Estimating Consumers' Willingness-To-Pay for Country-Of-Origin Labels in Fresh Apples and Tomatoes: A Double-Hurdle Probit Analysis of American Data Using Factor Scores

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Abstract

Data are collected from primary shoppers in Gainesville Florida, Atlanta Georgia and Lansing Michigan using a Vickrey (fifth-priced sealed bid) experimental auction and a survey questionnaire to provide a sample of 311 observations useable for analysis. The average willingness to pay (WTP) for country of origin labeling (COOL) "Grown in the U.S." in apples and tomatoes are calculated then tested for equivalence to assess if WTP is produce specific. A double-hurdle probit model is then estimated to ascertain the prominent determinants of WTP for COOL. Independent variables include demographics, food safety and factor scores derived from a factor analysis of food quality and food preference variables. Results show that on average consumers are willing to pay $0.49 and $0.48 for COOL in apples and tomatoes respectively with 79% of the consumers willing to pay more than $0.00 for apples labeled "Grown in the U.S." and 72% in the case of tomatoes. Premiums are found to be statistically equivalent suggesting that WTP for COOL is not produce specific. The double hurdle probit estimation finds most independent variables insignificant with the exception of the food quality factor scores and consumer trust levels for information they receive from U.S. government agencies. Location, age and income also turn out to be significant factors in the case of the truncated part of the estimation as do food quality and food safety concerns.

Key words: Willingness to pay, Country of Origin Labeling, Vickrey Auction, Apples and tomatoes

Introduction

As consumer demand for agricultural food-products becomes more complex and dynamic, food labeling is taking an increasingly important role in the food marketing system (McCluskey and Loureiro, 2003). Consumers are constantly obtaining different kinds of information about food-product attributes via food labels and their purchasing decisions are influenced by these. Theoretically, consumers demand food-product attributes (e.g. food quality or taste) not the food-product per se and the food-product is considered to be merely a bundle of these individual attributes that give rise to utility. Thus purchasing decisions made by consumers are based on specific food-product attributes embodied in a food-product (Lancaster, 1966). An understanding of this is important if one is to recognize the significance of food labeling. This is because food labels present information about specific food-product attributes, which potentially can affect consumer willingness to pay (WTP) and in turn the effective demand for the food-product.

Recent studies show that consumers will pay premiums for certain attribute claims made by different food labels, e.g. “Environmentally-friendly” claims made by eco-labels, “organically produced product” claims in organic labels, “non-GM food” claims in non-GM labels and “U.S. Certified” in the case of Country of Origin Labeling (COOL) (Loureiro, McCluskey and Mittlehammer, 2001; Burton et al 2001; Umberger et al, 2002 respectively). These studies allude to credence attributes, which consumers have no reasonable means of verifying for themselves.

In the U.S. fresh produce industry this is a topical issue, particularly COOL. The main reason is recent Mandatory Country of Origin Labeling (MCOOL) legislation in the

2002 Farm Security and Rural Investment Act. Subtitle D of this composite act specifies that currently market actors can voluntarily label their produce with COOL so as to inform shoppers at the final point of purchase the origin of the produce. Guidelines for voluntary COOL which were issued by the USDA in October 2002, apply to meats (beef, pork, lamb and fish) as well peanuts, fruits and vegetables – the so-called covered products (VanSickle, 2003). These products were selected because they are food products most prone to food safety and health problems.

The law, however, is set to change to MCOOL. This change was initially set to be effective on the 30th of September 2004 but has been postponed by two years with the passing of the Omnibus Appropriations bill in January 2003. The imminent change in law brings to the forefront several issues of debate, which surround justification of the policy. One of these major issues concerns consumers' WTP for COOL. There is little empirical information on how much consumers are WTP for COOL. Information on this would be important in pointing policy and/or decision makers in a particular direction in as far as implications of MCOOL are concerned (Menkhaus, 2001).

This study seeks to fill part of this information gap by analyzing if American primary shoppers are WTP a premium for fresh apples and tomatoes labeled "Grown in the U.S." In addition, the study examines whether premiums for "Grown in the U.S." labels are product specific or not, in the context of apples and tomatoes.

Previous Studies

Food labeling in the Apples Market

In the last decade several studies have been carried out on food labeling in the produce industry and apples in particular. In 1999, Blend and Van Ravenswaay studied eco-labeling in apples and found consumers to be willing to try eco-labeled apples. More than a third of American consumers were willing to pay a $0.40 premium for a pound of eco-labeled apples.

Loureiro, McCluskey and Mittelhammer (2001) also studied WTP for organic labels and eco-labels in apples. Using contingent valuation methods (CVM) they collected data from the Midwest and estimated a maximum-likelihood multinomial logit model. Results found food safety, produce quality and environmental concerns to be significant and positively affecting WTP. Presence of children under the age of 18 in the household was also found to be a significant factor increasing the probability of an American consumer to purchase organic labeled apples.

Country of Origin Labeling Studies

Schupp and Gillespie (2001) are part of the first researchers who turned the focus onto COOL in agricultural products and specifically beef. By analyzing a sample of Louisiana households they found an average of 90.3 percent consumers supporting MCOOL. Also, they estimated a probit model and established that food safety concerns were a significant factor increasing the probability of a consumer to support MCOOL. Consumer preference for locally produced beef also positively affected the likelihood to support MCOOL.

In Loureiro and Umberger (2002) Colorado consumers were sampled from different stores and shown to be willing to pay for a MCOOL program. Consumers who had completed a high level of education and had high household incomes were less likely to pay a premium for "U.S. Certified" labels in beef. This disproved initial hypotheses that more educated and wealthier consumers would pay attention to COOL and be more likely to pay a premium for it. Female consumers were most likely to pay a premium for COOL and to be more supportive of MCOOL.

In 2004, Loureiro and Umberger used experimental auctions to solicit information about U.S. consumers' WTP for COOL in beef. They ascertained that COOL in beef is a less important determinant of consumers' WTP as compared to food safety inspection labels, product quality labels (tenderness) or traceability of the beef. Similar findings were made in Europe, (see Roosen, Lusk and Fox; Verbeke and Ward) implying that food quality and food safety are very important factors that may override country of origin.

While all these studies provide evidence for a causal relationship between WTP for COOL, and the demographics, food quality and food safety variables, other variables may play a role on the nature of the relationship e.g. geographic location, or product under consideration. With respect to fruits and vegetables the situation is unclear, since the majority of previous studies focused on beef. This research delves into these specific issues to address COOL in apples and tomatoes.

Theoretical Framework

The random utility approach is used to estimate the consumer's WTP decision process. This process can be broken down into two parts, i) the participation decision and ii) the consumption decision, where the former refers to the choice whether or not the consumer is willing to pay for COOL and the latter referring to how much, if indeed the consumer is willing to pay.

We assume that the individual consumer can attain utility from a specific product attribute, in this case COOL in apples or tomatoes ("Grown in the U.S."). This utility is a function of consumer characteristics that influence consumer choice and the cost that the consumer is willing to pay in order to obtain the attribute. Thus,

(1) $U = U(\pi_i - c_i) \geq 0$, where π_i is a combination of consumer characteristics and c_i the cost that the consumer will pay to obtain the attribute.

Utility gained from the attribute is zero when the consumer is not willing to pay anything to obtain the attribute, otherwise it is greater than zero. We disregard the case of disutility (i.e. $U < 0$) because we assume a rational consumer where the buying decision ultimately must yield positive utility.

The utility function is unobservable and cannot be measured by the researcher. However, a proxy measure of utility can be estimated by the WTP. Similarly, we assume that not all consumer characteristics are directly observable and quantifiable, e.g. consumers' perceptions about food quality or consumers' feelings about food preferences. Instead, these are latent constructs whose phenomena are observed via other directly quantifiable proxy variables. Thus, we deconstruct the utility function in similar fashion to Adamowicz et al (1998), with the only difference being that we propose a directly observable deterministic part λ_i, an indirectly observable deterministic part ρ_i, and a stochastic error term ε_i. The error term is assumed to be independent and identically distributed with a mean of zero and a constant variance.

(2) $$U(\pi_i - c_i) = V(\lambda_i, \rho_i - c_i) + \varepsilon_i$$

We postulate that the variance of the indirectly observable ρ_i can be better estimated by way of a factor analysis of the directly observable and quantifiable proxies θ_i, rather than by using an individual observable proxy variable. Mathematically,

(3) $\rho_i = \psi\theta_i$, where ψ is a vector of factor loadings

Thus the WTP decision can then be framed in likelihood terms as

(4) $\Pr\{PMT_i \geq 0\} = \Pr\{V(\lambda_i, \rho_i) \geq -\varepsilon_i\}$, even though ρ_i is unobservable directly. The above forms the basic theoretical framework for the double hurdle model estimation with factor scores, which we propose in this study.

Methods

Since the decision process on WTP for COOL is a two-step process we model it using Cragg's double hurdle model. Thus;

(5) $WTP_i^* = Z_i^{'}\beta + u_i$ for the participation equation denoting the dichotomous willing to pay or not willing to pay part of the framework.

Then,

(6) $PMT_i^* = X_i^{'}\gamma + \varepsilon_i$ for the quantitative consumption part of the framework.

In (5) the variable WTP_i^* is the consumer willingness to pay assuming 0 if not and 1 if willing to pay. This dependent variable represents the underlying utility associated with the participation decision; essentially whether or not the consumer derives utility from the attribute. In (6) PMT_i^* is the actual premium that consumers are willing to pay for the apples or tomatoes with COOL, if in (5) WTP_i^* was equal to 1. This represents the magnitude of the latent utility associated with the COOL attribute.

$Z_i^{'}$ and $X_i^{'}$ are predictor vectors while β and γ are parameter vectors to be estimated for the respective predictor vectors. $Z_i^{'}$ and $X_i^{'}$ can potentially be identical and include reduced variables in the form of factor scores derived from factor analysis. If $Z_i^{'}$ and $X_i^{'}$ are equal and β and γ are also equal then the tobit model results instead of a truncated tobit.

u_i and ε_i are random error terms, normally independently distributed.

$u_i \sim NID(0,\sigma^2)$ and $\varepsilon_i \sim NID(0,1)$

Theoretically the underlying utility which is non-measurable can also be expressed as $U_i^* = f(X_i^*, Z_i^*)$ where U_i^* is the individual consumer's utility.

Equations (5) and (6) are estimated separately with the first being estimated first because its results are used in the estimation of the second (i.e. in estimation of the censoring rule). A probit model can be estimated for the first equation using the maximum likelihood function:

$$\text{(7)} \qquad \Pr(PMT_i = 0 \mid Z_i^*, X_i^*) = \Phi(-X_i^*\gamma/\sigma) + \Phi(X_i^*\gamma/\sigma)\Phi(-Z_i^*\beta)$$

Then the second equation can be estimated using,

$$\text{(8)} \qquad f(PMT_i \mid Z_i^*, X_i^*, PMT_i > 0) = \frac{\exp\{-(PMT_i - X_i^*\gamma)^2/2\sigma^2\}\Phi(Z_i^*\beta)}{\sqrt{2\pi\sigma^2}}$$

Where Φ signifies the standard normal cumulative density function.

Data

Data were collected in December 2003 and January 2004 using a Vickrey experimental auction (fifth-priced sealed bid) and a written questionnaire. The Vickrey auction solicited data on WTP premiums after which written questionnaires collected data on numerous variables including demographics, food safety concerns, food quality concerns and food preferences. Data were collected in Gainesville, FL, Atlanta, GA and Lansing, MI and participating respondents were randomly recruited through local civic organizations, ranging from faith based organizations to Parents Teachers Associations (PTA) at schools. The survey was conducted in each respective organization's facilities and compensation made for the use of the facilities. A total of 335 primary shoppers were sampled and Table 1a shows the breakdown of these across locations. In total, 311 observations were useable for analysis; 175 in the tomato auction and 136 in the apple auction. The 24 observations deleted were unusable due to missing data.

Fewer respondents were recruited from Lansing, MI, making the data unevenly distributed across locations, particularly in the case of the apples data. The respondents' ages ranged from 25 to 65 years and only primary shoppers participated in the survey. Research protocol had specifically asked for primary shoppers only. A primary shopper was defined as an individual responsible for at least 50 percent of food purchases in the household.

Comparing the sample data to the U.S. population census revealed several disparities. For instance, 88.4% of the sample was female compared to 50.9% in the U.S. census. This was nonetheless expected considering that most primary shoppers are indeed female and that this was the target population. However, the observed disparities call for caution in the interpretation of results from this study. Extrapolative generalizations based on the study may be erroneous. Table 2 shows details regarding the comparability of the survey data to the national census data.

Disparities are evident in terms of the ethnicity, the highest level of education attained and the pre-tax household income variables. The greatest disparity showed up in the highest level of education attained where the majority of the sample had attained a much higher level of education than the general U.S. population. Moreover, the survey captured household primary shoppers that were more affluent relative to the census data. Nearly a third of the respondents had a pre-tax household annual income greater than $100,000 as compared to only 14 percent for the census data (U.S Census Bureau, 2000). Even though the data used in the study were somewhat deviant from the U.S. population profile, they were useable because the deviation was initially expected since the target population of the study was American primary shoppers and not the general U.S. population. Also, some similarities with U.S. census data were found as shown in Table 2.

Empirical Model Specification

In analyzing the factors that influence the WTP for COOL, the following double hurdle probit model was specified.

$$WTP_i = \beta_1 Age + \beta_2 Gender + \sum_{i=3}^{4} \beta_i Edu_i + \sum_{i=5}^{6} \beta_i Loc_i + \sum_{i=7}^{9} \beta_i Inc_i + \beta_{10} Expose + \sum_{i=11}^{13} \beta_i PC_i + \beta_{14} Trust + \beta_{15} Safe + \sum_{i=16}^{18} \beta_i Pfr_i + \sum_{i=19}^{20} \beta_i Qual_i + u_i \quad (9)$$

Where: $\boldsymbol{WTP_i}$ is the dichotomous willingness to pay (i.e. participation dependent variable), expressed as a probability

For the second hurdle $\boldsymbol{PMT_i}$ replaces $\boldsymbol{WTP_i}$, where $\boldsymbol{PMT_i}$ is the quantitative willingness to pay (i.e. consumption dependent variable) and ε_i takes the place of u_i as the error term.

Age = Age of respondent

Gender = Gender of the respondent

Edu = Highest level of education completed by respondent

Loc= Location (one of Atlanta, Gainesville, or Lansing)

Inc = Income group

Expose = Self rating on exposure to food safety information in fresh fruit and vegetables

PC = Presence of children under age of 16 in the household

Trust = Extent of respondent's trust in information about food production obtained from U.S. Government Agencies, (e.g. USDA, FDA, EPA, etc.)

Safe = Perceptions about food safety

Pfr = Food preferences factor scores

Qual = Food quality factor scores

Results and Discussion

Willingness-To-Pay Estimates

The mean WTP for both the apples' and tomatoes' auction bids were calculated separately and significance tests performed on them. Four rounds of bidding had occurred in each auction and the bidding progressions of these are presented in Figure 1. The mean WTP for apples and tomatoes labeled "Grown in the U.S." came out to be approximately \$0.49 and \$0.48 respectively. Standard deviations in both cases were high, 0.58 and 0.55 respectively. This high level of dispersion suggests that different consumers have distinctly different levels of WTP (i.e. this can be viewed as an indicator of consumer surplus for COOL). Univariate hypothesis testing of the mean WTP proved both means to be significantly greater than zero at 0.05 alpha levels.

On calculating the means for only those consumers who were WTP a premium for either apples or tomatoes labeled "Grown in the U.S." the expected increase was registered, as shown in Table 3. This calculation was done to give further insight on the existing differentials between the sub-sample of consumers WTP and the whole sample. Overall, 79% of the consumers were WTP more than $0.00 for apples labeled "Grown in the U.S." while 72% were WTP in the case of tomatoes labeled "Grown in the U.S."

Following procedures outlined in Wellek (2003) equivalence testing was done to assess premium equivalency. The critical region for the unequal sample sizes was computed using the SAS program as recommended by Wellek. Using an alpha level of 0.05 the two premiums were found to be equivalent. This suggests that in the fresh produce industry the premium for COOL may not be product specific. Possibly this is due to similar quality and food safety conditions/standards across the produce sector.

Double Hurdle Probit Estimation

The independent variables of the double hurdle probit model are described in detail in Table 4. Of particular interest is the factor analysis used to derive food preference and food quality factor scores (see Tables 7a and 7b). Initially the food safety factor score was also to be derived but results showed low correlations (see Table 8) plus an extremely low Kaiser-Meyer-Olkin measure of sampling adequacy of less than 0.6. This necessitated the use of a single question from the questionnaire in the final model specification.

Table 5 presents the probit estimation. It shows that both food quality factor scores were significant at $\alpha = 0.05$. Consumers who were more conscious about food quality (be it quality in general or quality associated with natural foods) were found to be more likely to pay a premium for apples or tomatoes labeled "Grown in the U.S." The level of trust that consumers have for information they receive from U.S. government agencies (e.g. USDA, FDA, EPA etc.) was the only other significant variable (at $\alpha = 0.1$). Here we found that consumers who were more trusting of the information they receive from U.S. government agencies were more likely to pay for COOL. Surprisingly, all demographics turned out to be insignificant in the participation decision making process, suggesting that it does not matter if one is male or female or if their income is high or low. Perhaps the participation decision is simply not a function of demographics. Overall, the model was significant at 0.1 significance level with a 75.6% correct prediction rate.

In our estimation of the second stage of the double hurdle model we performed the chi-squared specification test, $\chi^2 = -2(\ln L_{probit} + \ln L_{truncation} - \ln L_{tobit})$ to evaluate if the truncated tobit estimation was a better fit than the tobit. The truncated tobit proved to be a superior fit ($\chi^2 = -55.9166$).

The truncated tobit estimation is presented in Table 6. It shows that age and location significantly determine how much the consumers are WTP once they have decided they are WTP. Marginal effects also show consumer WTP as -0.6 cents per pound for every year older that the respondent is. This implies that, on average, older consumers will pay less for COOL. In terms of location, the base used was Atlanta

Georgia and consumers in Lansing Michigan were found to be WTP substantially less than those in Atlanta (49 cents per pound less). In contrast, consumers in Gainesville, Florida were WTP 4 cents per pound more than those in Atlanta Georgia. A reason for this could be that MCOOL policy has been prevalent for the past 26 years at the state level in Florida. Thus, shoppers in Gainesville Florida could be accustomed to MCOOL and therefore are WTP for COOL. Conversely, Michigan is geographically far from either Georgia or Florida. Thus it could be case that Michigan consumers are less exposed to COOL and are therefore less WTP for COOL. For more details on location-based premium differentials refer to Table 1b.

Income level is another demographic that seemed to have an impact on the amount consumers are WTP. The greater than $100,000 income group was used as the base in the model. Findings suggest that consumers with an income level of less than $50,000 are the only group with a significantly greater WTP than the base (14 cents per pound more). This finding is similar to that in Loureiro and Umberger (2002), implying that more affluent consumers consider it unimportant to know where their apples or tomatoes come from and thus do not value COOL.

The truncated estimation also suggested that the food quality factor score associated with natural foods would positively increase the premium that consumers will pay by 6 cents for every unit increase in the factor score. However, the factor score for general quality had no significant impact on the amount they were WTP. In contrast, the food safety variable was significant, with consumers that think about food safety when purchasing fruits and vegetables being found to be WTP more for the label "Grown in the

U.S." Unexpectedly, this food safety variable had not been significant in the participation stage.

Conclusions

In this paper we have estimated the WTP for the label "Grown in the U.S." in apples and tomatoes to be approximately $0.49 and $0.48 per pound respectively, with 79% of the consumers WTP more than $0.00 for the label in apples and 72% in the case of tomatoes. An obvious implication of these findings is that we can safely assert that consumers do value COOL in apples and tomatoes. This adds to the justification for MCOOL or at least COOL on a voluntary basis in the apples and tomatoes market. Also, the findings suggests that it may be possible for producers and marketers to use label "Grown in the U.S." in order to garner a competitive advantage over import substitutes in the market. A comparison of how the label "Grown in the U.S." fairs with other country labels is, however, imperative if any conclusive assertions are to be made.

In addition, we have made the interesting finding, that premium equivalency exists between the WTP for COOL in apples and in tomatoes. This implies that WTP for COOL is not product specific, at least in the context of the apples and tomatoes markets. It may also suggest that there is potential to promote the generic label "Grown in the U.S." for all produce to enhance overall demand for U.S. produce over imports. Additionally, more research on this is required before generalizations can be made.

We have also used Cragg's double hurdle model to estimate the WTP for COOL and found that food quality perceptions are critical factors in both the participation and consumption decision making processes. Furthermore, the extent to which consumers trust information they receive from U.S. government agencies such as the USDA, FDA and EPA was found to be a significant determinant of the participation decision. This is likely due to the fact that the agencies are responsible for regulating and enforcing produce labeling laws. Since COOL is a credence attribute label this would be important, and if consumers trust the information they are getting from agencies then they are more likely to value COOL because they would believe that there is a trustworthy labeling verification system in place.

We have also established that for the consumption decision (i.e. how much to pay), some demographics (age, location and income level) are significant determinants. Also, we found that consumers who take food safety concerns into consideration when making the decision to purchase fruits and vegetables will pay more money for the label "Grown in the U.S." Clearly the implication here is that consumers regard U.S. produce to be safer.

In conclusion, we report that food quality is a more important determinant of WTP for COOL in apples and tomatoes during the participation decision stage together with trust levels for information from U.S. government agencies. Food safety and demographic variables start to have an impact at the consumption decision level, making them important variables if interested in influencing the amount consumers will pay.

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Table 1a. Tomato and Apple Data across Location

Product		Observations Deleted	Observations Retained	Percent	Cumulative Percent
TOMATOES	GNV, FL	3	67	38.3	38.3
	LAN, MI	2	49	28.0	66.3
	ATL, GA	9	59	33.7	100.0
	Total (n)	14	**175**	100.0	
APPLES	GNV, FL	1	56	41.2	41.2
	LAN, MI	4	17	12.5	53.7
	ATL, GA	5	63	46.3	100
	Total (n)	10	**136**	100.0	

Table 1b. Mean WTP across Location

	Gainesville, FL ($/Lb)	Lansing, MI ($/Lb)	Atlanta, GA ($/Lb)
Apples	0.41	0.18	0.64
Tomatoes	0.78	0.20	0.39

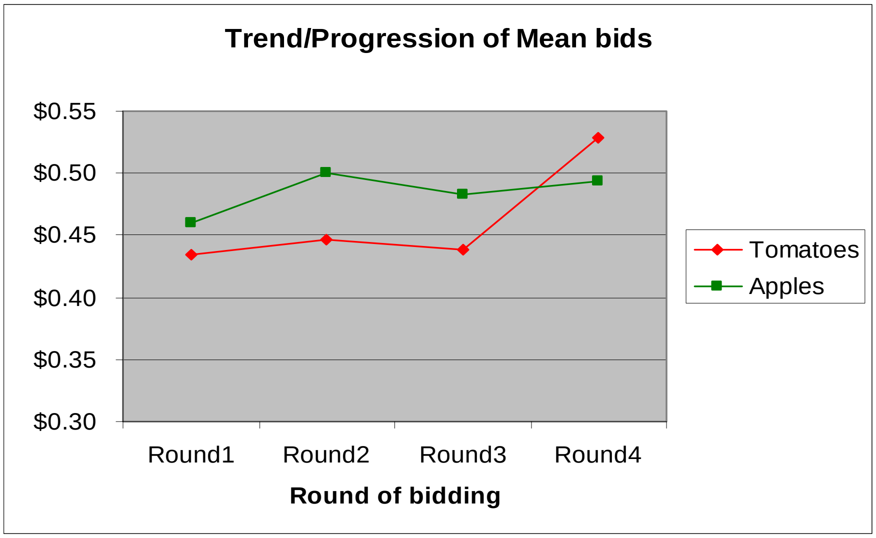

Figure 1. Line graph showing the trend of bids in both tomato and apple auctions, averaged over all locations

Table 2. Demographic profile of respondents

Category	U.S. Census Average (%)	Sample Average (%)	
		Apples	Tomatoes
Age			
25-34	**27**	11.0	9.1
35-44	**31**	39.0	48.9
45-54	**26**	36.8	34.6
55-65	**16**	13.2	7.4
Race			
White	**75**	84.6	90.9
Black or African American	**12**	7.4	4.6
Asian	**4**	2.2	1.7
Other	**9**	5.8	2.8
Ethnicity			
Hispanic	**12**	6.6	2.3
Income			
<$15,000	**15.2**	3.0	1.7
$15,000 to $24,999	**13.2**	5.1	4.5
$25,000 to $34,999	**12.3**	7.4	8.0
$35,000 to $49,999	**15.1**	11.0	13.1
$50,000 to $74,999	**18.3**	19.1	27.8
$75,000 to $99,000	**11.0**	22.0	13.6
$100,000 or above	**14.1**	32.4	31.3
Education			
Bachelors Degree or Higher	**24**	64.7	67.0
Some College	**27**	28.6	23.9
High School Diploma (or equivalent)	**29**	5.9	8.5
Less than High School	**20**	0.8	0.6
Total "Useable" Responses		136	175

Table 3. Average WTP for Apples (n = 108) and Tomatoes (n = 126): Sampling only those consumers who were WTP more than $0.00

	Mean		Standard Deviation	
	All four bids	**3rd and 4th round bids**	All four bids	**3rd and 4th round bids**
Apples	$0.60	**$0.61**	$0.56	**$0.59**
Tomatoes	$0.64	**$0.68**	$0.53	**$0.54**

Table 4. Description of Independent Variables used in the Double Hurdle Probit Model

Variable	Description
AGE	Numerical age of the respondent
GENDER	A dichotomous Gender variable: Whether the respondent was female (1) or male (0) (Male dropped)
EDU1	Highest level of education completed : Some College or less
EDU2	Highest level of education completed : University undergraduate degree
EDU3	Highest level of education completed : University postgraduate degree (dummy dropped)
LOC1	Location: Gainesville, Florida
LOC2	Location: Lansing, Michigan
LOC3	Location: Atlanta, Georgia (dummy dropped)
INC1	Pre-tax Household Income: Less than $50,000
INC2	Pre-tax Household Income: $50,000 to $74,999
INC3	Pre-tax Household Income: $75,000 to $99,999
INC4	Pre-tax Household Income: $100,000 and above (dummy dropped)
EXPOSE	Self rating on level of exposure to information about food safety in fruits and vegetables: Likert scale of 1-4 treated as a numerical variable. 1 is a great deal and 4 is nothing at all
PC1	Presence of Children under 16 years in the household: 0 present
PC2	Presence of Children under 16 years in the household: 1 child present
PC3	Presence of Children under 16 years in the household: 2 children present
PC4	Presence of Children under 16 years in the household: 3 or more present
SAFE	Likert scale rating on statement "I think about food safety when purchasing fruit and vegetables"1-6 scale treated as a numerical variable. 1 is strongly disagree and 6 is strongly agree
TRUST	Likert scale rating on level of trust that consumer has on information about food production from U.S. government agencies, (e.g. USDA, FDA, EPA) 1-6 scale treated as a numerical variable. 1 is strongly distrust and 6 is strongly trust
PFR1	First numerical Food Preference factor score: The more positive and higher it is the more preference for various foods and more open to different foods. (Open to unfamiliar foods)
PFR2	Second numerical Food Preference factor score: The more positive and higher it is the less preference for unfamiliar foods and risk (Choosey about foods)
PFR3	Third numerical Food Preference factor score: The more positive and higher it is the less preference for unfamiliar foods and risk (afraid of unfamiliar foods)
QUAL1	First numerical Food Quality factor score: The more positive and higher it is the more conscious about food quality in general
QUAL2	First numerical Food Quality factor score: The more positive and higher it is the more conscious about food quality associated with natural foods
Sigma	Disturbance standard deviation (Included in the truncated model)

Table 5. Probit Model for Combined Apples and Tomatoes data

Variable	Coefficient	Standard Error	Standardized Coefficient	Marginal Effects	p-value	Mean of Regressor
AGE	-.4987601401E-02	.89843999E-02	-.555	-.1919279199E-02	.5788	44.652733
GENDER	-.1506314335E-02	.24451369	-.006	-.5795546646E-03	.9951	.88424437
EDU1	.8934304564E-01	.22405863	.399	.3423510941E-01	.6901	.34083601
EDU2	.2921635947	.21260988	1.374	.1112207523	.1694	.40836013
LOC1	.3376497448	.21557927	1.566	.1280729540	.1173	.39549839
LOC2	-.1553967436	.22060002	-.704	-.6040256567E-01	.4812	.21221865
INC1	-.4497591802E-02	.23109429	-.019	-.1731197005E-02	.9845	.27009646
INC2	-.1281256856	.23297548	-.550	-.4968572212E-01	.5824	.24115756
INC3	.4748052243E-01	.25711959	.185	.1819134364E-01	.8535	.17363344
EXPOSE	.1397656405	.11427635	1.223	.5378322463E-01	.2213	-1.3086817
PC1	-.1681104058	.28317594	-.594	-.6531608218E-01	.5527	.24115756
PC2	.1157951964E-01	.27654556	.042	.4451611129E-02	.9666	.19292605
PC3	-.1347032843	.22487988	-.599	-.5204073545E-01	.5492	.36655949
SAFE	.5110638502E-01	.53805101E-01	.950	.1966625113E-01	.3422	3.7073955
TRUST	.9836671876E-01	.54673873E-01	1.799	.3785250303E-01	**.0720**	3.5305466
PFR1	-.1181649329	.91743310E-01	-1.288	-.4547105502E-01	.1977	.41588740E-16
PFR2	-.1953744819E-01	.84268266E-01	-.232	-.7518206625E-02	.8167	-.28938907E-06
PFR3	.8621127148E-01	.84614638E-01	1.019	.3317496462E-01	.3083	-.64308682E-07
QUAL1	.1951380882	.86579941E-01	2.254	.7509109958E-01	**.0242**	-.22508039E-06
QUAL2	.2116905722	.90676123E-01	2.335	.8146066195E-01	**.0196**	-.12861736E-06

Restricted log likelihood value, ln L_{10} = -175.1603
Maximum unrestricted log likelihood value, ln L_1 = -161.3024
Log likelihood $\chi^2_{(df=19)}$= 27.71589 (p = 0.08905090)
R^2 (McFadden, 1973) = 0.07912
R^2 (Estrella, 1998)= 0.08866
% of correct predictions = 75.6

(Note: E+nn or E-nn means multiply by 10 to + or -nn power.)

Table 6. Truncated Tobit Model for Combined Apples and Tomatoes data

Variable	Coefficient	Standard Error	Standardized Coefficient	Marginal Effects	p-value	Mean of Regressor
AGE	-.2011331950E-01	.11883652E-01	-1.693	-.6053047159E-02	**.0905**	44.433476
GENDER	.5798241453	.36794091	1.576	.1744964523	.1151	.88412017
EDU1	.6004921382E-02	.26060474	.023	.1807164268E-02	.9816	.33476395
EDU2	-.8938956639E-01	.24799648	-.360	-.2690153960E-01	.7185	.42489270
LOC1	.1050334990	.22539160	.466	.3160953729E-01	.6412	.42489270
LOC2	-1.636867141	.52123056	-3.140	-.4926105807	**.0017**	.18025751
INC1	.4523956249	.27241139	1.661	.1361471960	**.0968**	.27038627
INC2	.2676502762	.27020804	.991	.8054860086E-01	.3219	.23175966
INC3	.4125673997E-01	.30476093	.135	.1241610032E-01	.8923	.18025751
EXPOSE	-.2355544671	.14554979	-1.618	-.7088945703E-01	.1056	1.9184549
PC1	-.5693790471E-01	.32052071	-.178	-.1713530292E-01	.8590	.23605150
PC2	.2594145430E-01	.30407062	.085	.7807008001E-02	.9320	.19742489
PC3	.1582151576	.25664431	.616	.4761440846E-01	.5376	.36051502
SAFE	.1345360535	.71282246E-01	1.887	.4048824843E-01	**.0591**	3.7939914
TRUST	.2300756355E-01	.61955677E-01	.371	.6924061800E-02	.7104	3.5922747
PFR1	-.4410355142E-01	.11383960	-.387	-.1327284025E-01	.6984	.10062060E-01
PFR2	-.4311856205E-01	.95795419E-01	-.450	-.1297641046E-01	.6526	.31133047E-02
PFR3	.8044302038E-02	.98975595E-01	.081	.2420910164E-02	.9352	.21052146E-01
QUAL1	.1341120713	.13265582	1.011	.4036065217E-01	.3120	.81272704E-01
QUAL2	.1920079086	.11338409	1.693	.5778424223E-01	**.0904**	.81635408E-01
Sigma	.8325868115	.99336783E-01	8.381	--------	**.000**	--------

Number of observations = 311
Observation after truncation = 233
Log likelihood function = -101.6101
Threshold values for model: Lower = 0 Upper = +∞

(Note: E+nn or E-nn means multiply by 10 to + or -nn power.)

Table 7a. Rotated Component Matrix(a) for Food Quality Proxy Variables

Proxy Variable	Factor 1 (General Quality conscious)	Factor 2 (Natural quality conscious)
I usually aim to eat natural food	.227	**.813**
I am willing to pay somewhat more for a product of better quality	**.764**	.333
Quality is decisive for me in purchasing foods	**.919**	.181
I always aim at the best quality	**.860**	.343
When choosing foods, I try to buy products that do not contain residuals of herbicides and antibiotics	.271	**.799**
I am willing to pay somewhat more for food containing natural ingredients	.396	**.825**
For me, wholesome nutrition begins with the purchase of foods of high quality	**.704**	.462

Note: Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Table 7b. Rotated Component Matrix(a) for Food Preference Proxy Variables

Proxy Variable	Factor 1 (Open to unfamiliar foods)	Factor 2 (choosey)	Factor 3 (afraid of unfamiliar foods)
I like foods from different countries	**.712**	-.045	-.161
Ethnic food looks too weird to eat	-.279	.040	**.778**
I like to try new ethnic restaurants	**.832**	-.165	-.288
At parties, I will try a new food	**.852**	-.224	-.155
I am very particular about the foods I will eat	-.190	**.765**	.135
I am constantly sampling new and different foods	.685	-.280	-.382
I don't trust new foods	-.285	.283	**.700**
I will eat almost anything	**.585**	**-.654**	-.023
If I don't know what is in a food, I won't try it	-.080	**.730**	.337
I am afraid to eat things I have never eaten before	-.105	.490	**.645**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 5 iterations.

Table 8. Correlation Matrix For Food Safety Proxy Variables

		I think about food safety when I purchase fresh fruits and vegetables	Fruits and vegetables produced in the U.S. are more likely to be safe	I think about food safety when I purchase meats	The U.S. agricultural food industry provides the safest, most affordable food supply in the world	I believe there are currently too many chemical pesticide residues on fresh fruits and vegetables
Correlation	I think about food safety when I purchase fresh fruits and vegetables	1.000	.116	.502	.110	.339
	Fruits and vegetables produced in the U.S. are more likely to be safe	.116	1.000	.044	.448	-.042
	I think about food safety when I purchase meats	.502	.044	1.000	.232	.156
	The U.S. agricultural food industry provides the safest, most affordable food supply in the world	.110	.448	.232	1.000	-.034
	I believe there are currently too many chemical pesticide residues on fresh fruits and vegetables	.339	-.042	.156	-.034	1.000
Sig. (1-tailed)	I think about food safety when I purchase fresh fruits and vegetables		.091	.000	.103	.000
	Fruits and vegetables produced in the U.S. are more likely to be safe	.091		.309	.000	.317
	I think about food safety when I purchase meats	.000	.309		.004	.036
	The U.S. agricultural food industry provides the safest, most affordable food supply in the world	.103	.000	.004		.348
	I believe there are currently too many chemical pesticide residues on fresh fruits and vegetables	.000	.317	.036	.348	