# Grass-Fed versus Organic Dairy Production: Southeastern US Willingness to Pay

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## Abstract

This paper examines determinants of consumers' willingness to pay a premium for grass-fed and organic dairy by using a survey data from the southeastern United States. We use ordered and Heckman probit regression techniques to estimate the impact of consumer characteristics on their willingness to pay premiums. The results suggest that some of relevant determinants are: age, income, gender, and geographical variables. This research has important implications for the large dairy industries in Florida and also as provides important information for the growing dairy industries in the rest of the southeastern United States.



**Key Words: Grass-fed Dairy, Heckman Probit Regression, Organic Dairy, WTP**

Markets for environmentally friendly goods and services are on the rise with even large supermarket chains continually increasing their supply of "green" and eco-friendly products. This increase in demand has allowed eco-friendly products to charge a price premium which has encouraged many farmers to switch to environmentally friendly production techniques. This is especially true for livestock production, such as dairy, where vast amounts of natural resources are consumed during production.

Grass-fed production presents a more animal- and environmentally-friendly alternative by allowing cows to freely roam and graze in pastures. Additionally, the health benefits of grass-fed cows surpass the advantages of more efficient conventional milk production systems. For one, due to conventional milk increases the risk of antibiotic resistance among consumers (Clancy). Moreover, studies have established that grass-fed milk, compared to conventionally produced milk, has five times more conjugated linoleic acid (CLA) content, which is a very potent cancer fighter, the ideal ratio of omega-6 to omega-3 fatty acids and higher beta-carotene, vitamin A and vitamin E contents (Dhiman, et al.).

Organic milk production is another alternative method that promotes environmental and animal rights' issues, and has its own health benefits. Organically produced milk, as defined by the USDA, comes from cows that have not been treated with a bovine growth hormone or antibiotics, and are fed with either grass or grain grown without pesticides (Collins). The difference between organic and grass-fed milk is that the cows' access to pasture need not be permanent for organic dairy, as opposed to grass-fed in which cows roam freely as they feed (Collins).

In comparison, conventional beef and dairy production, accounting for about 85% of U.S. production, confine large numbers of animals in relatively small spaces (Robinson). This method is implemented along with the injection of bi-weekly hormones that increase milk production levels. While the conventionally grown cows are routinely fed with antibiotics to combat illnesses, grass-fed cows are less prone to diseases due to the lack of constant close quarter confinement (Clancy).

As consumers grow increasingly health and world conscious, the demand for healthier, more environmentally friendly products rises. The purpose of this study is to analyze the determinants of consumers' willingness to pay for grass-fed and organically produced milk through the use of a Heckman regression model. The results of this study indicate that while gender and household income are significant regressors for both organic milk and grass-fed milk, variables such as age and geographic location are the only significant regressors for grass-fed dairy.

The paper proceeds with a literature review on previous research conducted for organic dairy and grass-fed dairy and beef, followed by a review of different willingness-to-pay models. The data used in this study is explored, followed by the methodology. Finally the paper is concluded with a discussion on the findings.

**Literature Review**

In the last decade the US organic market has grown at a steady annual rate of 20%. Between 2004 and 2005, total organic product sales grew 17% to reach $14.6 billion. Between 2005 and 2006 estimated sales value of organic foods grew 22.1% from $13.8 billion in 2005 to $16.9 billion in 2006. Today, 23% of American consumers

report that they buy organic products weekly, while another 73% buy organics at least occasionally (Hartman Group). The pervasiveness of organic food has become evident through its widespread availability at mega stores such as Wal-Mart.

Previous research has focused on organic preferences, while grass-fed livestock is a more recent phenomenon. Therefore, literature available on grass-fed dairy is quite limited. However, many preferences found in organic studies will provide knowledge about grass-fed livestock. Moreover, while a limited amount of literature does exist on the determinants for the willingness to pay for organic dairy, virtually no literature exists on the willingness to pay for grass-fed dairy.

The results from organic willingness to pay studies have found that income, gender, age, household size, marital status, education and location are relevant determinants for consumer's price premiums for organics (Stevens-Garmon et al.). However, the majority of these studies focus on the consumer's willingness to pay premiums for produce and organic dairy has largely been ignored. Furthermore, it has been documented that there are regional differences between consumers' willingness to pay premiums for organics (Stevens-Garmon et al.). Therefore, it is imperative that research be conducted in the southeastern United States to fully understand the willingness of consumers to pay premiums for grass-fed and organic dairy. This is especially true as Florida is a major producer in the dairy markets and Georgia is fast expanding (USDA).

Ara (2003) found that consumers that lived further away from farms in Greece were more concerned about organic labels; however, those that lived closer to the farms were more concerned about environmentally friendly agriculture.

The research on econometric estimation of the willingness to pay for organic milk in the southeastern United States is not readily available. While information on summary statistics is readily available from USDA, and articles on other countries are available, few academic articles on the determinants of the willingness of consumers to consume organic milk exist.

A 2007 report by the USDA-ERS using a Nielsen panel found that a basic analysis showed that age, race, gender, region, and income were all contributing factors to the purchase of organic milk (Dimitri et al.). This is indeed keeping with the current literature available on organics.

Hill and Lynchehaun (2002) found through a case study analysis in England that income level was the most important factor in organic milk purchases. Age, gender, and location were also found to be significant. Specifically, they found that the location was significant because certain locations had higher levels of disposable income.

**Empirical Framework**

A telephone survey was used to elicit the willingness of consumers to pay premiums for organic and grass-fed dairy. The crucial valuation questions asked if the participants were willing to pay a specified premium for grass-fed milk. The participant was then also asked if they were willing to pay a specified premium for organic milk.

The definition for grass-fed was as follows: Grass-fed dairy cattle remain on the pasture their entire lives and are allowed to roam freely. They eat a natural diet, making them strong and healthy; therefore they have no need for antibiotics and hormones like

cows in conventional dairies. They grow naturally and produce wholesome and natural products.

The definition for organic dairy is as follows: Organic Milk comes from dairy cattle raised on feed that has been grown in fields that have been free of pesticide and chemical fertilizer for at least three years. A cow must eat such feed for an entire year before its milk is certified organic. The growth hormone normally used to boost milk production cannot be used to produce organic milk. If a cow becomes ill it may receive antibiotics, but then it must be removed from the milking herd for one year. All milk, organic or not, is regularly tested for drug residues by state inspectors who take random samples from bulk tankers coming off the farms. If residues are found, the tanker cannot be bottled for sale as organic milk.

This study will use the crucial valuation questions to estimate if there are different determinants for organic and grass-fed dairy. To estimate these determinants, this paper employs ordered and Heckman probit regression techniques to identify linkages between demographic, attitudinal and structural factors and the premiums that potential consumers in the Southeast region are willing to pay for grass-fed and organic milk. Ordered probit regression is first applied to separate models for grass-fed and organic milk to determine their distinct sets of indicators of consumers' price premiums. A Heckman probit model is then developed to explain the determinants of premium differences between the two types of milk products.

**Data**

Data consists of the responses of 655 randomly surveyed consumers from Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Tennessee who were contacted by phone in 2005 by the University of Georgia's Center for Agribusiness and Economic Development. Since the purpose of this article is to find the determinants of demand for grass-fed and organic dairy products, Tables 1 to 6 shows the breakdown of the demographics of the respondents to review the appropriateness of the sample.

Table 1, which shows the statistics for the gender of the respondents shows that the majority of respondents were female. This is primarily because the survey requests to speak to the primary shopper, the majority of who are females (Kaneko et al.). Table 2 reports the employment status of the respondents, showing the majority of respondents were fully employed followed by retirees.

While Table 3 reports the range of ages of the respondents with the youngest being 18 and the oldest 90. The average age of the respondents was 49. Table 4 then discusses the education statistics of the respondents with the categories of college graduate, high school diploma/GED, and some college/technical school being the three largest categories, respectively. However, all three of these categories were in the mid and upper 20% ranges.

Table 5 describes the different states represented in the sample. Florida and Georgia have the largest number of respondents with 35.70% and 22.37%, respectively. The other states have respondent rates of 4.44% to 13.78%. Table 6 describes the income variable. The income variable was the only variable where the largest number of

respondents was in the “Refused to Answer” category with a response rate 33.93%. This is followed by 20.89% of those respondents making $75,000 and over. After this category there is a large jump to the next biggest category with only 8.44% of the respondents making between $50,000 and $60,000. It is usual for those responding to the surveys to have the above demographics (Lourerio et al.).

The interviewees were asked questions about their milk consumption preferences, buying habits, and knowledge of grass-fed and organic dairy products. A series of questions elicited the respondents’ willingness to pay premiums for the two milk products by asking, starting from a low premium of $0.05 per gallon, then progressing (in increments of $0.05) with each positive response to higher premiums until the premium reaches a maximum of $0.60 per gallon.

For purposes of this analysis, the respondents’ highest revealed premiums were derived from the responses and classified under three categories: Zero premium (Class 1), $0.05 to $0.30 per gallon premiums (Class 2), and $0.35 to $0.60 per gallon premiums (Class 3). These premium classes are regressed against three classes of explanatory variables:

a) Buyer’s Preferences (PREF) – The participants were asked to classify themselves as either a health-conscious (HEALTH) or value shopper (VALUE). Moreover, the shoppers’ tendency toward brand recognition was revealed through responses on preference for PREMIUM, BRAND or GENERIC labels.
b) Demographic Characteristics (DEM) – The variables included in this analysis are AGE, years of education (EDUCATION), race (WHITE), gender (MALE) and location (AL, GA, FL, MS, NC, SC and TN).

c) Household Economic Structure (HES) – These characteristics include household income (HHINC), weekly food expense estimate (FOODEX) and the number of members of the household (HHSIZE).

**Model Specification**

*Ordered Probit Regression*

A STATA procedure designed to perform ordered probit regression technique is used for the first phase of this analysis. The general conceptual form of the estimating equations is:

$$Y_i^* = \alpha + PREF_t'\beta_1 + DEM_i'\beta_2 + HES_i'\beta_3 + \mu_i \quad (1)$$

where $Y_i$, the event of interest, is an ordered, discrete price premium variable that takes on a value of 2 for Class 3 (high) price premiums, a value of 1 for Class 2 (low) price premiums, and a value of 0 for Class 1 (zero) price premiums; $\alpha$ is the model's general intercept; the $PREF_i$, $DEM_i$, *and* $HES_i$ vectors (with their corresponding vectors of regression coefficients $\beta_1$, $\beta_2$ and $\beta_3$, respectively) are associated with three groups of independent variables representing buying preferences, demographic characteristics and household economic structure, respectively, that could influence the probability of obtaining price premiums; $\mu_i$ is the model's error term.

Probit regression is a log-linear approach to handling categorical dependent variables using the cumulative normal distribution. Thus, in this analysis, the cumulative normal probability of, for instance, obtaining a high premium ($Y_i = 2$) is specified as a nonlinear (probit) function of the consumers' buying preferences ($PREF_t$), demographic characteristics ($DEM_t$) and household economic structure ($HES_t$). Moreover, while the

dependent variable $Y_i$ in equation (1) is a latent, unobserved random variable, the observed price premium rate denoted by $Y_i$* is determined as:

$$
\begin{aligned}
&Y_i^* = 0 \text{ if } Y_t \le 0 \\
&Y_t^* = 1 \text{ if } 0 \le Y_t \le \eta_1 \\
&Y_t^* = 2 \text{ if } \eta_1 \le Y_i \le \eta_2.
\end{aligned}
\tag{2}
$$

where $\eta_1$ and $\eta_2$ are unknown parameters that collectively define the range of values into which the latent variable may fall (Greene). The $\eta$'s are to be estimated, along with the unknown $\beta$'s, coefficients of the explanatory variables.

The resulting probabilities that $Y_i^*$ takes values 0, 1, and 2 are:

$$
\begin{aligned}
&Prob\ (Y_i^* = 0) = \phi(-B'X) \\
&Prob\ (Y_i^* = 1) = \phi(\eta_1 - B'X) - \phi(-B'X) \\
&Prob\ (Y_i^* = 2) = \phi(\eta_2 - B'X) - \phi(\eta_1 - B'X)
\end{aligned}
\tag{3}
$$

where the function $\phi(.)$ indicates a standard normal distribution, X is a vector containing the three groups of regressors ($PREF_t$, $DEM_t$, and $HES_t$) and the vector B contains their corresponding coefficients $\beta_1$, $\beta_2$, and $\beta_3$.

*Heckman Probit Regression*

The second phase of this analysis focuses on the premium differences assigned to the grass-fed and organic milk products. A two-stage Heckman estimation technique is used to identify the significant determinants of premium differences. The Heckman probit approach allows the analysis of the determinants of two important decisions made by the consumers: discriminating between grass-fed and organic milk and the assignment of positive and negative premium differences by discriminating consumers reflecting

their preferences for either organic or grass-fed milk. This approach produces consistent, asymptotically efficient estimates for all parameters in the model being fitted. The Heckman selection model consists of the following selection (discriminating) mechanism and outcome equations (Greene, 2003):

(1) $Selection\ Mechanism: z_i^* = \gamma' w_i + \mu_i,$

$$z_i = 1 \quad if\ z_i^* > 0,$$

$$z_i = 0 \quad if\ z_i^* \le 0,$$

$$\Pr ob(z_i = 1) = \phi(\gamma' w_i),$$

$$\Pr ob(z_i = 0) = 1 - \phi(\gamma' w_i).$$

(2) $Outcome\ Model: w_i = \beta' x_i + \varepsilon_i, \quad if\ z_i = 1$

In the first stage, a probit estimation technique generates the selection equation. In this analysis, the dichotomous dependent variable takes a value of 0 for zero premium differences between the two milk products and 1 for non-zero premium differences. The probit equation is estimated to obtain estimates of the following inverse Mills ratio (IMR), calculated as the ratio of the density ($\phi$) and cumulative ($\Phi$) probability density functions, for every household that discriminates between organic and grass-fed dairy (Greene, 2003):

(3) $$\hat{\lambda}_i = \frac{\phi(\hat{\gamma}' w_i)}{\Phi(\hat{\gamma}' w_i)}.$$

In the second stage, the regression or outcome equation is applied to discriminating consumers (with non-zero price premium differences) to estimate the determinants of the likelihood of positive and negative price premium differences (calculated as organic price premium less grass-fed price premium). The IMR is included in this estimation as a separate predictor variable.

In this analysis, the expanded form of the selection equation is given as:

(4) $$z_i^* = \gamma_0 + \gamma_1 PREF + \gamma_2 DEM + \gamma_2 HES + \mu_i ,$$

which is almost identical to the estimating equation defined in (1) except that the location dummy variables and FOODEX were excluded from the DEM and HES variables. The dependent variable $z_i$ is the probability of discriminating between organic and grass-fed milk.

These excluded variables are included in the outcome equation, along with the rest of the explanatory variables in (4). The expanded form of the outcome equation is given by:

(5) $$w_i = \beta_0 + \beta_1 FV + \beta_2 ST + \beta_3 LOC + \beta_4 REQ + \mu_i .$$

The dependent variable in this outcome equation is dichotomous taking a value of 1 for positive price premiums (organic price premium (OPP) >grass-fed premium (GFP)) and a value of 0 for negative price premiums (OPP<GFP).

**Econometric Results**

In the first phase of the analysis employing probit regression techniques, the significance and directional effects of the explanatory variables are analyzed separately. Since the dependent variable in each probit model is defined as an ordered three-level variable (for upgrades, retentions and downgrades), the directional effects of each independent variable for all three categories of the dependent variable could not be deduced from the sign and magnitude of its coefficient estimates. The models' coefficients could only provide unambiguous indications of changes in the probability of moving from the highest to lowest categories, and vice versa, in addition to important information on the models' explanatory power and the relative statistical significance of each individual independent variable. The regressors' directional effects can be

discerned, however, from estimates of their marginal effects. The following sections separately discuss the variables' significance and their specific directional effects in each category of the dependent variable.

*Significant Determinants*

The results summarized in Table 7 identify the significant regressors in the separate ordered probit models for grass-fed and organic milk. In interpreting the coefficients, a positive (negative) coefficient result implies an increase (decrease) in the probability of being in class 3 (high price premium) and a decrease (increase) in the probability of being in class 1 (zero price premium).

Among the variables that significantly influence the probability of high price premiums, gender (MALE) and household income (HHINC) are the only significant regressors in both milk models, which are negatively and positively signed, respectively, in both instances. MALE's result suggests that male respondents (relative to their female counterparts) are more likely to refrain from assigning price premiums and less inclined to add high price premiums for both milk products. HHINC's result supports the logical notion that higher incomes increase the probability of high price premiums and decrease the probability of zero price premiums for both grass-fed and organic milk.

AGE and a geographical dummy variable (TN) are the other important variables in the grass-fed milk model. AGE's result implies that the probabilities of older respondents to assign zero and high price premiums for grass-fed milk are higher and lower, respectively. On the other hand, the probability of obtaining high organic milk price premiums is significant affected by the participants' preference for premium priced

milk (PREMIUM), household size (HHSIZE) and a couple of geographical dummy variables (AL and FL). These results indicate that larger households and the respondents' preference for premium milk labels both are associated with increasing and decreasing probabilities of high and zero price premiums for organic milk, respectively.

*Directional Effects*

The directional effects are more explicitly given by estimates of the marginal effects in Table 8. Marginal effects reported in the table were computed by adopting techniques from the ordinal probit regression routine in STATA. The marginal effects for each category of the dependent variable are calculated as follows using the probabilities defined in the series of equations in (3):

$$
\begin{aligned}
&\frac{\partial \Pr ob(Y_{it}^{*} = 0)}{\partial X} = -\phi(\beta' X)\beta, \\
&\frac{\partial \Pr ob(Y_{it}^{*} = 1)}{\partial X} = (\phi(-\beta' X) - \phi(\eta - \beta' X))\beta, \\
&\frac{\partial \Pr ob(Y_{it}^{*} = 2)}{\partial X} = \phi(\eta - \beta' X)\beta,
\end{aligned}
\tag{4}
$$

In the grass-fed milk model, the change in probabilities of being in the high and low premium classes decrease by 0.11% and 0.10%, respectively, with a one-unit change in the AGE variable. The probability of being in the zero price premium class, on the other hand, increases by 0.21% by the same unit increase in AGE. The MALE variable results indicate that probabilities associated with high and low price premiums decrease by 4.31 and 4.21%, respectively, but increase by 8.57% for zero premiums for every male respondent. As for the HHINC results, the marginal effects for the high and low price premiums are positive while the zero premium's marginal effect is zero.

In the organic milk model, MALE marginal effects are -5.16%, -4.30% and 9.46% for the high, low and zero price premium categories, respectively, which are consistent with the trends noted in this variable's results in the grass-fed milk model. The HHINC results also mirror the same implications noted in the other model where positive marginal effects are obtained for the high and low premiums while the zero price premium class yielded negative marginal effects.

PREMIUM results suggest that, relative to respondents that prefer GENERIC brand milk labels, the probabilities of assigning high and low price premiums increase by 15.56% and 6.17%, respectively, and decrease by 21.73% for zero price premiums for respondents that prefer PREMIUM milk labels. Moreover, an additional member that is added to a household (HHSIZE) will decrease the probability of high and low price premiums by 0.33% and 0.25%, respectively, while zero price premium probability increases by 0.58%.

*Heckman Probit Results*

The Heckman probit results presented in Table 9 identify the significant determinants of the discriminating decisions (selection equation) and the assignment of positive or negative price premium differences that reveal consumer's preferences between organic and grass-fed milk products. Interestingly, HHINC is the only significant determinant of the discriminating decision. The positive HHINC coefficient suggests that high income respondents are more likely to make distinctions between the milk products.

Among participants that make such distinctions (297 uncensored observations used in the outcome equation), respondents that are MALE and biased towards regular brands (BRAND), relative to generic brand patrons, are less inclined to favor organic over grass-fed milk products. On the other hand, high household incomes (HHINC) and consumers in AL, FL, NC, SC and TN (relative to GA consumers) are more likely to prefer organic over grass-fed milk products.

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**Table 1.** Summary Statistics for Gender Variable

| **Gender** | | |
|---|---|---|
| Variable | Observations | Percentage |
| Male | 185 | 27.41% |
| Female | 490 | 72.59% |
| **Total** | 675 | 100.00% |

**Table 2.** Summary Statistics for Employment Variable

| **Employment** | | |
|---|---|---|
| Variable | Observation | Percentage |
| 1. Employed full time | 326 | 48.30% |
| 2. Employed part time | 47 | 6.96% |
| 3. Retired | 179 | 26.52% |
| 4. Full time student | 13 | 1.93% |
| 5. Homemaker | 51 | 7.56% |
| 6. Unemployed | 40 | 5.93% |
| 9. Ref/DK/NA | 19 | 2.81% |
| **Total** | 675 | 100.00% |

**Table 3.** Summary Statistics for Age Variable

| **Age** | |
|---|---|
| Variable | Observation |
| Min | 18 |
| Max | 90 |
| Average | 49.35159817 |

**Table 4.** Summary Statistics for Education Variable

| **Education** | | |
|---|---|---|
| Variable | Observations | Percentage |
| 1. Less than high school degree | 37 | 5.48% |
| 2. High school diploma/GED | 177 | 26.22% |
| 3. Some college/technical school | 160 | 23.70% |
| 4. College graduate | 200 | 29.63% |
| 5. Post-graduate degree | 93 | 13.78% |
| 9. Ref/DK/NA | 8 | 1.19% |
| **Total** | 675 | 100.00% |

**Table 5.** Summary Statistics for Area Variable

| **Area** | | |
|---|---|---|
| Variable | Observations | Percentage |
| Alabama | 50 | 7.41% |
| Florida | 241 | 35.70% |
| Georgia | 151 | 22.37% |
| Mississippi | 30 | 4.44% |
| N. Carolina | 93 | 13.78% |
| S. Carolina | 36 | 5.33% |
| Tennessee | 74 | 10.96% |
| **Total** | 675 | 100.00% |

**Table 6.** Summary Statistics for Income Variable

| **Income** | | |
|---|---|---|
| Variable | Observations | Percentage |
| 1. Under $15,000 (under $289 per week) | 36 | 5.33% |
| 2. $15,000 to less than $20,000 ($289 to $384 per week) | 25 | 3.70% |
| 3. $20,000 to less than $25,000 ($385 to $480 per week) | 23 | 3.41% |
| 4. $25,000 to less than $30,000 ($481 to $576 per week) | 31 | 4.59% |
| 5. $30,000 to less than $40,000 ($577 to $769 per week) | 51 | 7.56% |
| 6. $40,000 to less than $50,000 ($770 to $961 per week) | 45 | 6.67% |
| 7. $50,000 to less than $60,000 ($962 to $1153 per week) | 57 | 8.44% |
| 8. $60,000 to less than $70,000 ($1154 to $1442 per week) | 37 | 5.48% |
| 9. $75,000 and over ($1143 and over per week) | 141 | 20.89% |
| 10. Ref/DK/NA | 229 | 33.93% |
| **Total** | 675 | 100.00% |

**Table 7.** Ordered probit results for grass-fed and organic milk products.

| Variables | Grass-Fed Milk | | Organic Milk | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| Premium Labels[*] | 0.4393 | 0.3625 | 0.5517[c] | 0.3398 |
| Brand[*] | 0.0784 | 0.1134 | -0.1100 | 0.1214 |
| Health[**] | -0.0132 | 0.1265 | 0.0669 | 0.1235 |
| Age | -0.0052[c] | 0.0030 | -0.0026 | 0.0029 |
| Male | -0.2177[b] | 0.1066 | -0.2495[b] | 0.1112 |
| Education | -0.0082 | 0.0163 | 0.0195 | 0.0163 |
| Household Income | 6.33e-06[a] | 1.40e-06 | 5.21e-06[a] | 1.39e-06 |
| White | -0.1347 | 0.1159 | -0.1292 | 0.1219 |
| AL[g] | 0.0818 | 0.1883 | 0.4987[b] | 0.1985 |
| FL[g] | -0.0373 | 0.1302 | 0.2370[c] | 0.1329 |
| MS[g] | 0.0457 | 0.2319 | 0.1627 | 0.2104 |
| NC[g] | -0.0988 | 0.1578 | 0.2400 | 0.1667 |
| SC[g] | -0.2505 | 0.2451 | 0.2543 | 0.2386 |
| TN[g] | -0.3255[c] | 0.1681 | 0.0517 | 0.1589 |
| Household Size | -0.0147 | 0.0092 | -0.0151[c] | 0.0080 |
| Weekly Food Expenses | 0.0007 | 0.0007 | 0.0008 | 0.0007 |
| Wald $Chi^2$ | 41.44[a] | | 41.13[b] | |

Notes: [a, b, c] denote significance at the 99%, 95% and 90% confidence levels, respectively.

[*] The excluded category for the brand preference dummy variables is Generic brand.

[**] The excluded category for type of shopper is Value shopper.

[g] The excluded category for the location (state) variable is GA.

**Table 8.** Marginal effects of ordinal logit models for grass-fed and organic milk products.

| Variables | Grass-Fed Milk | | | Organic Milk | | |
|---|---|---|---|---|---|---|
| | High Premium | Low Premium | Zero Premium | High Premium | Low Premium | Zero Premium |
| Premium Labels[*] | 0.11403 | 0.05887 | -0.17290 | 0.15563 | 0.06170 | -0.21733 |
| Brand[*] | 0.01678 | 0.01437 | -0.03115 | -0.02348 | -0.01867 | 0.04216 |
| Health[**] | -0.00275 | -0.00248 | 0.00523 | 0.01503 | 0.01092 | -0.02595 |
| Age | -0.00109 | -0.00097 | 0.00206 | -0.00058 | -0.00043 | 0.00101 |
| Male | -0.04307 | -0.04263 | 0.08569 | -0.05155 | -0.04304 | 0.09459 |
| Education | -0.00172 | -0.00154 | 0.00327 | 0.00428 | 0.00323 | -0.00751 |
| Household Income | 1.32e-06 | 1.19e-06 | -2.51e-06 | 1.15e-06 | 8.66e-07 | -2.01e-06 |
| White | -0.02950 | -0.02408 | 0.05357 | -0.02964 | -0.02069 | 0.05032 |
| AL[g] | 0.01780 | 0.01474 | -0.03254 | 0.13480 | 0.06193 | -0.19673 |
| FL[g] | -0.00776 | -0.00703 | 0.01480 | 0.05418 | 0.03792 | -0.09209 |
| MS[g] | 0.00980 | 0.00838 | -0.01817 | 0.03870 | 0.02507 | -0.06377 |
| NC[g] | -0.01984 | -0.01916 | 0.03901 | 0.05785 | 0.03634 | -0.09419 |
| SC[g] | 0.04597 | -0.05144 | 0.09740 | 0.06292 | 0.03726 | -0.10018 |
| TN[g] | -0.05872 | -0.06724 | 0.12596 | 0.01162 | 0.00844 | -0.02006 |
| Household Size | -0.00308 | -0.00276 | 0.00584 | -0.00332 | -0.00251 | 0.00583 |
| Weekly Food Expenses | 0.00014 | 0.00012 | -0.00026 | 0.00018 | 0.00014 | -0.00032 |

Notes: [*] The excluded category for the brand preference dummy variables is Generic brand.

[**] The excluded category for type of shopper is Value shopper.

[g] The excluded category for the location (state) variable is GA.

**Table 9.** Heckman probit results for grass-fed and organic milk premium differences

| Variables | Discriminating Decision (Selection Equation) | | Positive vs. Negative Price Premium Differences (Outcome Equation) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| Intercept | 0.1703 | 0.2856 | -1.3455[a] | 0.3795 |
| Premium Labels[*] | 0.3161 | 0.3499 | 0.3959 | 0.3260 |
| Brand[*] | -0.0874 | 0.1191 | -0.2583[b] | 0.1354 |
| Health[**] | -0.1804 | 0.1225 | -0.1459 | 0.1381 |
| Age | -0.0024 | 0.0025 | 0.0023 | 0.0031 |
| Male | -0.1368 | 0.1134 | -0.2090[c] | 0.1285 |
| Education | -0.0134 | 0.0134 | 0.0218 | 0.0162 |
| Household Income | 5.35e-06[a] | 1.35e-06 | 2.96e-06[c] | 1.56e-06 |
| White | -0.0987 | 0.1016 | -0.1202 | 0.1207 |
| Household Size | -0.0056 | 0.0112 | 0.0123 | 0.0435 |
| Weekly Food Expenses | | | 0.0005 | 0.0009 |
| AL[g] | | | 0.3991[a] | 0.1481 |
| FL[g] | | | 0.3016[b] | 0.1323 |
| MS[g] | | | 0.0054 | 0.2888 |
| NC[g] | | | 0.3307[b] | 0.1501 |
| SC[g] | | | 0.4765[b] | 0.1985 |
| TN[g] | | | 0.2938[c] | 0.1672 |
| Wald $Chi^2$ | 50.23[a] | | | |
| Uncensored Observations | 297 | | | |
| Wald Independence Test | 0.05 | | | |

Notes: [a, b, c] denote significance at the 99%, 95% and 90% confidence levels, respectively.

[*] The excluded category for the brand preference dummy variables is Generic brand.

[**] The excluded category for type of shopper is Value shopper.

[g] The excluded category for the location (state) variable is GA.