Mark Only One Box) →	☐	☐	☐