Journal of Agricultural and Applied Economics, 41,3(December 2009):731–744

Does Price or Income Affect Organic Choice? Analysis of U.S. Fresh Produce Users

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This study analyzes consumer purchasing behavior of organic fresh fruits and vegetables using the 2006 Nielsen Homescan panel. An ordered logit model was estimated to quantify the impacts of economic and socio-demographic factors on the probability of a household belonging to a specific organic user group—devoted, casual, or nonuser. Results suggest that price and income, to some extent, affect consumer purchases of organic produce. Additionally, the profile of an organic produce user is most likely to consist of an Hispanic household residing in the Western United States with children under 6 years old and a household head older than 54 years with at least a college degree.

Key Words: Nielsen Homescan data, ordered logit, organic fruits and vegetables, user groups

JEL Classifications: C25, D12, M31, Q11

The market for organic foods has grown rapidly in the past decade as they have become increasingly affordable and available in mainstream grocery stores. A widely held belief in the organic trade circle is that price and income do not necessarily track organic sales (Fromartz, 2006; Hartman Group, 2006). Lack of influence exerted by price and income on organic purchases appears to contradict each other. In the early development of the organic food market, organic sales concentrated in niche markets, such as natural and specialty food stores, which serve affluent consumers. Affluent consumers may place a high value on the health and environmental benefits of organic food and hence may be willing to pay the premium—price does not matter but income does. As organic foods seep into mainstream supermarkets, they become available to a much larger consumer base of less affluent, price conscious customers. As a result of the phenomenal growth in the organic sector during the past decade, the roles of price and income in organic sales may have evolved.

A traditional and popular perception suggests that most organic consumers are white, female, young, wealthy, and well-educated (Buzby and Skees, 1994; Govindasamy and Italia, 1999; Roddy, Cowan, and Hutchinson, 1996; Thompson, 1998). According to Hartman Group (2002), half of the respondents who purchase organic food frequently have income below $50,000 and that African Americans, Asian Americans, and Hispanics purchase more organic products than Caucasians. Similarly, more recent studies (Hartman Group, 2006; Zhang et al., 2008) also report that nonCaucasian Americans are more likely to be organic

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Research for this study was supported by USDA-ERS Cooperative Agreement No. 43-3AEM-5-80043. The views expressed in this study are those of the authors, and do not necessarily reflect those of the U.S. Department of Agriculture.

purchasers. Although many studies find that higher income households are more likely to purchase organic products (Dettmann and Dimitri, 2009; Zhang et al., 2008), others have shown that income is uncorrelated with organic purchase behavior (Durham, 2007; Li, Zepeda, and Gould, 2007; Zepeda and Li, 2007). These results appear inconsistent and perhaps counterintuitive. However, it is also possible that the profile of organic consumers may have changed over time, reflecting the dynamic nature of the organic industry.

According to the *Nutrition Business Journal* (NBJ, 2008), retail sales of organic foods increased from $3.6 billion in 1997 to $18.9 billion in 2007 representing 3.3% of total U.S. food sales. Among the organic food categories, fruits and vegetables by far comprised the largest retail sales ($6.9 billion), accounting for 37% of total organic food sales in 2007 (NBJ, 2008). The importance of fruits and vegetables in the organic food market is also reflected in the production statistics, showing that only 0.2% of U.S. corn and soybean acreage was certified organic in 2005, compared with 2.5% of fruits and 5% of vegetables (U.S. Department of Agriculture—Economic Research Service, 2008). Apparently, fresh produce has dominated the current market food basket of organic food consumers.

Empirical analysis of demand for organic foods has been limited and has focused mainly on using the contingent valuation approach to examine how high a price premium consumers are willing to pay for organic foods and how socioeconomic and demographic factors affect their willingness to pay. Additionally, national mail and telephone survey data have been used to elicit food shoppers' attitudes and awareness toward organic foods, as well as purchasing habits (Bellows et al., 2008; Li, Zepeda, and Gould, 2007; Zepeda and Li, 2007). The recent addition of organic food sales to scanner data, by Nielsen and Information Resources, Inc., has enabled researchers to quantify consumer demand for organic foods in response to changes in price, income, and other socioeconomic characteristics throughout the United States. With a few exceptions, there is little systematic study based on actual purchases of organic foods. For example, household scanner data have been used to quantify organic consumption (Zhang et al., 2008), to describe organic purchasing patterns (Stevens-Garmon, Huang, and Li, 2007), and to examine premium structures for fresh produce in the United States (Huang and Lin, 2007; Lin, Smith, and Huang, 2008). These studies are distinguished from most previously published papers for utilizing household purchase data from a national sample to examine what consumers are actually buying and paying in the marketplace when they have a choice between organic and conventional produce. However, there are limitations including the lack of rigorous empirical evaluation (Stevens-Garmon, Huang, and Li, 2007) and the failure to consider important economic factors such as price (Wier et al., 2008; Zhang et al., 2008), while Huang and Lin (2007) and Lin, Smith, and Huang (2008) focus exclusively on organic price premiums.

The main purposes of the research are to examine the effects of price and income on the decision to buy organic fresh fruits and vegetables, as well as to characterize and profile organic fresh produce users. More specifically, this study uses the 2006 Nielsen Homescan data to examine American consumers' purchasing patterns of organic produce by estimating an ordered logit model for fresh fruits and vegetables separably. The study will determine to what extent, if at all, prices and income influence purchases of organic fruits and vegetables, and what differences may emerge between the two types of produce. Furthermore, the study aims to determine the effects of social and demographic factors on potential classification of organic user groups.

Methodology

For the purpose of the study, a qualitative choice model based on the premises of random utility maximization developed by McFadden (1981) provides the theoretical foundation for model formulation. In particular, an ordered logit model derived from the random utility maximization process is developed for empirical implementation.

Consider a sample of N consumers, each facing a set of M discrete alternatives. Each alternative i ($i = 1, \ldots, M$) provides utility, U_i, to

consumer n ($n = 1, \ldots, N$). An individual is said to choose an alternative i that maximizes his utility among M alternatives. The maximum utility attainable given each alternative i can be expressed as:

$$U_i = u(A_k, S_t), \quad k = 1, \ldots, K;\ t = 1, \ldots, T. \tag{1}$$

where U_i is the maximum utility attainable when alternative i is chosen, A_k is a vector of K attributes or characteristics associated with alternative i, and S_t is a vector of T socio-demographic characteristics of the individual n. For estimation purposes, the $u(.)$ is assumed to be a linear function of A_k and S_t, and it can be decomposed into a deterministic component $(A_k,\ S_t;\ \theta)_i$ and a stochastic component (ξ_i). Thus, Equation (1) can be rewritten as:

$$U_i = (A_k,\ S_t; \theta)_i + \xi_i, \tag{2}$$

where θ is a vector of parameters associated with A_k and S_t.

In the decision-making process, an individual is assumed to evaluate and compare the utility derived from each alternative i as specified in Equation (2). An individual will choose alternative j, if and only if it provides the highest utility,

$$U_j \geq \max\ (U_i \mid i = 1, \ldots, M;\ j \neq i). \tag{3}$$

In practice, U_j represents a latent variable, which is unobservable, and only the outcome of the decision process is observed. Thus, let Y be the observed variable that is ordinal in nature and $Y = j$ is the observed outcome when response category j is chosen. It follows that a regression relation implied by Equation (3) can be specified and estimated with appropriate statistical procedures:

$$Y_n = X_n\beta + \varepsilon_n, \tag{4}$$

where

$$Y_n = j, \quad \text{if } \mu_{j-1} < Y_n \leq \mu_j \rightarrow U_{j,n} \geq U_{j\text{-}1,n}, \quad j = 2, \ldots, M,$$

and

$$\Pr\ (Y_n = j \mid U_{j,n} \geq\ U_{j\text{-}1,n}) = \Phi\left[(\mu_j - X_n\beta)/\sigma\right] - \Phi\left[(\mu_{j\text{-}1} - X_n\beta)/\sigma\right], \tag{5}$$

where X_n is a matrix of explanatory variables that represent A_k and S_t in Equation (2) and β is a vector of unknown parameters; ε_n is a vector of error terms assumed to be independently and identically normally distributed, i.e., $\varepsilon_n \sim N(0, \sigma^2)$; $\mu_1, \ldots, \mu_M$ are the category thresholds for the underlying response variable (Y_n) with $\mu_1 \leq \mu_2 \leq \ldots \leq \mu_M$ and $\mu_1 = -\infty$ and $\mu_M = +\infty$; and $\Phi(.)$ denotes the standard normal cumulative distribution function. The definitions for the set of explanatory variables specified for Equation (4) are presented in Table 1. The model presented in Equation (5) is underidentified since any linear transformation applied to the underlying response variable and threshold value μ_js would lead to the same model. To identify the model, it can be assumed without loss of generality that $\mu_1 = 0$ and $\sigma = 1$. Thus, the log-likelihood function for the model is:

$$\log L(\beta, \mu_2, \ldots, \mu_{M-1}) = \sum_{n=1}^{N}\sum_{j=2}^{M} C_{jn} \times \log\left[\Phi(\mu_j - X_n\beta) - \Phi(\mu_{j-1} - X_n\beta)\right], \tag{6}$$

where $C_{jn} = 1$, if $\mu_{j\text{-}1} < Y_n \leq \mu_j$, and $C_{jn} = 0$, otherwise. Consistent parameter estimates for the β vector and the μ_js that maximize the log-likelihood function can be obtained by applying the ordered logit procedure available in the Stata program (StataCorp, 2007).

Classification of Consumer Groups

To the best of our knowledge, past studies that aim to classify consumers into organic user groups have done so based on respondents' self reported measures (Hartman Group, 2002, 2006; Zepeda and Li, 2007) or observations from focus groups (Hill and Lynchehaun, 2002). These studies use the respondents' answers pertaining to awareness and attitudes of organic foods, or stated frequency of organic purchases to classify them into consumer segments. A limitation of this method is that respondents' answers may be skewed due to the subjective nature of survey data (Bertrand and Mullainathan, 2001). A notable exception is by Wier et al. (2008) who divided British and Danish consumers into different user groups according to the size of their organic budget relative to total food expenditure.

Table 1. List of Independent Variables

Variable	Variable Definition
Organic premium index	Percentage points, weighted average organic premium for fresh fruit or vegetables within a specific market area
On-sale	The ratio of fresh fruit or vegetable purchases made on-sale
Household income	The ratio of household income over the federal poverty level, where household income is the midpoint of the income class
Married	= 1 if the marital status of the household is married, = 0 otherwise
Children <6 years	= 1 if there is a child under 6 years old present in the household, = 0 otherwise
Educational level	
High school diploma or less	= 1 if the male or female head has a high school education or less, = 0 otherwise
Some college	= 1 if the male or female head has attended some college, = 0 otherwise
College degree and beyond[a]	= 1 if the male or female head has a college degree or post college education, = 0 otherwise
Age of household head	
<35 years	= 1 if the male or female household head is less than 35 years old, = 0 otherwise
35–54 years	= 1 if the male or female household head is between 35 and 54 years old, = 0 otherwise
55 years or older[a]	= 1 if the male or female household head is at least 55 years old, = 0 otherwise
Urban	= 1 if the household resides in an urban area, = 0 otherwise
Region	
Northeast	= 1 if the household resides in the Northeastern region of the United States, = 0 otherwise
North Central	= 1 if the household resides in the North Central region of the United States, = 0 otherwise
South[a]	= 1 if the household resides in the Southern region of the United States, = 0 otherwise
West	= 1 if the household resides in the Western region of the United States, = 0 otherwise
Race	
White[a]	= 1 if the race of the household is Caucasian, = 0 otherwise
African	= 1 if the race of the household is African-American, = 0 otherwise
Hispanic	= 1 if the race of the household is Hispanic-American, = 0 otherwise
Asian	= 1 if the race of the household is Asian-American, = 0 otherwise
Other	= 1 if the race of the household is other American, = 0 otherwise

[a] Reference category.

However, their classification of organic users is chosen in an inexorable manner.[1]

Similar to Wier et al. (2008), we categorized each household into a user or nonuser group according to whether or not the household purchased any organic food in question. User households are then further classified into one of the two user groups, casual and devoted users, based on their organic budget share—the percent of their fresh fruit or vegetable budget

[1] Wier et al. (2008) define "heavy users" as having an organic budget share higher than 10%, "medium users" between 2.5% and 10%, and "light users" lower than 2.5% based on Danish purchases made between 1997 and 2001 and British purchases made between 2001 and 2003.

spent on organic produce. Derived from the Homescan panelist purchase records, we define the threshold between causal and devoted users as the average organic budget share among organic users. That is, casual users are defined as those households that committed an organic budget share no more than the average budget share among organic users. Households that spent more than the mean organic budget share, who are likely to be core customers that expend a relatively large amount on organic, are classified as devoted users.[2]

Data Source

The Nielsen Homescan panel data include purchases of both random-weight and Uniform Product Code (UPC) food items. According to Nielsen, the panel is representative of U.S. households that provide food purchase data for at-home consumption. In 2006, more than 7,500 households participated in the Homescan panel and reported their purchases of both UPC-coded and random-weight foods. Panelists report their purchases by scanning either the UPC or a designated code for random-weight (unpackaged) products of all their purchases from grocery stores or other retail outlets. For packaged or UPC-coded food products, organic produce can be identified by the presence of the United States Department of Agriculture organic seal or with organic-claim codes created by Nielsen. For random-weight items, the descriptions of designated codes can be used to identify organic produce. In addition, the Homescan data include product characteristics and promotional information, as well as detailed socio-demographic information of each household. For our analysis, household spending on fresh fruits and vegetables was aggregated over all purchase records for the year 2006.

Price Premium Index

Price is one of the most important factors influencing consumers' food choices. As organic food is made available to a wider consumer base of less affluent and more price sensitive consumers, we would expect organic premiums to play an increasingly important role in consumers' decisions to purchase organic or conventional foods. To the best of our knowledge, organic price premiums have not been considered in modeling consumers' participation in the organic food sector.

Several issues concerning prices arise in the Homescan data. First, Homescan panelists do not report prices they pay for each food; they report total quantity and expenditures for each food. Therefore, a unit value (price) for each purchase can be derived as the ratio of reported expenditures, net of any promotions, to the corresponding quantity. To avoid potential problems that may be caused by inadvertent reporting errors, the derived unit prices for organic and conventional produce that were greater than the sample mean plus three standard deviations were considered as outliers and thus excluded from the sample data. Secondly, organic prices can only be constructed from reported purchases—organic prices facing nonusers are unobserved. Therefore, we use reported unit values for organic and conventional produce to construct a market price premium index for each of the 52 major market areas and four regional rural areas identified in Homescan. Specifically, the organic market premium for the ith produce in the kth market ($prem_{ik}$) is computed by taking the difference between average organic and conventional prices and then expressing the difference as a percentage above the average conventional price,

$$prem_{ik} = \frac{\bar{p}^{o}_{ik} - \bar{p}^{c}_{ik}}{\bar{p}^{c}_{ik}}.$$

There are 24 fruits and 26 vegetables identified in Homescan data. To account for the fact that organic shares within each market vary by produce, such as apples versus peaches, organic market shares are used to derive the weighted average premiums for fruits and vegetables in each market. The organic market share for produce i in market k ($orgshare_{ik}$) is computed as the percent of organic sales produce i holds within market k,

$$orgshare_{ik} = \frac{\sum orgsales_{ik}}{\sum orgsales_{k}}.$$

[2] The mean organic budget share among organic fresh fruit and vegetable users was 9.93% and 9.36%, respectively.

Therefore, the sum of the weighted premiums in each market represents a market premium for n organic fruits (I_k^F) and m organic vegetables (I_k^V) faced by a household in market k and is defined as,

$$I_k^{F,V} = \sum_{i=1}^{n,m} (orgshare_{ik} * prem_{ik}) .$$

Comparison between User Groups

In 2006, as shown in Table 2, nonusers accounted for about 73% and 59% of fruit and vegetable consumers, respectively. Casual users represented almost 21% of fruit consumers and just over 31% of vegetable users, while devoted users accounted for about 6% and 10%, respectively. In terms of budget share for fresh produce, expenditures on organic produce averaged around 3% for the casual users and about 28–33% for the devoted users. It is interesting to note that the average organic market premium (as defined from above) paid by organic fruit users was about 44%, while devoted organic vegetable users paid a lower market price premium (39%) than their casual counterparts (47%). Likewise, both devoted organic fruit and vegetable users have a lower proportion of purchases made on-sale as compared with the other two user groups, suggesting that low-price seeking behavior differs by user groups.

Comparing demographic information across user groups in 2006 gives us further insights in terms of how organic purchases are related to these characteristics. User group membership is positively correlated with household income (as defined as the ratio of income over the federal poverty level). It is not surprising that organic users have the larger household incomes considering that organic fresh produce commands a price premium (Lin, Smith, and Huang, 2008).

Organic produce users tend to concentrate among married households and households with children under 6 years old. Married households account for 51% of organic fruit users (both causal and devoted), compared with 48% of nonusers. Eight percent of devoted organic fruit users have young children, compared with 7% and 5% among casual and nonusers. On the other hand, 59% of casual organic vegetable users are married, compared with 50% and 45% for devoted and nonusers. Similarly, a larger proportion of casual vegetable users have young children, compared with devoted and nonusers. With respect to educational attainment, the largest proportion of organic produce users, especially vegetable users, have at least a college degree while the largest proportion of nonusers have only a high school diploma or less.

Among Homescan panelists, there is an even distribution between middle- and older-age households (35–54 versus 55 and older in age). However, the middle-age households represent a higher proportion of the devoted fruit and vegetable users. In contrast, a great proportion of casual users belong to the group of older households. In terms of geographic locations, the Southern and North Central regions have the largest proportions of nonusers, while the largest proportion of devoted produce users are found in the Western region. The nonuser and casual user groups have the largest proportion of whites, while a relatively large proportion of Hispanic-American consumers belong to the devoted users groups, especially for fruit consumers.

Ordered Logit Results

In Table 3, several goodness-of-fit measures are reported. One measure is the log-likelihood ratio. The second measure used is the pseudo-R^2 (Maddala, 1983, p. 40), and the third one examines how well the model classified the households correctly based on the estimated probabilities. In general, the regression models perform well. The computed statistical measures indicate that the models had satisfactory explanatory power and fit the data reasonably well. The log-likelihood ratio tests for the specified models were highly significant as compared with the restricted models of including only the constant term. The overall goodness of fit as measured by pseudo-R^2 is about 2% for fruits and 3% for vegetables, which is quite low but expected for qualitative response models based on cross-sectional data. In terms of prediction performance, the

Table 2. Sample Means of Fresh Fruit and Vegetable Expenditures and Household Characteristics by User Group, 2006[a]

	Fruits				Vegetables			
Variable	Nonusers	Casual	Devoted	Total	Nonusers	Casual	Devoted	Total
Organic budget share (%)	0.00	3.12	33.36	2.29	0.00	3.57	28.32	3.31
Organic premium index (%)[b]	44.81	43.53	44.43	44.57	46.26	46.77	39.39	45.85
On-sale (%)	30.38	30.05	24.23	29.99	23.43	22.25	18.62	22.71
Household income	3.78	4.55	4.13	3.93	3.75	4.30	4.23	3.95
Married (%)	48.44	51.23	51.49	49.09	45.07	59.30	49.93	49.48
Children <6 years (%)	4.79	6.68	8.33	5.30	4.38	7.15	5.91	5.29
Educational level (%)								
High school diploma or less	35.08	25.63	25.71	32.94	37.36	27.35	19.03	33.04
Some college	32.99	32.43	31.23	32.80	31.19	36.41	32.82	32.80
College and beyond	31.93	41.94	43.06	34.26	31.45	36.24	48.15	34.16
Age (%)								
<35 years	11.68	10.28	11.94	11.45	10.62	12.92	10.86	11.29
35–54 years	45.42	39.01	51.26	44.63	44.50	42.84	56.84	44.03
55 years or older	42.90	50.71	36.80	43.92	44.88	44.24	32.30	43.67
Urban (%)	74.31	78.57	73.96	75.03	73.13	77.88	80.18	75.04
Region (%)								
Northeast	19.08	18.31	17.36	18.85	17.44	21.04	19.88	18.65
North Central	23.72	21.28	22.38	23.22	25.03	18.72	20.01	22.84
South	37.02	33.61	33.61	36.25	39.57	31.79	34.32	36.94
West	20.18	26.80	26.65	21.67	17.96	28.46	25.79	21.56
Race (%)								
White	75.04	73.89	63.80	74.23	76.07	71.06	70.11	74.17
African	10.86	10.64	13.47	10.96	11.71	9.58	11.10	11.06
Hispanic	9.75	11.01	19.29	10.48	8.52	14.12	13.80	10.53
Asian	2.55	2.27	2.10	2.47	1.96	3.44	2.48	2.42
Other	1.80	2.19	1.34	1.85	1.74	1.81	2.51	1.82
Sample size	5,297	1,513	455	7,265	4,275	2,275	746	7,296
% of sample	72.91	20.83	6.27		58.59	31.18	10.22	

Note: User groups are classified based on a household's organic budget share—the percent of fresh fruit or vegetable expenditures committed to organic produce. We define the casual users as those households with an organic budget share no more than the average budget share. Households with an organic budget share of more than the average are classified as devoted users.

[a] The sample means are computed as weighted averages by applying the sampling weights reported in the Nielsen Homescan data to ensure the sample statistics reflect a more accurate representation of the U.S. population.

[b] The organic premium index is calculated based on observed purchases within a market. The mean organic premium indices by user group are obtained by taking the average of the market premiums among all households in each user group.

ability of the model to yield correct classifications on consumer purchasing behavior of organic fresh fruits was 72.9% and 58.8% for fresh vegetables.

The estimated coefficients from the ordered logit regression models do not provide any meaningful economic interpretations *per se* except that they do represent the potential change in the probability of observing the dependent variable.[3] In other words, the estimated coefficients serve as an indicator of how they may affect positively or negatively the probability that a certain event would occur due to a unit change in a particular explanatory variable. A more meaningful approach is to

[3] Estimated coefficients are available in Appendix A.

Table 3. Summary Statistics Obtained from the Ordered Logit Analysis

	Fruit	Vegetables
Log-likelihood value	−4697.541	−6003.733
−2 × Log-likelihood ratio	194.92*	377.57*
McFadden's R^2	0.020	0.030
% Correct predictions	72.9	58.8
Number of observations	7,265	7,296

* Statistically significant at the 0.01 significance level.

compute the marginal effects or marginal probabilities, which measures the change in probability of each choice or user group with respect to a change in each explanatory variable. The probability derivatives for binary variables, however, do not exist. Therefore, the marginal probability for a given binary variable was calculated by taking the difference between the Pr (Y | X = 1) and Pr (Y | X = 0), holding all other variables at the weighted sample means. The estimated marginal probabilities and their corresponding *t*-statistics are presented in Table 4. Note that the sum of marginal probabilities is equal to zero because an increase in probability in one category must be offset by corresponding decreases of probability in another category or categories.

As shown in Table 4, the marginal probabilities for the organic premiums at the market level are negative for both fruits and vegetables, implying that organic premiums discourage participation in the organic fruit and vegetable markets. But the premium coefficient for fruit is not statistically significant, whereas the premium coefficient for vegetables is significant at the 5% level. The results indicate that as the market premium for organic vegetables increases by one percentage point, vegetable consumers are 0.03% more likely to be a nonuser. To account for the price conscious consumer, the on-sale variable captures the consumers' effort to search for lower priced produce. An increase in a household's ratio of purchases made on-sale increases the probability that the household will be a nonuser. The relative small/insignificant change of the marginal effect of price, coupled with our finding for on-sale purchases, may be due to the notion that consumers (whether an organic user or nonuser) most often arrive at a shopping destination to accomplish certain tasks, rather than to search for a set of products at the lowest price (Hartman Group, 2006). In other words, fresh produce consumers set out with certain purchases in mind and may only be swayed marginally, if at all, by price.

The marginal probabilities associated with a change in household income indicate that a household is more likely to become an organic user than a nonuser as income increases. The shift from nonusers to casual users is estimated at least twice as likely as a shift from nonusers to devoted users in both models. Given that income is a ratio relative to the federal poverty level (which is a function of household size), the results indicate that a one percentage point increase in income increases the probability of being an organic produce user by less than one percent in both models. The results point to a significant, yet small marginal change in user group affiliation relative to income. Our finding of a significant income effect that moves a household to become a user of organic produce would directly refute a popular belief that consumers tend to purchase organic foods regardless of their income status (Fromartz, 2006). Stevens-Garmon, Huang, and Lin (2007) found that consumption of organic produce in 2004 was wide spread across all income spectrums. They speculated that as mainstream grocery stores replace natural and specialty food stores as the main supplier of organic foods, income could play a smaller role in the consumer's purchase decision of organic foods.

Both models suggest that married households have a higher probability of becoming an organic user than a nonuser as compared with unmarried households. However, marital status has a more pronounced influence on user group status in terms of both statistical significance and magnitude for vegetables over fruits. For example, fresh vegetable users that are married are 2.7% more likely to be devoted than unmarried households. Whereas under the same scenario, married fruit users are only 0.5% more likely to be devoted. Households with a positive attitude toward cooking show a greater preference for purchasing organic foods (Li, Zepeda, and Gould, 2007; Wilkins

Table 4. Estimated Marginal Probability from the Ordered Logit Model

	Fruit			Vegetables		
Variable	Nonusers	Casual	Devoted	Nonusers	Casual	Devoted
Organic premium index	0.0075 (0.55)[a]	−0.0054 (−0.55)	−0.0021 (−0.55)	0.0347** (2.24)	−0.0243** (−2.24)	−0.0104** (−2.24)
On-sale	0.0406** (2.23)	−0.0293** (−2.23)	−0.0113** (−2.23)	0.0541** (2.23)	−0.0379** (-2.23)	−0.0162** (−2.22)
Household income	−0.0086*** (−4.78)	0.0062*** (4.76)	0.0024*** (4.71)	−0.0072*** (−3.31)	0.0051*** (3.30)	0.0022*** (3.30)
Married	−0.0165* (−1.64)	0.0119* (1.64)	0.0046* (1.63)	−0.0903*** (−7.76)	0.0631*** (7.69)	0.0273*** (7.51)
Children <6 years	−0.0918*** (−3.60)	0.0639*** (3.73)	0.0279*** (3.28)	−0.0451* (−1.76)	0.0309* (1.80)	0.0142* (1.67)
High school diploma or less	0.0767*** (6.28)	−0.0558*** (−6.20)	−0.0210*** (−6.19)	0.1045*** (7.04)	−0.0743*** (−6.90)	−0.0302*** (−7.07)
Some college	0.0450*** (3.96)	−0.0326*** (−3.93)	−0.0124*** (−3.95)	0.0069 (0.49)	−0.0048 (−0.49)	−0.0021 (−0.49)
<35 years	0.0753*** (5.43)	−0.0554*** (−5.31)	−0.0199*** (−5.57)	0.0226 (1.18)	−0.0160 (−1.17)	−0.0066 (−1.21)
35–54 years	0.0531*** (5.09)	−0.0383*** (−5.06)	−0.0148*** (−5.00)	−0.0023 (−0.19)	0.0016 (0.19)	0.0007 (0.19)
Urban	−0.0185 (−1.61)	0.0134 (1.61)	0.0051 (1.62)	−0.0564*** (−4.22)	0.0400*** (4.15)	0.0164*** (4.31)
Northeast	−0.0052 (−0.36)	0.0037 (0.36)	0.0014 (0.36)	−0.0717*** (−4.29)	0.0489*** (4.40)	0.0228*** (4.02)
North Central	−0.0134 (−0.97)	0.0096 (0.97)	0.0038 (0.96)	0.0003 (0.02)	−0.0002 (−0.02)	−0.0001 (−0.02)
West	−0.0648*** (−4.46)	0.0460*** (4.51)	0.0188*** (4.22)	−0.1326*** (−8.29)	0.0885*** (8.59)	0.0442*** (7.30)
African	−0.0386** (−2.19)	0.0275** (2.22)	0.0111** (2.12)	−0.0099 (−0.51)	0.0069 (0.52)	0.0030 (0.51)
Hispanic	−0.0696*** (−3.81)	0.0490*** (3.89)	0.0206*** (3.57)	−0.0719*** (−3.78)	0.0487*** (3.90)	0.0232*** (3.49)
Asian	0.0444 (1.59)	−0.0325 (−1.57)	−0.0119 (-1.65)	−0.0406 (−1.14)	0.0278 (1.16)	0.0128 (1.08)
Other	−0.0314 (−0.82)	0.0223 (0.83)	0.0090 (0.78)	−0.0397 (−0.91)	0.0273 (0.93)	0.0125 (0.87)

[a] The numbers in parentheses are asymptotic *t*-ratios.

*, **, and *** indicate statistically significant at 0.10, 0.05, and 0.01 significance levels, respectively. Marginal probabilities are computed at the weighted means and may not sum to zero due to rounding error.

and Hillers, 1994; Zepeda and Li, 2007). Vegetables are more likely to be used as "inputs" for meal preparation than fruits. If married households tend to prepare and show a preference to prepare meals at home, then they would be more likely to buy organic vegetables but not necessarily organic fruits. Therefore, it is not surprising to find such a stark difference between the types of produce.

The presence of children younger than 6 years old is an important factor in increasing the probability of being an organic consumer, suggesting that parents may be more concerned about food safety and related problems especially when there are babies or young children living at home (Wier et al., 2008). Our finding tends to agree with Wier et al. (2008) and support their notion that it is the presence of

younger children rather than children *per se* that is related significantly to the purchase of organic foods. The marginal effect of being an organic user is much stronger for fruits (9.2%) than vegetables (4.5%), and the marginal effect of being a devoted fruit user (2.8%) is twice that of devoted vegetable users (1.4%). Parents of younger children may see the organic option as a healthier alternative to conventional produce, and as a means of getting their children to eat fresh produce absent of undesirable attributes so often related to conventionally grown foods. However as noted above, the marginal effect of young children on the household decision is not only statistically stronger, but also larger in magnitude for fruits than for vegetables. It is plausible that young children prefer eating fruits over vegetables.

With respect to educational attainment, we find that households with a high school diploma or less are more likely to be a nonuser than an organic user as compared with those with a college or postcollege degree. Previous studies (Wier et al., 2008; Zepeda and Li, 2007; Zhang et al., 2008) also found a positive and significant relationship between a household's educational attainment and its spending on organic produce. Zhang et al. (2008) also showed that educational level is highly significant in explaining both market participation and consumption of fresh organic produce. Similarly, medium and long education and social status (an indicator of educational level) were observed to have increased the organic budget share significantly in Denmark and Great Britain, respectively (Wier et al., 2008).

Although we find no significant age effect on user group affiliation among fresh vegetable consuming households, we do see that older households (55 years or older) are most likely to be organic fresh fruit users than those that are less than 55 years of age. Our findings seem consistent, in part, with that of Wier et al. (2008) who identified age as a significant factor influencing the organic budget share of Danish and British households. Their study revealed that middle-aged households in Great Britain had the highest propensity to purchase organic foods, while in Denmark organic purchases generally increased with age. Although our results seem to contradict those of earlier research in which younger consumers (under 45 years) were found to be more likely to purchase organic food (Buzby and Skees, 1994; Huang, 1996), a possible explanation is that the young consumer may be over-represented among early adopters in developing markets, while older consumers appear to be well represented in more mature markets (O'Doherty Jensen et al., 2001).

We found the effect of urbanization positively correlated with organic fresh vegetable use. The casual user group will gain the most as households shift from nonusers to users of organic. For example, households in urban areas are 5.6% more likely to be organic vegetable users—4.0% more likely to be casual and 1.6% more likely to be devoted. The results seem consistent with the hypothesis that households located closer to central business districts may be more aware and have greater access to organic produce than those located in more rural areas.

Geographic location significantly affects a household's purchasing behavior of organic fresh produce. In particular, households located in the West, where the vast majority of organic handlers reside (Dimitri and Oberholtzer, 2008), are more likely to purchase organic produce than those located in the South. The probability of being a nonuser will decrease by about 6.5% if a fruit consuming household is residing in the Western instead of the Southern region of the United States, and by over 13% for vegetable consuming households. For households in the West, the results suggest that vegetable users are more than twice more likely to be casual (8.9%) or devoted users (4.4%) than casual (4.6%) or devoted (1.9%) fruit users.

Our findings with regard to race and ethnicity appear plausible and similar to those of recent studies (Hartman Group, 2002, 2006; Zhang et al., 2008). Our results suggest that Hispanic-American households are more likely to become organic users than nonusers with the highest probability of being a casual user relative to white households. Although the probability of being a casual user for both fruits and vegetables is about 5%, we see a slightly stronger tendency for Hispanic-Americans to be devoted vegetable users (2.3%) as compared

Table 5. Estimated Probability of Subpopulation Belonging to a User Group

	Fruit			Vegetables		
Subpopulation	Nonusers	Casual	Devoted	Nonusers	Casual	Devoted
High Profile[a]	0.4359	0.3680	0.1961	0.3920	0.4244	0.1836
Medium-high profile[b]	0.6060	0.2848	0.1092	0.4754	0.3867	0.1379
Medium-low profile[c]	0.7019	0.2240	0.0741	0.6130	0.3032	0.0839
Low profile[d]	0.8892	0.0878	0.0229	0.7842	0.1775	0.0384
Average American	0.7803	0.1693	0.0504	0.6442	0.2816	0.0741

Note: Premium, on-sale, urban, and married were held at weighted averages for all subpopulations, while estimated probabilities for average American were computed at the weighted average for all variables.

[a] Hispanic-American, west, high-income, older than 54, with child less than 6, at least a college degree.

[b] Hispanic-American, northeast, median income, older than 54, with child less than 6, some college.

[c] African-American, north central, median income, age 35–54, with child less than 6, some college.

[d] White, south, low-income, less than 35, no child less than 6, high school diploma or less.

with devoted fruit users (2.1%). To a lesser extent concerning fruit consuming households, African-American households are also found to more likely be organic fruit users. Other races were found to not significantly affect the decision to purchase organic fresh produce.

The ordered-logit results confirm that organic participation varies by income and socio-demographic characteristics. Using the results, we construct four types of households by their likelihood in organic participation—high, medium-high, medium-low, and low profiles (Table 5). Specifically, the high profile organic produce user demographically reflects the highest probability of purchasing organic fruits and vegetables—a Hispanic household residing in the Western United States with a high income[4] and a child under the age of 6, older than 54 years, and with an educational attainment of at least a college degree. By holding other characteristics at their mean values, we can calculate and compare the marginal probabilities of these four household types belonging to a particular user group. As the profile moves from high to low, we see that the probability of being a non-user doubles for both fruits and vegetables. However, the probability of a low profile versus a high profile household belonging to the casual user group more than quadruples for fruits, but is only about two and one-half times higher for vegetables. A similar pattern is observed for devoted user groups among fruits and vegetables. We see that the average fresh produce consumer is predicted to be a nonuser with a probability of 78% for fruit users and 64% for vegetable users and falls somewhere between the medium-low to low profiles.

Conclusions

Increasing interest in organic markets coupled with the growing demand for organically grown foods has raised substantial research attention in this area. Prior to the phenomenal growth in the mid1990s, organic food was considered a niche market. As organic food started making inroads into mainstream supermarkets, it has began to serve consumers who are less affluent and more price conscious than those who may shop at natural or health food stores. In this study, we estimated an ordered logit model using data from the 2006 Nielsen Homescan panel. We examined organic purchase decisions of fresh fruits and vegetables based on economic and socio-demographic factors affecting the probability that a household will belong to a specific organic user group with an emphasis on price and income. The results seem plausible and give new insights into what factors are driving organic purchase decisions of American fresh produce users. Previous studies have found that consumers buy organic foods because they appear to possess many

[4] Income was defined based on sample distribution—75th percentile represents high income (5.12), 50th percentile represents the median income (3.31), and the 25th percentile denotes those with a low income (1.79).

perceived positive attributes (e.g., pesticide-free, environmentally friendly, better taste, more nutritional value, etc.) (Hartman Group, 2002, 2006; Huang, 1991, 1996; Williams and Hammitt, 2001; Zepeda and Li, 2007). However, our data do not permit such investigations into organic awareness and attitudes. Instead, our research focused on economic and demographic factors influencing organic fresh fruit and vegetable purchases.

Overall, our finding of a significant positive income effect is important to show that demand for organic foods may still be income dependent. The demand for organic fresh produce may continue to expand as household income increases. This finding contradicts a conventional belief that income does not track consumer behavior on organic food purchases. Future research on the role of income in organic food purchases should be encouraged. Additionally, we model the effect of organic premiums at the market level and find that fresh produce users are marginally, if at all, affected by the difference between conventionally and organically grown fresh produce. This notion is further expected as we find that those households that are price conscious (purchasing fresh produce proportionally more on sale) are less likely to be organic users.

Furthermore, we find that geographic location is the most important factor that would affect the probability of a household to become an organic vegetable user, while the presence of children under 6 has the greatest impact on a household's organic fruit decision, though both variables influence organic produce choice in general. In particular, households in the West are most likely to be organic produce users, while households in the South and North Central are least likely to be fresh organic produce users relative to those located in other regions of the United States. Educational attainment is the second leading role in the organic produce decision for both fruits and vegetables showing that a higher education is linked to increased organic produce purchases. Considering other demographic variables, we find that household heads aged 55 years and older are more likely to purchase organic produce than those households with younger household heads. Moreover, we find married households are more likely to be organic produce consumers than their unmarried counterparts.

In particular, the profile of an organic produce user appears to consist of those households that are of Hispanic origins residing in the Western region of the United States with young children living at home and a household head that is older than 54 years and has a college degree or postgraduate education. Considering that the Hispanic population is the fastest growing ethnic group in the United States coupled with their high propensity to purchase organic produce, we would expect this sector to be a viable part of the organic industry. The specific consumer profiles associated with the users of organic produce provide important implications and helpful information to the organic industry in developing and delineating any market segments and planning its marketing strategies.

[Received November 2008; Accepted March 2009.]

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Appendix A. Regression Results Obtained from the Ordered Logit Analysis

	Fruit		Vegetables	
Variable	Estimated Coefficient	Asymptotic *t*-ratio	Estimated Coefficient	Asymptotic *t*-ratio
Constant	−1.251***	−10.43	−1.039***	−10.01
Organic premium index	−0.044	−0.55	−0.151**	−2.24
On-sale	−0.237**	−2.23	−0.236**	−2.23
Household income	0.052***	4.77	0.032***	3.31
Married	0.096*	1.64	0.395***	7.70
Children <6 years	0.479***	3.95	0.192*	1.79
High school diploma or less	−0.470***	−5.96	−0.469***	−6.81
Some college	−0.270***	−3.85	−0.030	−0.49
<35 years	−0.491***	−4.79	−0.100	−1.17
35–54 years	−0.313***	−5.02	0.010	0.19
Urban	0.110	1.59	0.251***	4.12
Northeast	0.030	0.36	0.306***	4.38
North Central	0.077	0.98	−0.001	−0.02
West	0.358***	4.68	0.559***	8.46
African	0.215**	2.29	0.043	0.52
Hispanic	0.375***	4.09	0.304***	3.87
Asian	−0.280	−1.46	0.173	1.16
Other	0.175	0.85	0.170	0.93
Estimated threshold parameter				
μ_2	1.669***	35.17	1.931***	46.92

*, **, and *** indicate statistically significant at 0.10, 0.05, and 0.01 significance levels, respectively.