Consumer Responses to New Food Quality Information: Are Some Consumers More Sensitive than Others

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Abstract

In the main approaches used to elicit consumer preference for food attributes, only limited attribute information are present. Though useful for ranking and revealing consumer preferences, these methods are not appropriate when results may be dependent upon the information set presented in the surveys. Studies have found out that additional quality information in surveys significantly affected respondents' attitudes to or WTP for a specific product attributes. By using cluster analysis we are able to classify respondents into different consumer groups and investigate the difference in responses to new attribute information across consumer groups. Results show that different types of consumer's WTP for beef steak attributes varies significantly and their responses to new attribute information are different, if a specific attribute is studied. Over all, there was no significant difference between the responses to new information between consumer groups. However, in the case where cue attributes existed, consumers with small family size, less children, lower income, are single and younger, respond significantly intensive to the new information than other consumers.

Keywords: Food Attribute, Willingness-to-Pay, Choice Experiment, Cluster Analysis

A large body of literature has examined consumer valuation of specific food attributes such as organic, natural, country of origin, GMO etc (Huffman et al.1996; Loureiro and Umberger 2003; Loureiro and Umberger 2005; Krystallis and Chryssohoidis 2005; Hossain et al. 2003; Hu et al. 2004; Fox et al. 1994; Fox 1995). The main approaches used are contingent valuation, choice experiment, and experimental auction. Though useful for ranking and revealing consumer preferences, these methods make limited information available to survey participants. This is problematic when results may be dependent upon the information set presented in the surveys and the food product attribute information provided in surveys is much less than what is present in actual retail settings. By focusing only on information of most interest to the researchers, consumer valuation studies may have biased results that are similar in nature to omission of relevant variables in econometrics.

Hallman et al. (2003) showed that research questions reinforced consumer attention to the information of interest. Several studies in conjoint analysis literature have also shown that the missing information on product attributes affected consumer behavior. In the case of partial profiles, where levels of some attributes were missing from some profiles, consumers can infer the missing attribute levels by determining the systematic pattern of the profile, or use cues (e.g., price) that were provided in the survey (Broniarczyk and Alba 1994; Huber and McCann 1982; Johnson and Levin 1985). Kardes et al. (2004) conducted a comprehensive review of the process and context of consumer inference under incomplete information. He summarized eight types of inferences when consumers made judgments based on incomplete relevant information. A wide range of information (e.g. specific attribute, cue, general categories etc) available to consumer can be used as tool to facilitate the inference procedure. Islam et al. (2007) showed that a missing attribute in a choice experiments affected consumers' behavior by changing both the systematic

and random components of consumer utility function. Hensher et al. (2005) demonstrated that the ignorance of certain attributes by respondents in choice experiments resulted in significantly lower estimates of WTP for travel time saving. Hensher's (2006) results indicated that the mean-weighted average WTP for time saving was not significantly influenced by the design dimensions if all of the design dimensionality, such as number of choice sets, attributes, alternatives, attribute levels and range of attribute levels were controlled. However, he showed that as the number of attributes increased, the average WTP for time saving increased if other dimensions were not controlled. Neither study found systematic relationships between the inclusion/exclusion of the attributes and heterogeneity across respondents. A recent study showed that missing attribute information affected both the means and variances of consumer WTP for food attributes (Gao and Schroeder 2007). There was no monotonic relationship between the number of attributes in a choice experiment and the elicited WTP. However, variance of WTP deceased with increasing numbers of attribute information.

The dependence of consumer behavior and preferences on the information content of surveys raises concerns about our ability to accurately quantify WTP values in consumer surveys, whether they are hypothetical or not. A large body of literatures has shown that consumer demographics affect consumer preferences for different food attributes (Fox 1995; Wang et.al 1997; Lusk et.al 2003; Loureiro and Umberger 2003; Alfnes 2004). For instance, Fox (1995) showed that gender, consumer safety concern and prior knowledge of bST significantly affected the bids for bST milk. Loureiro and Umberger (2003) demonstrated that females, consumers with higher education and primary shoppers in the household had stronger preferences for country of origin labeling. Alfnes (2004) showed that females and older people were less likely to buy imported and hormone-treated beef, while urban residents and people with more trade

experience had a higher probability of purchasing imported beef. So, regarding the effect of additional attributes information on consumer preferences, one important question is, do all consumers respond in the same way to additional product label information? If not, are some consumers less sensitive to a change in information content of a survey? If consumers' responses to new information can be connected to their demographics or shopping experiences, more specific marketing strategies can be designed for different consumer groups. In addition, if we can determine how consumer traits are related to the sensitivity of valuation results in survey, it will help researchers to better interpret estimated WTP relative to the information content of surveys.

The purpose of this study is to investigate responses of different consumer groups to new food attribute information and to determine the factors that explain differences in consumer responses. To achieve this goal, we designed two sets of choice experiments for valuation of strip loin beef steak products with the number of attributes revealed to consumer varying across choice experiments. One set of choice experiments included a cue attribute "Certified U.S. Product" and another set of choice experiments only used independent attributes. Consumers were classified as two groups, using cluster analysis based on their demographic and shopping experience. The effects of additional attribute information on preferences of different consumer groups were tested based on the change in WTP. That is, changes in consumer WTP due to additional attributes being present in choice experiment were estimated by consumer group, and then the changes were compared across consumer groups. Therefore, we could investigate the difference in the consumer's response to the new attribute information between two consumer groups.

Hensher (2006) suggested future studies on identifying the impacts of the complexity of choice experiments on the mean and variance of WTP estimation. As a result, the elicited WTPs could be compared and adjusted according to the differences in the design of choice experiments. Results in this paper, from another perspective, will also enhance our ability to compare and adjust the WTP estimations across studies based on the characteristic of the respondents in the survey samples.

Changes in WTP with Additional Attribute Information

Random utility theory suggests that consumer utility is a function of observable products attributes and a random component. The utility of consuming products depends on the types of consumers such as their demographics, shopping experiences and so forth. Our model shows that consumer WTP for a specific attribute is related to the number of product attributes presented. And potential changes in WTP resulting from additional product attributes being present differ across different types of consumers.

Assuming a linear random utility function, consumer *i's* utility of consuming product *j* could be defined by:

(1) $U_j^i(i \in N) = \alpha^i \cdot p_j + \sum_{k=1}^{T-1} \beta_k^i \cdot x_{jk} + \varepsilon_j^i$.

Where β_k^i is the weight on the k^{th} attribute, p_j and x_{jk} are the price and k^{th} attributes respectively. T is the total number of attributes. N represents the types of consumers. And, ε_j^i is the random component with certain type of probability distribution.

Consumer *i's* WTP for k^{th} attribute can be calculated as the negative ratio of the parameter of k^{th} attribute to the parameter of price: $WTP_k^i(i \in N) = -\beta_k^i / \alpha^i$. With more attributes

information (e.g. M-T additional attributes) provided to respondents, consumer random utility function becomes:

(2) $U_j^i(i \in N) = a^i \cdot p_j + \sum_{k=1}^{T-1} b_k^i \cdot x_{jk} + \sum_{k=T+1}^{M} b_k^i \cdot x_{jk} + \varepsilon_j^i$

Equation (2) implies that with more attribute information, consumer WTP for attribute *k* will change from $WTP_k^i(i \in N) = -\beta_k^i / \alpha^i$ to $WTP_k^{i*}(i \in N) = -b_k^i / a^i$. Consumer response to new attribute information can be defined as the difference in WTP after and before the additional attribute information is provided to respondents,

(3) $DWTP_k^i(i \in N) = WTP_k^{i*} - WTP_k^i$.

If a consumer *h* fits a particular consumer group profile such as *O*, then the utility level that he/she will get by consuming a product may be different from that of consumer *i* who fits another profile. For instance, consumer *h's* utility function can be specified as

(4) $U_j^h(h \in O) = \alpha^h \cdot p_j + \sum_{k=1}^{T-1} \beta_k^h \cdot x_{jk} + \varepsilon_j^h$.

The response to the new attribute information of consumer *h* can be measured as:

(5) $DWTP_k^h(h \in O) = WTP_k^{h*} - WTP_k^h$.

By comparing *DWTP*, the changes in WTP before and after inclusion of additional attribute information, we can investigate if consumers *i* and *j* respond in the same way to new information.

Surveys with Overlapped Choice Experiments

Four online surveys containing a series of choice experiments (CEs) were collected to investigate the effect of additional attributes on consumer preference across different types of consumers. Choice experiments are used because it is easier to add additional quality attributes in a CE than that in contingent valuation and experimental auction methods and it is consistent with

Lancaster's theory (1972) of utility maximization. Two sets of attributes of beef steak (beef strip lion steak, also known as KC strip) were used to compose alternatives in choice sets. The first set of attributes included price per 12-ounce steak, "Certified U.S. Product" (COOL), "Guaranteed Tender" (Tenderness), "Guaranteed Lean" (Lean), and "Days before Sell-by Date" (Freshness). The second set of attributes included "Price", "Guaranteed Tender", "Guaranteed Lean", "Days before Sell-by Date", and "Enhanced Omega-3 Fatty Acids". To have those two distinguishable sets of attributes is important, because a cue attribute such as "Certified U.S Product" may be used as a proxy of product quality or other product traits. Therefore, consumer reaction to new attribute information may be different when a cue is present. For example, Umberger et al. (2003) determined that consumers envision several product attributes together when they were presented a country-of-origin label (such as food safety, health, freshness, quality, and support for local producers).

The prices of beef steak used in the choice sets were $4.64/lb, $6.93/lb, $9.22/lb and $11.50/lb. The base price ($6.93/lb) roughly matched retail prices of beef strip steaks (Steak, T-bone, USDA Choice, bone-in, LMIC 2006). All other attributes were selected to have two different levels such as "Certified U.S. Product" vs. no origin label, "Guaranteed Tender" vs. not guaranteed etc. and, "2 Days before Sell-by Date" vs. "8 before Sell-by Date". Keeping the alternative attributes at only two levels helped to reduce the size of the choice experiments. As a result, respondents fatigue could be minimized when presented with too many choices in a short time frame.

To test the impact of additional attribute information on consumer WTP, we constructed a sequence of choice experiments with the number of beef attributes presented to the respondent being 3, 4 and 5. This methodology was applied to both sets of attributes (with and without a

cue attribute). Thus, we had a total of six choice experiments. The attributes in the first choice experiment (CE1) were "Price", "Certified U.S. Product" and "Guaranteed Tender". Attributes "Guaranteed Lean" and "Days before Sell-by Date" were added to CE1 in sequence to design CE2 and CE3, respectively. Similar attributes were used in the CEs that excluded the cue. In particular, the attributes in the fourth choice experiment (CE4) were "Price", "Guaranteed Tender" and "Guaranteed Lean". Attributes "Days before Sell-by Date" and "Enhanced Omega-3 Fatty Acids" were added to CE4 in sequence to design CE5 and CE6, respectively.

Because the number of choice sets in the choice experiment could adversely affect respondent decisions (Hanley, Wright and Koop 2002; Hensher 2006), we minimized this impact by designing all experiments with the same number of choice sets. Orthogonal fractional factorial design was used to generate three sets of unlabeled alternatives with the number of attributes being 3, 4 and 5, each set consisted of eight original alternatives. The designs of all the three sets of alternatives had a D-efficiency of 100%. The first attribute of the alternatives had four levels, corresponding to the four prices levels. The other attributes had two levels, corresponding to other attributes of the beef steaks. In the second step, the eight original alternatives in each set were randomly ordered and paired with the original alternatives to create choice sets. Because in logit models, only the differences in attribute levels matter, (Louviere, Hensher and Swait 2004), the random-ordered alternatives had the maximum difference with the original alternatives. The numerical attribute levels were labeled with corresponding attribute levels of the beef steaks. A "none" alternative to each choice set was also provided to make the choice task more realistic as respondents might choose this option when shopping (Lusk and Schroeder 2004). Overall, there were eight choice sets in each choice experiment, and each

choice set included three alternatives “Option A”, “Option B” or, “Neither A nor B” (see figure 1 for examples of choice sets of CE1-CE3).

Four surveys were designed, each comprised of two choice experiments. The first survey A1 included choice experiments CE1 and CE2 and, the second survey A2 included CE2 and CE3. The third survey B1 included choice experiments CE4 and CE5 and, the fourth survey B2 included CE5 and CE6. Survey A1 and A2 were used to investigate the effects of additional attributes on consumer WTP when a cue attribute was presented while survey B1 and B2 were used to test the impact of additional attributes when no cue attribute existed. The overlapped choice experiments in the survey enabled us to conduct both within and between subject comparisons of consumer WTP. Within-subject comparisons can be conducted by comparing the WTP from choice experiments in the same survey (for example, CE1 vs. CE2 in survey A1), while between-subject comparisons can be conducted by comparing the WTP from choice experiment in different surveys (for example, CE1 in survey A1 vs. CE2 in survey A2). Each comparison approach has its advantages and disadvantages (Lusk and Schroeder 2004; Carlsson and Martinsson 2001), this enables us to draw more robust conclusions on the impacts of additional attribute information on the estimation of consumer WTP. Questions regarding respondent demographic characteristics were placed in between the two choice experiments in the survey. This helped relax respondents from the task of conducting continuously large amount of selections, thus reducing respondent fatigue by making a large number of choice decisions in a short time.

Survey Delivery and Cluster Analysis

In November, 2006, e-Rewards, Inc. an online-survey company, sent out surveys to 2200 Chicago residents, each of the four surveys went to 550 online panel members. The survey

company has comprehensive mechanisms to ensure survey respondents do not repeatedly complete a survey to gain more rewards. In addition, because we were charged for each response, budget constraints necessitated discontinuing the survey when we achieved at total of 310 respondents. This resulted in 74 completes of survey A1, 76 of A2, 78 of B1, and 82 of B2. Table 1 reports summary statistics of demographics for the four surveys completed in Chicago. The common method to study the effect of demographic on consumer behavior is to add interaction terms between attribute variable and demographic variables. The merit of this method is that the effect of each demographic variable such as gender, age etc. can be investigated explicitly. However, if large number of demographic variables and product attributes exist, adding interaction terms will significantly reduce the degrees of freedom of econometric model. This problem becomes severe in survey research where large amounts of data are not available. Therefore, in this study we used cluster analysis to classify the respondents in each survey into consumer groups based on the combinations of respondents' demographic characteristics. The basic idea of cluster analysis is that the items are organized into groups such that the similarity within groups is maximized and minimized between groups, where similarity can be can be defined as a function of distance between two items. The un-weighted pair-group method using arithmetic average was used in our analysis because this method judges the similarity between pairs of clusters in a manner less extreme than other methods such as single linkage and complete linkage methods (Romesburg 1984). Most importantly, it created the most balanced consumer groups in terms of the number of respondents. This was critical in our study because in each survey we have limited numbers of respondents. If the number of respondents in each consumer groups generated from cluster analysis was quite different, we would have one group with less than 20 respondents while the other have more than 50. The small number of

respondents in one group hindered our ability to estimate statistically efficient econometric models in the next step.

The distance between two respondents was calculated using DGOWER methods such that:

(6) $d(x,y) = 1 - \sum_{j=1}^{v} d_{x,y}^{j} / v$, where *x, y* represent two respondents and v is the number of demographic compared between two respondents.

In addition, $d_{x,y}^{j} = 1 - |x_j - y_j|$ for income level, number adults at home, number of children at home and education level.

$d_{x,y}^{j} = 1$ if two respondents have same gender or same marriage status and $d_{x,y}^{j} = 0$ otherwise.

Distance between two consumer groups can be defined as

(7) $D_{KL} = \frac{1}{N_K N_L} \sum_{i \in C_K} \sum_{j \in C_L} d(x_i, x_j)$,

where N_i *(i=K, L)* is the number of respondents in consumer group i, and x_i, x_j represent the i_{th} and j_{th} respondent.

The distance between two consumer groups is the average distance between pairs of respondent, one in each group (SAS/STAT). The consumer groups were created such that the distance between consumer groups was maximized while the distance within consumer groups was minimized. As a result, consumers in the same groups share similar characteristics. Employment status was excluded from the cluster analysis, because adding employment status to the cluster analysis did not improve the classification of consumer groups. Overall, the respondents in each survey were classified into two consumer groups (table 2). For each survey, one group (Group 1) of respondents consisted of more singles, had small family size with fewer children, lower income, and was younger, compared to the rest of the sample (Group 2).

Random Parameters Logit Models and WTP Estimates

We used the random parameters (or mixed) logit model to estimate WTP. The random parameters model eliminates limitations of standard logit models such as homogeneous taste among individuals and restricted substitution patterns between alternatives. In addition, unlike a probit model, the random parameters logit model does not require a normal distribution of the random component in the utility function, which may result in difficulty in model estimation when the number of alternatives in a model is larger than four (Train 2005; Greene 2002).

In a random parameters logit model, coefficients in an individual random utility function are decomposed into random and nonrandom parameters. For an attribute that consumers are assumed to have homogeneous preferences, a nonrandom parameter is assigned. For an attribute that there is believed to be unobserved heterogeneity among individuals, a random parameter can be assigned. Particularly, consumer random utility functions can be rewritten as:

(8) $U_{ij} = \alpha \cdot p_{ij} + \beta' \cdot x_{ij} + \varepsilon_{ij}$,

where α is the parameter associated with product price; β_{ij} is a vector of random parameters associated with other beef steak attributes x_{ij} and ε_{ij} is identically independently distributed with a Gumbel distribution which has probability density function (PDF),

$f(\varepsilon_{ij}) = e^{-\varepsilon_{ij}} \cdot \exp(-e^{-\varepsilon_{ij}})$.

The probability that consumer *i* chooses one alternative, such as *j* is $P_{ij} = \frac{e^{\mu V_{ij}}}{\sum_{k=1}^{N} e^{\mu V_{ik}}}$, where

$V_{ij} = \alpha \cdot p_{ij} + \beta' \cdot x_{ij}$, and μ is the scalar parameter that accounts for the variance of the random component in the random utility function (Train 2005; Louviere, Hensher and Swait 2004).

Heterogeneous preference among individuals and correlation across alternatives are introduced through the random parameters in the utility function. In equation (8), assuming alternative *j* has *m* number of attributes with random parameter β_{ij}, then β_{ij} can be specified as $\beta_j + \Gamma v_{ij} = \beta_j + \eta_{ij}$ (Hensher, Rose and Greene 2005). $\beta_j = [\beta_{j1} \dots \beta_{jk} \dots \beta_{jm}]$ accounts for the mean valuation of attribute across individuals, Γ is a lower triangular matrix, and v_{ij} is the random term with mean vector zero and covariance matrix *I*. The random term Γv_{ij}, or η_i captures the variations in preference across consumers or the correlations over alternatives (attributes). The full covariance matrix of random parameters β_{ij} is $\sum = \Gamma \cdot var(v_{ij}) \cdot \Gamma$. As a result, the specification of Γ will allow us to have different assumptions regarding the random parameters, thus the underlying assumption about variation in consumer preferences. If Γ is a full lower triangular matrix, all the nonrandom parameters in the consumer utility function are correlated--both the heterogeneous preferences across consumers and correlation across attributes (alternatives) can be introduced in the model (Greene 2002; Train 2005).

In the choice experiments, one respondent makes a sequence of choices. It is rational to assume that each respondent have consistent preference over product attributes, thus the random component η_i between two consumers should not be the same. Therefore, we allowed panels in the error term of the random parameters, such that $\beta_{ijt} = \beta_j + \Gamma(v_{ijt} + \mu_{ij})$, where v_{ijt} is the random error with independent and identical normal distribution across individual *i*, alternative *j* and choice set *t*, and μ_{ij} is the random error normally distributed over individual *i* and alternative *j*, but not choice sets (Greene 2002).

In the estimation of the random parameters logit models, the coefficient on product price was assumed to be a nonrandom parameter. The coefficients of other beef steak attributes were

defined as random parameters with a normal distribution to allow heterogeneous preferences for those attributes across consumers. The price coefficient was not allowed to be being random, because the normal distribution has density on both sides of zero. Assuming a normal distribution of the price coefficients would imply that some people would have positive price coefficients, which would not be consistent with the negative price-demand relationship.

Consumer WTP for *kth* attribute can be estimated as $WTP = -\beta_k/\alpha$, where β_k is the coefficient of the *kth* beef steak attribute such as "Certified U.S. Product", "Guaranteed Tender"… and α is the coefficient of price. Because the price coefficient is a nonrandom parameter and beef steak coefficients are random parameters with normal distribution, the estimated WTP for steak attributes is also a random variable with normal distribution. This will allow us not only to compare the changes in mean WTP across different consumer groups, but also to investigate the changes in the variance of WTP across different consumer groups.

With estimated mean and variance of random parameters, the Krinsky-Robb (1986) bootstrap method was used to generate 2000 values of coefficients of each beef attribute, thus, 2000 WTP could be simulated for each attribute of the beef steaks. The means of WTP from different choice experiments across consumer groups could be compared using standard t-tests, because WTPs were normally distributed. The variance of WTP could also be compared by the estimates of standard deviations of random parameters from different choice experiments. In addition, we calculated the total WTP for an alternative as the sum of the WTP for every individual attribute in a choice experiment. The total WTP measures the amount of dollars a consumer would be willing to pay for a beef steak which had all the attributes presented in a choice experiment.

Results of Model and WTP Estimates

For each consumer group, two random parameters logit models were estimated (one for each choice experiment). With eight consumer groups, a total of 16 models were estimated, four models for each survey. Tables 3 and 4 report estimation results of the 16 random parameters logit models. Because in all models the estimated off-diagonal elements of the covariance matrix of random parameters were not statistically significant, the correlation between beef steak attributes did not exist. Only the standard deviations of random parameters are reported. All the coefficient estimates were economically reasonable, with price coefficient being negative, and coefficients of other beef steak attributes being positive. Although some estimates of the coefficient of "Days before Sell-by Date" were negative, they were not significantly different from zero (0.05 level). The negative signs on the price coefficients implied negative price-demand relationships, while the positive signs of beef steak attributes indicated consumers were willing to pay premiums for those attributes. The standard deviations of random parameters of beef steak attributes were significant in most consumer groups and choice experiments. This implies there are significant heterogeneous preferences for beef steak attributes among consumers.

The results of survey A1 and A2 show that the two consumer groups respond differently to different beef steak attributes. In general, consumer group 1 was more sensitive to all the beef steak attributes, including price, with larger coefficient estimates. Consumer group 1 also had more heterogeneous preferences for "Certified U.S. Product" and "Guaranteed Tender". The results of survey B1 and B2 delivered different information. Consumer group 1 was more sensitive to "Guaranteed Tender", "Days before Sell-by Dates" and "Enhanced Omega-3 Fatty Acids", with larger absolute values of coefficient estimates. Mixed results existed with the attributes of "Guaranteed Lean" and "Price". In survey B1, consumer group 1 was more sensitive

to “Guaranteed Lean” while in survey B2 consumer group 2 was more sensitive. Consumer group 1 responded less intensively to “Price” in survey B1, while more intensively to “Price” in survey B2 compared to consumer group 2. In addition, consumer group 1’s preferences to “Guaranteed Tender” were more homogeneous in survey B1, while more heterogeneous in survey B2 compared to consumer group 2. Regarding to “Guaranteed Lean”, in general (3 in 4 cases) consumer group 1 had more homogenous preferences than consumer group 2.

Simply comparing the estimated coefficients in utility functions cannot clearly describe differences in consumer preference for product attributes across different consumer groups and surveys. This is because estimates in the random parameters logit models were confounded with the variance of the random term in the consumer utility function and the variance could not be separated from the parameter estimates. Direct comparisons of estimated parameters across choice experiments in surveys and consumer groups are not appropriate (Swait and Louviere 1993). In addition, as shown in tables 3 and 4, consumer preferences over one beef attribute and price may change in the same direction as we compare across consumer groups or surveys. As a result, comparisons of the coefficients do not represent the true differences in consumer preference across different surveys or consumer groups. Comparisons of WTP across different choice experiments provide a way to investigate changes in consumer preferences. This is because WTP estimates are the ratio of parameters of product attributes and price which do not confound with the variance of the random term in the random utility function. In addition, this ratio accounts for both changes in price and attribute coefficients when different numbers of attributes are presented in the choice experiments.

Tables 5 and 6 report means and standard deviations of WTP across surveys and consumer groups. Most of the WTP estimates are statistically different from zero (0.05 level), except the

WTP for "Days before Sell-by Date. Positive WTP indicates consumers would pay a premium for a product possessing those attributes. For both consumer groups, the value ranking of the beef steak attributes was the same, only the magnitude of WTP differed. "Certified U.S Product" is the most important beef steak attribute, followed by "Guaranteed Tender", "Guaranteed Lean" and "Enhanced Omega-3 Fatty Acids". Results are consistent with Mennecke et al. (2007) who found "Region of Origin" to be the most important beef attribute to consumers, while "Guaranteed Tender" was the 4th most important attribute ("Organic Certification" and "Cost of Cut" ranked second and third in their study). The surprisingly high WTP for "Certified U.S. Product" in some of the choice experiment may be due to our study being hypothetical, which commonly results in higher estimates of WTP in conjoint analysis. This is because in hypothetical conjoint analysis, respondents' choice processes do not involve real money, thus they may place a value for their preferred attributes higher than what they would willingly pay in real world (Lusk and Schroeder, 2004).

We are particularly interested in changes in WTP when additional attribute information was provided to respondents. Moreover, we are interested in different consumer groups' responses to the new attribute information. To achieve this purpose, we calculated the difference in WTP between different choice experiments for the same attribute. Because we were more interested in the differences in the responses to new attribute information across different consumer groups, only within subject comparisons were conducted. For example, to study the effect of "Guaranteed Lean" on the WTP for "Certified U.S. Product" and "Guaranteed Tender", only the WTP estimations between CE2 and CE1 within group 1 were compared, the WTP between CE2 in group 1 and CE1 in group 2 were not compared.

Table 7 reports differences in WTP estimation between choice experiments for all consumer groups in all surveys. Notice that the choice experiment in each survey with larger index (e.g. CE2, CE3) had one more beef steak attribute than the choice experiment with smaller index (e.g. CE1, CE2), the negative value of the differences indicated that consumers were less willing to pay for that attribute when an addition attribute was added to the choice experiment. The results in table 7 imply that the WTP did not decrease or increase monotonically with the number of attributes increasing in the choice experiments. Changes in WTP depended on the attributes we investigate and the newly added attribute in the choice experiment. For both consumer groups, WTP for "Certified U.S. Product" in survey A1 and "Guaranteed Tender" in survey B1, decreased as "Guaranteed Lean" and "Days before Sell-by Date" were added to choice experiments CE2 and CE5 respectively. However, after "Days before Sell-by Date" and "Enhanced Omega-3 Fatty Acids" were added to choice experiment CE3 and CE6 respectively, consumer WTP for "Certified U.S. Product" in survey A2 and "Guaranteed Tender" in survey B2 increased. Different consumer groups responded differently to new attribute information for "Guaranteed Tender" in survey A1 and "Guaranteed Lean" in survey B1. After "Guaranteed Lean" was added to choice experiment CE2, consumer group 1's WTP for "Guaranteed Tender" increased while consumer group 2's WTP decreased.

In general, changes in the variance of WTP as a result of new attribute information were also not monotonic with the number of the product attributes. For "Certified U.S. Product" in survey A1 and A2, the variance of WTP increased as "Guaranteed Lean" and "Days before Sell-by Date" was added to CE2 and CE3 respectively, for both consumer groups. For "Guaranteed Tender" in survey B1 and B2, as "Days before Sell-by Date" was added to CE5, the variances of

consumer WTP decreased, while the variance increased when one additional attribute, "Enhanced Omega-3 Fatty Acids " was added to CE6.

To further explore the factors that affected consumer responses to new attributes information, we estimated a simple linear regression:

(8) $DWTP = \alpha + \beta_1 \cdot Cue + \beta_2 \cdot Group1$.

Where $DWTP$ was the changes in WTP between choice experiment in Table 7, *Cue* was a dummy variable, equaling 1 if the difference in WTP was estimated from survey A1, *Group1* was also a dummy variable, equaling 1 if the difference in WTP was for consumer group 1 and zero otherwise. The estimates for this model were: $DWTP = 0.21 + 0.43 \cdot Cue + 0.52 \cdot Group1$ and all the coefficients were not significantly different from zero. In addition, the R-square was only 0.03. This implies there is no significant difference between consumer group responses to new attribute information, and the cue attribute, "Certified U.S. Product", did not affect the changes in consumer WTP. This makes sense as the results in table 7 described a mixed picture in the change in consumer WTP across consumer groups, surveys, and beef steak attributes. For example, the in survey B1, the WTP for "Guaranteed Tender" decreased more intensively for consumer group 1, while the WTP also increased with larger magnitudes than those for group 2; the change in WTP for "Guaranteed Tender" of consumer group 2 in survey A1 was negative, while the change in survey B2 was positive. In addition, for group 1 in survey A1, the change in consumer WTP for "Certified U.S. Product" was negative, while the change was positive for "Guaranteed Tender". All the results indicated that for individual beef steak attribute, the effects of additional attribute information were significantly differently between consumer groups, while the effects were not significant if we consider all the attributes.

Results in table 7 show that for some beef steak attributes, one consumer group responded in an opposite direction to the other group. It may be that one consumer group responded more intensively to new attribute information compared to other group. This would mean the absolute values of the changes in the WTPs for one consumer group were larger than those for another group. Another simple linear model was estimated as:

(8) $ADWTP = \alpha + \beta_1 \cdot Cue + \beta_2 \cdot Group1$.

Where $ADWTP$ was the absolute value of the changes in WTP between choice experiments in Table 7, *Cue* and *Group1* were defined same as in equation (7). The estimate of the model was: $ADWTP = 0.75 + 1.45 \cdot Cue - 0.08 \cdot Group1$. The coefficient of *Group1* was not significantly different from zero, while the coefficient of *Cue* was significantly different from zero at 1% significance level. The R-square was 0.32. The results of the simple regression suggest that, overall, the two consumer groups responded in the same way to the new attribute information. However, if the cue attribute, "Certified U.S. Product", was present in the surveys, consumers tended to respond more intensively to the newly added attribute information. In addition, two similar linear models were estimated with the dependent variables being the changes in the variance and absolute value of variance, respectively of WTP between choice experiments in Table 7. Results showed that both variables *cue* and *group1* did not have significant effects on the dependent variable.

With cue attributes in a survey, consumers' more intensive responses to the new attribute information were reasonable. This is because a cue attribute such as "Certified U.S. Product" serves as a proxy to product quality. The presence of a cue attribute always implies the existence of other food attributes, and may indicate the quality of other food attributes. New attribute information will decrease or enhance the proxy function of the cue attributes, depending on the

relationship between the new attribute and the attribute of interest. Loureiro and Umberger's (2003) showed that consumers viewed country of origin labels as indicators of food safety, freshness and other quality attributes, which is consistent with our results.

Conclusions and Discussion

Progressively more studies on consumer perceptions and WTP for food product attributes are being conducted to provide information to policy makers, producers, and processors. In most studies, consumer WTP for one quality attribute is assumed to be independent of other attributes and limited attribute information on food products are provide in consumer surveys. Various studies in conjoint analysis have shown that additional attributes affect consumer choice behavior and preference (Broniarczyk and Alba 1994; Hensher et al. 2005; Hensher's 2006; Islam et al. 2007; Johnson and Levin 1985). Results of those studies raise questions about our ability to accurately elicit consumer preferences for product attributes using survey methods. Few have investigated factors that affect consumer responses to new attribute information or connect consumer responses to new attributes to consumer characteristics.

Our study provides new knowledge on how consumer characteristics affect WTP of food product attribute information and how this is conditional on the attribute information set provided to the consumer. Cluster analysis provides a way to divide respondents in each survey into groups according to consumer demographic characteristics. For each survey, one group (Group 1) of respondents had smaller family size with fewer children, lower income, and were younger, compared to the rest of the sample (Group 2). The 16 sets of WTP (2 consumer groups×2 CE in each survey×4 surveys=16) calculated from random parameter logit models showed that consumer WTP for beef attributes varied significantly across groups, conditioning whether a cue attributes was included in the CE or not. When there was no cue attribute (in

survey B1 and B2), consumers in Group 1(2 in 12 comparisons) were willing to pay more for most of beef attributes. Consumer responses to new attribute information were also conditioned on the existence of the cue attributes. For individual beef steak attributes, different consumer groups responded to new attribute information significantly differently. However, if all attributes were considered, overall, there was no significant difference in the responses to new attribute information between the two groups. In the survey where the cue attribute "Certified U.S. Product" was presented, consumers in both groups responded significantly more intensively to new information than in the case where there was no cue attribute in the survey. In addition, when the cue attribute existed in surveys, consumer responses to new information in group 1 were more heterogonous (larger variance of the changes in WTP) than the responses of consumers in group 2.

A weakness in our study is our survey was hypothetical as no money nor actual products were involved in respondent purchase decisions. This may result in higher WTP estimates as is typical in hypothetical conjoint analysis (Lusk and Schroeder, 2004). However, we are particularly interested in how and whether the difference exist in changes of revealed WTP between different consumer groups. We do not contend that our results demonstrate the WTP for COOL or other beef attributes by society. In fact, we show that WTP estimation is conditional on attribute information provided in the surveys (consistent with meta-analysis findings of Verlegh and Steenkamp), and when cue attributes exist, consumers are more sensitive to new attributes. The magnitude of change in WTP estimates as the number of attributes presented to the consumer varies is an empirical issue. And the fact that when the cue attribute exists in the survey, the elicited WTP estimates are more fragile to the information ignored or excluded in a survey. Future studies should focus on the mechanism or methodology to reduce the impact of

additional attribute information on consumer decision making so that the preferences elicited from survey studies are more stable with respect to excluded attribute information.

Choice set in CE1

Attribute:	*Option A*	*Option B*
Price ($/lb.):	$6.93	$4.64
Certified U.S. Product:	Yes	Yes
Guaranteed Tender:	Yes	No
I choose.....		
Neither A nor B	*Option A*	*Option B*

Choice set in CE2

Attribute:	*Option A*	*Option B*
Price ($/lb.):	$4.64	$9.22
Certified U.S. Product:	No	Yes
Guaranteed Tender:	No	Yes
Guaranteed Lean:	Yes	Yes
I choose.....		
Neither A nor B	*Option A*	*Option B*

Choice set in CE3

Attribute:	*Option A*	*Option B*
Price ($/lb.):	$6.93	$9.22
Certified U.S. Product:	Yes	Yes
Guaranteed Tender:	Yes	Yes
Guaranteed Lean:	No	Yes
Days before Sell-by Date:	2	8
I choose.....		
Neither A nor B	*Option A*	*Option B*

Figure 1 Example Choice Sets in Different Choice Experiments

Table 1. Means and Standard Deviations of Respondent Demographics by Location and Survey

	Chicago, IL			
Variable	A1	A2	B1	B2
Age [c]	43.30[a]	45.46	44.33	46.98
	(12.10)[b]	(11.91)	(12.30)	(10.62)
Income [d]	6.57	6.30	6.35	5.96
	(2.35)	(2.12)	(2.36)	(2.27)
# of Adults [e]	2.01	2.00	1.94	1.99
	(0.81)	(0.79)	(0.72)	(0.92)
# of Children [f]	0.62	0.30	0.47	0.45
	(1.01)	(0.69)	(0.83)	(0.77)
Gender [g]				
Male	43%	36%	59%	32%
Female	57%	64%	41%	68%
Education [h]				
1	8%	0%	0%	0%
2	20%	5%	1%	6%
3	38%	29%	24%	34%
4	34%	33%	41%	34%
5	0%	33%	33%	26%
Marriage				
Single	26%	28%	24%	24%
Married	62%	57%	63%	57%
Other	12%	16%	13%	18%
Employment				
Full Time	68%	78%	69%	72%
Part Time	12%	4%	17%	12%
Unemployed	9%	1%	3%	7%
Student	4%	0%	3%	1%
Retired	7%	4%	9%	7%
# of respondents	74	76	78	82

a Reported statistics of Age, Income, # of Adults and # of Children are mean values.
b The numbers in parentheses are standard deviations.
c Age: Age in years
d Income: Household annual income level.
1=Under $10,000; 2=$10,000 to $24,999 …13=$300,000 to $399,999; 14=$400,000 and more
e # of Adults: Number of people 18 years old and older living in household
f # of Children: Number of children less than 18 years old living in household
g Reported statistics of Gender, Education, Marriage, and Employment are frequency of the variable levels among respondents.
h Education: 1=1st through 8th grade; 2=Some high School or high school graduate; 3=Some college/2 year associate degree; 4=Four year college degree; 5=Master or Ph.D. degree

Table 2. Means and Standard Deviations of Respondent Demographics by Survey and Consumer Group

	Survey A1		Survey A2		Survey B1		Survey B2	
Variable	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Age	43.22	43.36	40.24	49.47	41.10	46.24	45.54	48.04
	12.68	11.94	11.01	11.24	11.48	12.60	11.76	9.80
Income	5.34	7.50	5.88	6.63	5.69	6.73	4.86	6.79
	2.09	2.16	2.04	2.16	2.55	2.21	1.83	2.25
# of Adults	1.56	2.36	1.76	2.19	1.45	2.22	1.49	2.36
	0.76	0.69	1.03	0.50	0.63	0.62	0.89	0.76
# of Children	0.13	1.00	0.21	0.37	0.10	0.69	0.14	0.68
	0.34	1.19	0.60	0.76	0.31	0.96	0.43	0.89
Gender								
Male	25%	57%	33%	37%	34.48%	44.90%	22.86%	38.30%
Female	75%	43%	67%	63%	65.52%	55.10%	77.14%	61.70%
Education								
1	41%	14%	0%	0.00%	0.00%	0.00%	0.00%	0.00%
2	13%	5%	0%	9%	0.00%	2.04%	8.57%	4.26%
3	47%	57%	30%	28%	27.59%	22.45%	42.86%	27.66%
4	0%	24%	33%	33%	41.38%	40.82%	31.43%	36.17%
5	0%		36%	30%	31.03%	34.69%	17.14%	31.91%
Marriage								
Single	59%	0%	64%	0%	65.52%	0.00%	57.14%	0.00%
Married	19%	95%	0%	100%	0.00%	100%	0.00%	100%
Other	22%	5%	36%	0%	34.48%	0.00%	42.86%	0.00%
# of respondents	32	42	33	43	29	49	35	47

Table 3. Random Parameters Logit Model Result for Surveys A1 and A2 by Consumer Group

Survey	Survey A1				Survey A2			
Consumer Group	Group 1		Group 2		Group 1		Group 2	
Choice Experiment	CE1	CE2	CE1	CE2	CE3			CE3
Independent Variable	Coefficient							
Certified U.S. Product	3.79	2.79	2.53	1.59	2.30	2.23	2.00	2.74
	(0.00)[a]	(0.00)	(0.00)	(0.00	(0.00)	(0.00)	(0.00)	(0.00)
Guaranteed Tender	1.29	1.77	1.78	1.15	1.91	2.09	1.50	1.45
	(0.00)	(0.00)	(0.00)	(0.00	(0.00)	(0.00)	(0.00)	(0.00)
Guaranteed Lean		0.89		0.75	0.88	0.95	1.09	0.67
		(0.04)		(0.02	(0.02)	(0.01)	(0.00)	(0.01)
Days before Sell-by Date						0.21		0.11
						(0.01)		(0.01)
Price	-0.38	-0.34	-0.31	-0.28	-0.44	-0.31	-0.36	-0.24
	(0.00)	(0.00)	(0.00)	(0.00	(0.00)	(0.00)	(0.00)	(0.00)
Constant for the None Option	0.17	0.79	0.34	0.25	-0.59	2.39	-0.21	1.52
	(0.74)	(0.21)	(0.42)	(0.58	(0.31)	(0.00)	(0.64)	(0.00)
	Standard deviations of parameter distributions							
Std Guaranteed U.S. Product	1.67	1.72	1.32	0.89	0.77	1.42	1.40	1.47
	(0.00)	(0.00)	(0.00	(0.00)	(0.13)	(0.00)	(0.00)	(0.00)
Std Guaranteed Tender	1.72	1.31	1.33	0.96	2.32	0.89	0.53	0.75
	(0.00)	(0.00)	(0.00	(0.00)	(0.05)	(0.01)	(0.05)	(0.00)
Std Guaranteed Lean		1.61		1.55	1.21	0.09	1.55	0.95
		(0.00)		(0.35)	(0.00)	(0.89)	(0.00)	(0.00)
Std Days before Sell-by Date						0.11		0.13
						(0.03)		(0.00)
Log Likelihood	-178.1	-186.2	-256.6	-278.3	-184.7	-204.3	-269.0	-294.3
# of respondents	32		42		33		43	

[a] The number in parentheses are p-values.

Table 4. Random Parameters Logit Model Result for Surveys A1 and A2 by Consumer Group

Survey	Survey B1				Survey B2			
Consumer Group	Group 1		Group 2		Group 1		Group 2	
Choice Experiment	CE4	CE5	CE4	CE5	CE5	CE6	CE5	CE6
Independent Variable	Coefficient							
Guaranteed Tender	2.22	2.06	2.05	2.47	2.14	2.03	1.42	1.57
	(0.00)[a]	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Guaranteed Lean	1.14	1.47	0.84	1.07	0.94	0.92	1.12	1.20
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Days before Sell-by Date		0.10		-0.06	0.09	0.06	-0.01	-0.03
		(0.12)		(0.31)	(0.09)	(0.20)	(0.73)	(0.45)
Enhanced Omega-3 Fatty Acids						0.45		0.41
						(0.14)		(0.06)
Price	-0.39	-0.43	-0.51	-0.70	-0.57	-0.35	-0.38	-0.32
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant for the None Option	-1.73	-1.01	-1.89	-3.54	-2.94	-0.71	-2.13	-1.00
	(0.74)	(0.86)	(0.00)	(0.00)	(0.00)	(0.09)	(0.00)	(0.00)
	Standard deviations of parameter distributions							
Std Guaranteed Tender	1.42	0.96	1.62	1.14	1.22	1.32	0.47	0.17
	(0.00)	(0.12)	(0.00	(0.00)	(0.13)	(0.00)	(0.11)	(0.77)
Std Guaranteed Lean	1.10	0.68	1.59	1.01	1.04	0.07	0.57	0.45
	(0.00)	(0.70)	(0.00	(0.00)	(0.02)	(0.89)	(0.03)	(0.14)
Std Days before Sell-by Date		0.22		0.31	0.19	0.16	0.11	0.12
		(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Std Enhanced Omega-3 Fatty						1.19		0.08
						(0.00)		(0.00)
Log Likelihood	-194.61	-176.0	-305.6	-264.7	-218.0	-253.2	-319.6	-343.4
# of respondents	29		49		35		47	

[a] The number in parentheses are p-values.

Table 5. WTP Estimates in Survey A1 and A2 by Consumer Group

	Survey A1				Survey A2			
	Group 1		Group 2		Group 1		Group 2	
WTP for…[a]	CE1	CE2	CE1	CE2	CE2	CE3	CE2	CE3
Certified U.S. Product	10.17* (1.77)[e]	8.57* (2.34)	8.42* (1.46)	5.88* (1.47)	5.33* (1.07)	7.41* (1.80)	5.74* (1.15)	11.55* (2.30)
Guaranteed Tender	3.40* (1.21)	5.43* (1.72)	5.97* (1.35)	4.26* (1.29)	4.45* (1.37)	7.01* (1.58)	4.28* (0.89)	6.15* (1.48)
Guaranteed Lean		2.67* (1.34)		2.76* (1.27)	2.05* (0.87)	3.25* (1.19)	3.08* (0.99)	2.82* (1.27)
Days before Sell-by Date						0.71* (0.19)		0.44* (0.18)
Total WTP [b]	13.58*	16.68*	14.40*	12.92*	11.82*	18.38*	13.10*	20.97*

[a] WTP values are derived from models in Table 3. WTP values are dollars for a 12 oz beef steak.
[b] Total WTP are the sum of WTP for all individual attributes in each choice experiment.
[c] Reported statistics are mean of 2000 simulated WTP estimations.
[*] indicates statistically significantly different from zero at 5% significance level
[e] Values in parenthesis are standard deviation

Table 6. WTP Estimates in Survey B1 and B2 by Consumer Group

	Survey B1				Survey B2			
	Group 1		Group 2		Group 1		Group 2	
WTP for…[a]	CE4	CE5	CE4	CE5	CE5	CE6	CE5	CE6
Guaranteed Tender	5.75*	4.83*	4.02*	3.56*	3.79*	5.92*	3.76*	4.96*
	(1.07)	(0.97)	(0.67)	(0.43)	(0.59)	(1.15)	(0.57)	(0.88)
Guaranteed Lean	2.99*	3.45*	1.63*	1.55*	1.65*	2.70*	3.00*	3.80*
	(0.85)	(0.83)	(0.58)	(0.43)	(0.55)	(0.74)	(0.62)	(0.70)
Days before Sell-by Date		0.22		-0.09	0.15	0.17	-0.03	-0.08
		(0.15)		(0.09)	(0.10)	(0.14)	(0.10)	(0.11)
Enhance Omega-3 Fatty Acids						1.31		1.28
						(0.85)		(0.69)
Total WTP [b]	8.74*	8.51*	5.65*	5.02*	5.61*	10.10*	6.73*	9.95*

[a] WTP values are derived from models in Table 4. WTP values are dollars for a 12 oz beef steak.
[b] Total WTP are the sum of WTP for all individual attributes in each choice experiment.
[c] Reported statistics are mean of 2000 simulated WTP estimations.
[*] indicates statistically significantly different from zero at 5% significance level
[e] Values in parenthesis are standard deviation

Table 7. Changes in WTP Estimates between Choice Experiment by Survey and Consumer Group

	Survey A1		Survey A2		Survey B1		Survey B2	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Differences in WTP[a]	CE2-CE1	CE2- CE1	CE3- CE2	CE3- CE2	CE5-CE4	CE5-CE4	CE6-CE5	CE6-CE5
Certified U.S. Product/ Guaranteed Tender [b]	-1.60* (0.57)[c]	-2.54* (0.01)	2.08* (0.73)	5.81* (1.14)	-0.91* (-0.10)	-0.46* (-0.25)	2.12* (1.14)	1.20* (0.73)
Guaranteed Tender/ Guaranteed Lean	2.02* (0.51)	-1.71* (-0.07)	2.56* (0.20)	1.88* (0.58)	0.46* (0.03)	-0.08* (-0.15)	1.04* (0.59)	0.80* (0.21)
Guaranteed Lean/ Days before Sell-by Date			1.20* (0.31)	-0.27* (0.27)			0.01* (0.28)	-0.05* (0.31)

[a] Difference in WTP between different choice experiments, CEi-CEj, where i-j=1, and i=2, 3, 5, 6.
[b] Upper attributes in each row are for survey A1 and survey A2 and bottom attributes in each row are for survey B1 and survey B2.
[c] Values in parenthesis are difference in standard deviation of WTP between different choice experiments.

References

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

Broniarczyk, S.M. and J.W. Alba. 1994 "The Role of Consumers' Intuitions in Inference Making." *Journal of Consumer Research* 21:393-407.

Carlsson, F. and P. Martinsson. 2001. "Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments?- Application to the Valuation of the Environment." *Journal of Environmental Economics and Management* 41:179-192.

Fox, J.A., D.J. Hayes, J.B. Kliebenstein and J.F. Shogren. 1994. "Consumer Acceptability of Mile From Cows Treated with Bovine Somatotropin." *Journal of Dairy Science* 77:703-707.

Fox, J.A. 1995. "Determinants of Consumer Acceptability of Bovine Somatotropin." *Review of Agricultural Economics*. 17: 51-62.

Gao, Z. and T. Schroeder. "Effect of Additional Quality Attributes On Consumer Willingness-to-Pay for Food Labels." Selected Paper, Annual Meeting, American Agricultural Economics Association, Portland, Oregon, July, 2007

Greene, W.H. 2002. *NLOGIT Version 3.0 Reference Guide*, Plainview, NY, USA: Econometric Software, Inc.

Hanley, N., R.E. Wright and G. Koop. 2002. "Modeling Recreation Demand Using Choice Experiments: Climbing in Scotland." *Environmental and Resource Economics* 22:449-466.

Hallman, W.K., W.C. Hebden, H.L. Aquino, C.L. Cuite and J.T. Lang. 2003. "Public Perception of Genetically Modified Foods: A national Study of American Knowledge and Opinion."

(Public number RR-1003-004). New Brunswick, New Jersey; Food Policy Institute, Cook College, Rutgers- The State University of New Jersey.

Hensher, D.A., J. Rose and W. H. Greene. 2005. "The Implications on Willingness to Pay of Respondents Ignoring Specific Attributes." *Transportation* 32:203-222.

Hensher, D.A. 2006. "Revealing Difference in Willingness to Pay due to the Dimensionality of Stated Choice Designs: An Initial Assessment." *Environmental and Resource Economics* 34:7-44.

Hensher, D.A., J.M. Rose and W.H. Greene. 2005. *Applied Choice Analysis: A Primer* Cambridge, UK: Cambridge University Press.

Hossain, F., B. Onyango, B. Schilling, W. Hallman and A. Adelaja. 2003. "Product attributes, Consumer Benefits and Public Approval of Genetically Modified Foods." *International Journal of Consumer Studies* 27: 353-365.

Hu, W., A. Hunnemeyer, M. Veeman, W. Adamowicz and L. Srivastava. 2004. "Trading off Health, environmental and Genetic Modified Attributes in Food." *European Review of Agricultural Economics* 31: 389-408.

Huber, J. and J. McCann. 1982. "The Impact of Inferential Beliefs on Product Evaluations." Journal of Marketing Research 19:324-333.

Huffman, K.L., M.F. Miller, L.C. Hoover, C.K. Wu, H.C. Brittin, and C.B. Ramsey. 1996."Effect of Beef Tenderness on Consumer Satisfaction with Steaks Consumed in the Home and Restaurant." Journal of Animal Science 74:91-97.

Islam, T., J.J. Louviere and P.F. Burke. 2007. "Modeling the Effects of Including/Excluding Attributes in Choice Experiments on Systematic and Random Components." *International Journal of Research in Marketing* 24:289-300.

Johnson, R.D. and I.P. Levin. 1985. "More than Meets the Eyes: The Effects of Missing Information on Purchase Evaluations." *Journal of Consumer Research* 12:169-177.

Kardes, F. R., S.S. Posavac, and M.L. Cronley. 2004. "Consumer Inference: A Review of Processes, Bases and Judgment Context." *Journal of Consumer Psychology* 14:230-256.

Krinsky, I., and A. Robb. 1986. "On Approximating the Statistical Properties of Elasticities." *Review of Economics and Statistics* 64:715-719.

Krystallis, A. and G. Chryssohoidis. 2005. "Consumer's Willingness to Pay for Organic Food: Factors that affect it and Variation per Organic Product Type." *British Food Journal* 107: 320-343.

Lancaster, Kelvin. 1972. *Consumer Demand: A New Approach* New York: Columbia University Press.

Livestock Marketing Information Center. 2006. *Retail Scanner Prices for Meats*. Lakewood, CO, January.
Available at: http://www.retail-lmic.info/CD/StandardReports/BLSTable1.htm (Accessed February, 2006)

Louviere, J.J., D.A. Hensher and J.D. Swait. 2000. *Stated Choice Methods: Analysis and Application* Cambridge, UK: Cambridge University Press.

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

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

Lusk, L.J., J. Roosen and J. A. Fox. 2003. "Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France,

Germany, the United Kingdom and the United States." *American Journal of Agricultural Economics* 85:16-29.

Lusk, L.J. and T.C. Schroeder. 2004. "Are Choice Experiment Incentive Compatible: A Test with Quality Differentiated Beef Steak." *American Journal of Agricultural Economics* 86: 467-482.

Mennecke, B., A. Townsend, D. J. Hayes, and S. Lonergan. 2007. "A Study of the Factors that Influence Consumer Attitudes Toward Beef Products Using the Conjoint Market Analysis Tool." *Journal of Animal Science* 85: 2639-2659.

Romesburg, C. H. 1984. *Cluster Analysis for Researchers, Belmont,* CA: Lifetime Learning Publications.

Swait, J. and Louviere J. 1993. "The Role of the Scale Parameter in the Estimation and Comparison of Multinomial Logit Models." *Journal of Marketing Research* 30:305-14.

SAS/STAT(R) 9.2 User's Guide. Available online at http://support.sas.com/documentation/cdl/en/statug/59654/HTML/default/statug_cluster_sect012.htm

Train, K.E. 2005. *Discrete Choice Methods with Simulation*, New York: Cambridge University Press.

Umberger,W.J., D. M. Feuz, C. R. Calkins and B. M. Stiz. 2003. "Country-of-Origin Labeling of Beef Products: U.S. Consumer' Perceptions." *Journal of Food Distribution Research* 34:103-116.