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Consumer Premiums for Environmentally Friendly Grass-Fed and Organic Milk in the Southeast

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This paper examines determinants of consumers' willingness to pay a premium for grass-fed and organic dairy by using survey data collected from several southeastern states. Ordered and Heckman probit regression techniques were used to identify the significance of consumer characteristics on their willingness to pay separate and comparative premiums, respectively, for the two milk product alternatives. The results indicate that while gender and household income are significant determinants of price premiums for both organic and grass-fed dairy products, only household income is positively significant in the Heckman selection estimation.

Key Words: grass-fed dairy, Heckman probit regression, ordered probit, organic dairy, willingness to pay

Demand for specialized markets for healthier and environmentally friendly goods are on the rise, with even large supermarket chains continually increasing their supply of organic and eco-friendly products. This increase in demand has allowed many agricultural industries to diversify their markets. One such industry is the dairy sector. Organic milk is already being embraced among dairy producers who acknowledge and support the organic production method's goals of preserving environmental balance, promoting animal rights, and enhancing their output's health benefits. Organically produced milk, as defined by the U.S. Department of Agriculture (USDA),[1] 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, 2006).

Dairy producers have recently started to explore the grass-fed dairy as a new niche market. "Grass-fed" as defined by the USDA website is:

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[1] The USDA's rules and regulations for organic certification can be accessed at the following link: http://www.ams.usda.gov/AMSv1.0/nop.

> Grass and forage shall be the feed source consumed for the lifetime of the ruminant animal, with the exception of milk consumed prior to weaning. The diet shall be derived solely from forage consisting of grass (annual and perennial), forbs (e.g., legumes, Brassica), browse, or cereal grain crops in the vegetative (pre-grain) state. Animals cannot be fed grain or grain byproducts and must have continuous access to pasture during the growing season. Hay, haylage, baleage, silage, crop residue without grain, and other roughage sources may also be included as acceptable feed sources. Routine mineral and vitamin supplementation may also be included in the feeding regimen. If incidental supplementation occurs due to inadvertent exposure to non-forage feedstuffs or to ensure the animal's well-being at all times during adverse environmental or physical conditions, the producer must fully document (e.g., receipts, ingredients, and tear tags) the supplementation that occurs including the amount, the frequency, and the supplements provided.[2]

Proponents of the grass-fed method argue that the health benefits of the cows they raise surpass the advantages of more efficient, conventional milk production systems. Moreover, studies have established that grass-fed milk, compared to its conventional counterpart, has five times more conjugated linoleic acid (CLA) content (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., 1999). The organic and grass-fed production methods promote almost identical values, except for some slight variation in handling the animals. Cows' access to pasture need not be permanent for organic dairy, while grass-fed farms allow their cows to roam freely as they feed (Collins, 2006).

The purpose of this study is to analyze consumer demand for these markets by identifying the determinants of consumers' willingness to pay (WTP) for grass-fed and organically produced milk through the use of ordered and Heckman probit estimation techniques. Specifically, we seek to identify a separate set of significant determinants of consumer demand for each production method. Moreover, a comparative analysis of premiums assigned for the two alternative products will identify the determinants of consumers' preferred choices for one product over the other. 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. Next we describe the data used in this study. Model specification and econometric results are then presented. The paper concludes with a discussion of our findings.

Literature Review

While the considerable growth in demand for organics has generated interest in consumer preference studies in recent years, the demand for grass-fed products is

[2] For further information, interested readers are referred to http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateN&navID=GrassFedMarketingClaimStandards&rightNav1=GrassFedMarketingClaimStandards&topNav=&leftNav=GradingCertificationandVerfication&page=GrassFedMarketingClaims&resultType=&acct=lsstd.

still relatively unexplored, resulting in a dearth of available literature. Even with an increased interest in organic consumer demand, there is a limited amount of literature that investigates the determinants for consumers' willingness to pay for organic dairy. Moreover, our review of the literature found no studies examining the willingness to pay for grass-fed dairy.

An organic products demand study focusing on the characteristics of organic consumers (i.e., what they buy, how much they spend, and the price premiums they pay) revealed that income, gender, age, household size, marital status, education, and location are relevant determinants for consumers' price premiums for organics (Stevens-Garmon, Huang, and Lin, 2007). A 2007 report by the USDA/ Economic Research Service using a Nielsen panel data set found that decisions to purchase organic milk were influenced by age, race, gender, region, and income (Dimitri and Venezia, 2007), which is consistent with general findings in the current available literature on organics. From a case study analysis in England, Hill and Lynchehaun (2002) found that consumer income level was the most important factor in organic milk purchases. Age, gender, and location were also reported to be significant. In particular, the authors explain the significance of location by noting that certain locations had higher levels of disposable income. Furthermore, it has been documented that there are regional differences exhibited in consumers' willingness to pay premiums for organics (Stevens-Garmon, Huang, and Lin, 2007). The geographical research area of our study focuses on demand within the southeastern United States, since states such as Florida and Georgia are considered to be emerging as strong producers in the dairy industry.

Empirical Framework

A telephone survey was conducted to elicit consumers' WTP premiums for organic and grass-fed dairy. The crucial valuation questions asked participants if they were willing to pay a series of premium values for grass-fed milk. Similarly, the participants were then asked if they were willing to pay the same set of premiums for organic milk.

The survey interviewers provided the respondents with clarifications of the definitions of the dairy products being investigated. The grass-fed method was defined as one that requires cows to remain on the pasture their entire lives and allowed to roam freely. Organic milk production, on the other hand, was defined as coming from dairy cattle raised on feed that has been grown in fields free of pesticide and chemical fertilizer for at least three years. Organic milk production practices also require that cows must eat such feed for an entire year before their milk can be certified organic. Bovine somatotropin (bST), 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 contents cannot be bottled for sale as organic milk.

Table 1. Survey Demographic Distributions

Variable	% of Observations
Gender	
Male	27.41
Female	72.59
Location	
Alabama (*AL*)	7.41
Florida (*FL*)	35.70
Georgia (*GA*)	22.37
Mississippi (*MS*)	4.44
North Carolina (*NC*)	13.78
South Carolina (*SC*)	5.33
Tennessee (*TN*)	10.96
Household Income	
Under $15,000	5.33
$15,000 to $19,999	3.70
$20,000 to $24,999	3.41
$25,000 to $29,999	4.59
$30,000 to $39,999	7.56
$40,000 to $49,999	6.67
$50,000 to $59,999	8.44
$60,000 to $70,000	5.48
Over $70,000	20.89
No response	33.93

This paper utilizes crucial valuation questions to estimate if there are different determinants for organic and grass-fed dairy. To estimate these determinants, we employ ordered and Heckman probit regression techniques to identify linkages among 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 the distinct sets of indicators of grass-fed and organic milk 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

The data consist of the responses of 655 randomly surveyed consumers from Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Each survey participant was contacted by phone in 2005 by the University of Georgia's Center for Agribusiness and Economic Development. Table 1 shows the breakdown of the demographics of the respondents from the survey. Survey results show 72.59% of the respondents were female, which is considerably larger than the participation rate of women in the agricultural census conducted by the USDA (51.3%). The higher rate of female participation in this survey, however, is

not unexpected since the survey interviewers requested to speak to each household's primary shopper, the majority of whom are females (Kaneko and Chern, 2005).

Based on our survey results, Florida and Georgia have the largest number of respondents (35.70% and 22.37%, respectively), with the remaining states accounting for 4.44% to 13.78% of the total respondents. These findings are consistent with the trend in the agricultural census data where Florida (with 33.40%) and Georgia (with 17.09%) registered the highest participation rates. Income statistics from the survey indicate that 20.89% of the respondents declared making $75,000 and over annually, while 8.44% stated they were making between $50,000 and $60,000. Our survey households in 2005 are close in comparison to the census data income distribution, with the exception of the "less than $15,000" and "greater than $70,000" categories; these income strata each reflect a 10-point jump in their respective percentages over the census data. Such trends in these major demographic indicators are considered typical for surveys of this nature (Lourerio and Hine, 2002).

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' WTP premiums for the two milk products by 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 reached a maximum of $0.60 per gallon. For purposes of this analysis, the participants' highest revealed premiums were derived from the responses and classified under three categories: (*a*) zero premium (class 1), (*b*) $0.05 to $0.34 per gallon premiums (class 2), and (*c*) $0.35 to $0.60 per gallon premiums (class 3).

These premium classes are regressed against three classes of explanatory variables. The explanatory variables were primarily chosen from previous literature concerning WTP studies of organic consumers (see Stevens-Garmon, Huang, and Lin, 2007; Jolly, 1991; Glaser and Thompson, 2000; Misra, Huang, and Ott, 1991). Glaser and Thompson's research on the demand for organic and conventional milk was used to identify the branding variables. In their study, they found organic and branded milk can be substitutes; therefore, the branding variables were added here to avoid omitted variable bias. Following are the three classes of explanatory variables used in our analysis:

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

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

Model Specification

Ordered Probit Regression

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

$$Y_i^* = \alpha + \mathbf{PREF}_i'\boldsymbol{\beta}_1 + \mathbf{DEM}_i'\boldsymbol{\beta}_2 + \mathbf{HES}_i'\boldsymbol{\beta}_3 + \mu_i, \quad (1)$$

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; α is the model's general intercept; the $\mathbf{PREF}_i$, $\mathbf{DEM}_i$, and $\mathbf{HES}_i$ vectors (with their corresponding vectors of regression coefficients $\boldsymbol{\beta}_1$, $\boldsymbol{\beta}_2$, and $\boldsymbol{\beta}_3$) are associated with the three groups of independent variables representing buying preferences, demographic characteristics, and household economic structure, respectively, that could influence the probability of obtaining price premiums; and μ_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 obtaining a high premium ($Y_i = 2$) is specified as a nonlinear (probit) function of the consumers' buying preferences ($\mathbf{PREF}_i$), demographic characteristics ($\mathbf{DEM}_i$), and household economic structure ($\mathbf{HES}_i$). 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:

$$\begin{aligned} &Y_i^* = 0 \text{ if } Y_i \le 0, \\ &Y_i^* = 1 \text{ if } 0 \le Y_i \le \eta_1, \\ &Y_i^* = 2 \text{ if } \eta_1 \le Y_i \le \eta_2, \end{aligned} \quad (2)$$

where η_1 and η_2 are unknown parameters that collectively define the range of values into which the latent variable may fall (Greene, 2003). The $\boldsymbol{\eta}$'s are to be estimated, along with the unknown $\boldsymbol{\beta}$'s (coefficients of the explanatory variables).

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

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

where the function $\phi(\cdot)$ indicates a standard normal distribution, **X** is a vector containing the three groups of regressors (**PREF**$_i$, **DEM**$_i$, and **HES**$_i$), and the vector **B** contains their corresponding coefficients $\boldsymbol{\beta}_1$, $\boldsymbol{\beta}_2$, and $\boldsymbol{\beta}_3$.

Heckman Probit Regression

The second phase of the 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):

(4) Selection Mechanism:
$$z_i^* = \gamma w_i + \mu_i,$$
$$z_i = 1 \text{ if } z_i^* > 0,$$
$$z_i = 0 \text{ if } z_i^* \le 0,$$
$$\text{Prob}(z_i = 1) = \phi(\gamma w_i),$$
$$\text{Prob}(z_i = 0) = 1 - \phi(\gamma w_i);$$

(5) Outcome Model:
$$w_i = \boldsymbol{\beta}\mathbf{x}_i + \varepsilon_i \text{ if } z_i = 1.$$

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 a value of 1 for nonzero premium differences. The probit equation is estimated to obtain estimates of the following inverse Mills ratio (IMR), calculated as the ratio of the density (ϕ) and cumulative (Φ) probability density functions, for every household that discriminates between organic and grass-fed dairy (Greene, 2003):

(6)
$$\hat{\lambda}_i = \frac{\phi(\hat{\gamma} w_i)}{\Phi(\hat{\gamma} w_i)}.$$

In the second stage, the regression or outcome equation is applied to discriminating consumers (with nonzero 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 specified as:

$$z_i^* = \gamma_0 + \gamma_1 \mathbf{PREF} + \gamma_2 \mathbf{DEM} + \gamma_3 \mathbf{HES} + \mu_i, \tag{7}$$

which is almost identical to the estimating equation defined in (1) except that the location dummy variables (**LOC**) 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 remainder of the explanatory variables in (4). The expanded form of the outcome equation is given by:

$$w_i = \beta_0 + \boldsymbol{\beta}_1 \mathbf{LOC} + \boldsymbol{\beta}_2 \mathbf{FOODEX} + \boldsymbol{\beta}_3 \mathbf{PREF} + \boldsymbol{\beta}_4 \mathbf{DEM} + \boldsymbol{\beta}_5 \mathbf{HES} + \mu_i. \tag{8}$$

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

The first phase of the analysis employs a probit regression technique, while 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 high, low, and zero premiums), 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 relation 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 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 2 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). In the text that follows, we discuss the individual organic and grass-fed results and then give a comparison of the two.

Table 2. Ordered Probit Results for Grass-Fed and Organic Milk Products

	Grass-Fed Milk		Organic Milk	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
PREMIUM	0.4393	0.3625	0.5517*	0.3398
BRAND	0.0784	0.1134	−0.1100	0.1214
HEALTH	−0.0132	0.1265	0.0669	0.1235
AGE	−0.0052*	0.0030	−0.0026	0.0029
MALE	−0.2177**	0.1066	−0.2495**	0.1112
EDUCATION	−0.0082	0.0163	0.0195	0.0163
HHINC	6.33e-06***	1.40e-06	5.21e-06***	1.39e-06
WHITE	−0.1347	0.1159	−0.1292	0.1219
AL	0.0818	0.1883	0.4987**	0.1985
FL	−0.0373	0.1302	0.2370*	0.1329
MS	0.0457	0.2319	0.1627	0.2104
NC	−0.0988	0.1578	0.2400	0.1667
SC	−0.2505	0.2451	0.2543	0.2386
TN	−0.3255*	0.1681	0.0517	0.1589
HHSIZE	−0.0147	0.0092	−0.0151*	0.0080
FOODEX	0.0007	0.0007	0.0008	0.0007
Wald χ^2	41.44***		41.13**	

Notes: Single, double, and triple asterisks (*,**,***) denote significance at the 90%, 95%, and 99% confidence levels, respectively. The excluded category for the buyer's label preference dummy variables is *GENERIC* brand. The excluded category for type of shopper is *VALUE* shopper. The excluded category for the location (state) variable is *GA*.

For the organic ordered probit estimation, results indicate the significant determinants that are unique to organic dairy products alone are premium labels (*PREMIUM*), household size (*HHSIZE*), and the geographic regions of Alabama (*AL*) and Florida (*FL*). The premium labels are positively correlated such that a premium label will increase the price premiums the respondents are willing to pay. This finding is as expected since organic fluid milk captured 61% of the total sales from fluid milk sales in 2002, with only two brands (Horizon and Organic Valley) capturing over 80% of the organic fluid milk market (Ihde, 2002; Dimitri and Venezia, 2007). Both males and larger households are less willing to pay a higher premium. The coefficients for the geographical dummy variables *FL* and *AL* show that respondents from those states are more willing to pay a price premium.

In the grass-fed model, the variables that are specifically significant to this model are *AGE* and the geographical dummy variable *TN*. The ordered probit result for *AGE* implies that the probabilities of older respondents to assign zero and high price premiums for grass-fed milk are higher and lower, respectively.

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. The result for *HHINC* 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.

Directional Effects

The directional effects are more explicitly given by estimates of the marginal effects reported in table 3. Marginal effects 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):

$$\frac{\partial \text{Prob}(Y_i^* = 0)}{\partial \mathbf{X}} = -\phi(\boldsymbol{\beta}'\mathbf{X})\boldsymbol{\beta}, \tag{9}$$

$$\frac{\partial \text{Prob}(Y_i^* = 1)}{\partial \mathbf{X}} = \left(\phi(-\boldsymbol{\beta}'\mathbf{X}) - \phi(\boldsymbol{\eta} - \boldsymbol{\beta}'\mathbf{X})\right)\boldsymbol{\beta},$$

$$\frac{\partial \text{Prob}(Y_i^* = 2)}{\partial \mathbf{X}} = \phi(\boldsymbol{\eta} - \boldsymbol{\beta}'\mathbf{X})\boldsymbol{\beta}.$$

In the grass-fed milk model, the change in probability of being in the high and low premium classes decreases by 0.11% and 0.10%, respectively, with a one-unit change in the *AGE* variable. In contrast, the probability of being in the zero price premium class increases by 0.21% with 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 4.26%, respectively, but increase by 8.57% for zero premiums for every male respondent. 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, consistent with the trends noted in the results for this variable in the grass-fed milk model. The *HHINC* results also mirror the same implications noted in the grass-fed milk model where positive marginal effects are obtained for the high and low premiums, and the zero price premium class yields negative marginal effects.

PREMIUM results suggest that relative to respondents who 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 who prefer *PREMIUM* milk labels. Moreover, one additional member 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%.

Table 3. Marginal Effects of Ordinal Probit Models for Grass-Fed and Organic Milk Products

	Grass-Fed Milk			Organic Milk		
Variable	High Premium	Low Premium	Zero Premium	High Premium	Low Premium	Zero Premium
PREMIUM	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
HHINC	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	0.01780	0.01474	−0.03254	0.13480	0.06193	−0.19673
FL	−0.00776	−0.00703	0.01480	0.05418	0.03792	−0.09209
MS	0.00980	0.00838	−0.01817	0.03870	0.02507	−0.06377
NC	−0.01984	−0.01916	0.03901	0.05785	0.03634	−0.09419
SC	0.04597	−0.05144	0.09740	0.06292	0.03726	−0.10018
TN	−0.05872	−0.06724	0.12596	0.01162	0.00844	−0.02006
HHSIZE	−0.00308	−0.00276	0.00584	−0.00332	−0.00251	0.00583
FOODEX	0.00014	0.00012	−0.00026	0.00018	0.00014	−0.00032

Notes: The excluded category for the buyer's label preference dummy variables is *GENERIC* brand. The excluded category for type of shopper is *VALUE* shopper. The excluded category for the location (state) variable is *GA*.

Heckman Probit Results

The Heckman probit results presented in table 4 identify the significant determinants of the discriminating decisions (selection equation) and the assignment of positive or negative price premium differences which reveal consumers' preferences for organic and grass-fed milk products. Meanwhile, *HHINC* is the only significant determinant of the discriminating decision. The positive *HHINC* coefficient suggests high-income respondents are more likely to make distinctions between the milk products.

Among participants who make such distinctions (297 uncensored observations used in the outcome equation), respondents who are *MALE* and biased toward regular brands (*BRAND*), relative to *GENERIC* brand patrons, are less inclined to favor organic over grass-fed milk products. In contrast, 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.

Table 4. Heckman Probit Results for Grass-Fed and Organic Milk Premium Differences

	Discriminating Decision (Selection Equation)		Positive vs. Negative Price Premium Differences (Outcome Equation)	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
Intercept	0.1703	0.2856	−1.3455***	0.3795
PREMIUM	0.3161	0.3499	0.3959	0.3260
BRAND	−0.0874	0.1191	−0.2583**	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*	0.1285
EDUCATION	−0.0134	0.0134	0.0218	0.0162
HHINC	5.35e-06***	1.35e-06	2.96e-06*	1.56e-06
WHITE	−0.0987	0.1016	−0.1202	0.1207
HHSIZE	−0.0056	0.0112	0.0123	0.0435
FOODEX			0.0005	0.0009
AL			0.3991***	0.1481
FL			0.3016**	0.1323
MS			0.0054	0.2888
NC			0.3307**	0.1501
SC			0.4765**	0.1985
TN			0.2938*	0.1672
Wald χ^2	= 50.23***			
Uncensored Observations	= 297			
Wald Independence Test	= 0.05			

Notes: Single, double, and triple asterisks (*,**,***) denote significance at the 90%, 95%, and 99% confidence levels, respectively. The excluded category for the buyer's label preference dummy variables is *GENERIC* brand. The excluded category for type of shopper is *VALUE* shopper. The excluded category for the location (state) variable is *GA*.

Conclusions

This paper investigates the differences in consumer preferences for grass-fed and organic milk, which are alternative dairy products produced using methods consistent with certain convictions associated with environmental, animal rights, and health issues. These preferences were revealed through price premiums elicited from survey respondents via phone interviews. Specifically, this study identified the determinants of these price premiums as applied separately to grass-fed and organic milk products. Further analysis of the comparative assessment by consumers of these two products was pursued by relating the revealed price premiums for the two products.

Our predominant results indicate the relative importance of income and gender effects in both separate and comparative price premium analyses conducted. Higher household incomes and female consumers tend to assign higher price premiums for both products. Results of the Heckman selection analysis suggest that income tends to be the primary consideration for households to discriminate between these two alternative products. Among those individuals who revealed product preferences, usually female consumers—especially those with higher incomes and residing outside Georgia—are more inclined to patronize organic over grass-fed milk products.

The more consistent income and gender effects in both analyses reinforce the expectation that consumers with higher incomes tend to show more interest and be more accommodating in consuming relatively newer products in the market, such as grass-fed milk. Female buyers often may be more informed about the latest innovative, relevant developments circulating in the market that affect consumer and health issues, among others. Thus, the introduction of grass-fed products in the market could have been quickly observed and well scrutinized by the more vigilant, informed female consumers.

There is a need to instill greater consumer awareness of grass-fed dairy products, especially since recent research has identified their additional benefits, including the increase of omega-3 fatty acids which improves the omega 6:3 ratio (Dhiman et al., 1999). Recent research by Lusk and Parker (2009) found that the improved health benefits of beef products where the cattle consumed a grass-fed diet were desirable to consumers. Furthermore, as the authors point out, while beef products are likely to suffer a taste change, this would not be an issue for grass-fed dairy products. Thus, our study's results can provide motivation to pursue further interest in the market analysis of grass-fed dairy products as a potentially viable niche market.

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