Journal of Agricultural and Resource Economics 26(2):404–416

Assessing Consumer Preferences for Organic, Eco-labeled, and Regular Apples

Maria L. Loureiro, Jill J. McCluskey, and Ron C. Mittelhammer

We assess consumer choice of eco-labeled, organic, and regular apples, and identify sociodemographic characteristics affecting the choice among those three alternatives. Eco-labeled apples are less desirable than organic when food safety, the environment, and children's needs are considered. Characteristics that may be expected to positively affect the decision to buy eco-labeled apples relative to regular apples actually have the opposite effect with the inclusion of the organic alternative. When considering all three choices, the eco-labeled product is found to be an intermediate choice among consumers.

Key words: apples, contingent valuation, eco-labels, organic foods

Introduction

The public's increasing awareness of environmental issues since the 1970s has led to an expanding demand for environmentally friendly products. The food industry has responded by offering products with eco-labels in both domestic and international markets. European industries have been very successful in developing and promoting large eco-label programs for nonagricultural products. For instance, the German eco-label, Blue Angel (*Blauer Engel*), which was introduced in 1978, has become a successful instrument in environmental protection with nearly 4,000 certified products. Launched in 1998, the Euro-eco-label regulates and sets common standards for all eco-labels in the European Union (EU) countries.[1]

In the United States, eco-labels are proliferating rapidly, with programs such as Green Seal, Scientific Certification Systems, and the U.S. Environmental Protection Agency's Energy Star Program. In addition, there are regional programs in agriculture designed to target specific niche markets. In the Pacific Northwest, eco-label programs for produce include Stemilt Growers, Inc., located in the State of Washington, California Clean Growers, and The Food Alliance (TFA), situated in Portland, Oregon.

Maria L. Loureiro is assistant professor, Department of Agricultural and Resource Economics, Colorado State University; Jill J. McCluskey is assistant professor, Department of Agricultural Economics, Washington State University; and Ron C. Mittelhammer is professor, Department of Agricultural Economics, and adjunct professor, Program in Statistics, Washington State University. The authors wish to thank without implicating Phil Wandschneider, John Loomis, Priscilla Salant, Tom Schotzko, and the anonymous reviewers for helpful discussion and advice. The authors gratefully acknowledge the financial support from the Federal State Marketing Improvement Program (FSMIP) of the U.S. Department of Agriculture.

Review coordinated by Gary D. Thompson.

[1]The emblem of the European Community environmental labeling system is a stylized flower incorporating the EU's star symbol.

An eco-label identifies environmentally preferable products based on an environmental impact assessment of the product compared to other products in the same category. The environmental impact assessment includes the production process, use, and disposal of the product (van Ravenswaay and Blend). While eco-labels require compliance with standards, they are still considered market-oriented because they do not involve direct government regulation.

Because eco-labeled products and organic products are marketed as "environmentally friendly," they will sometimes appeal to the same consumers. In general, the idea of an eco-label is more vague, and the personal benefits are more difficult to measure compared with organic products. Altruism may be reflected in an eco-label purchase because environmental quality is generally a public good. While eco-label standards often include reducing or eliminating pesticide use, organic standards will likely be more stringent. The term "organic" has been applied to measurable product standards, such as no observed synthetic pesticides, as well as process standards. Under the latter definition, organic foods are distinguished from conventional foods by production and processing principles rather than attributes which are noticeable in the product itself. The organic philosophy stresses production and processing without the use of synthetic chemicals, and soil fertility management using techniques for enhancing biological activity in the soil such as composting, green manuring, and rotating crops (Vandeman and Hayden).

In this study, we identify factors affecting consumer choices among eco-labeled, organic, and regular apples, with a particular interest in factors which induce consumers to choose an organic product rather than an eco-labeled product. When considering all three choices—organic, eco-labeled, and regular—we evaluate whether the eco-labeled product is an intermediate choice. A multinomial logit model is used to quantify the effects of factors affecting choices among regular, eco-labeled, and organic apples. In contrast to previous studies on eco-labels, we allow consumers to consider both organic and regular products as substitutes for eco-labeled products.

Previous Studies

Many researchers have investigated behavioral changes occurring in response to labeling. Examples include studies by Chang and Kinnucan; Kim, Nayga, and Capps; Mathios; and Wessells, Johnston, and Donath. These studies consistently found that a change in labeling or information can change consumers' perceptions and behavior.

Fewer studies have specifically examined the effect of eco-labels. Disagreement remains over whether eco-labels increase consumers' willingness to pay (WTP) for a particular product. In their examination of willingness to pay for eco-labeled apples, Blend and van Ravenswaay found, at a $0.40 per pound premium, over one-third of surveyed households would be willing to buy eco-labeled apples. Ethier et al. reported 30.6% of phone respondents and 35.5% of mail survey respondents said they would choose to join the Green Choice™ program for "green" electricity at a $6/month price premium.

Although Nimon and Beghin identified a premium for organic cotton fibers, they could not find evidence of a premium associated with environmental friendly dyes.[2] Teisl, Roe, and Levy studied how eco-marketing and seals of approval affect consumer choice, preference rankings of electricity suppliers, and how rankings differ across consumers.

[2] Note that these choices do not need to be mutually exclusive.

They concluded the presence of an eco-label on a product was more likely to affect the preference rankings of products than the choice of products.

Complicating eco-label valuation is the fact that eco-labels may work better for some products than for others, implying a general "recipe" to stimulate "green markets" may not work. As evidence of the absence of a single approach to eco-labeling, Wessells, Johnston, and Donath found consumers do not value all certified fish and seafood species identically, stating higher subjective willingness-to-pay values for certified salmon than cod. In addition, Johnston et al. reported differences in international reactions to seafood eco-labels in their comparison study of consumer preferences in the United States and Norway.

Model of Apple Choice

The discrete choice from among organic, eco-labeled, and regular apples was modeled within a multinomial logit framework.[3] The theoretical foundations of the (unordered) multinomial logit model lie in the random utility model (Mittelhammer, Judge, and Miller). Suppose the ith consumer's utility derived from the selection of apples of type j (eco-labeled, organic, or regular) can be represented as follows:

$$U_{ij} = \mathbf{X}_i\beta_j + \varepsilon_{ij}, \qquad i = 1, \ldots, n;\ j = 1, \ldots, J, \tag{1}$$

where U_{ij} represents the utility obtained by the ith consumer from choosing the jth type of apple; $\mathbf{X}_i$ represents a row vector of the ith consumer's sociodemographic characteristics such as presence of children in the household, income, and family size, as well as beliefs and perceptions such as food safety concerns, environmental attitudes, and perceptions of apple quality; β_j is a vector of coefficients associated with $\mathbf{X}_i$; and ε_{ij} is the residual error term which captures errors in perception and in the overall representation of the level of utility. Note that consumers were asked to select among organic, eco-labeled, and regular apples offered at equal prices, sizes, colors, and varieties. Thus, intrinsic characteristics related to the apples being selected are assumed to be identical across all apples. Finally, the utility from choosing the jth alternative is, of course, not observable. However, the consumer's choice is observable.

Assuming the consumer is a rational agent, we expect him or her to select the type of apple—organic, eco-labeled, or regular—which results in the highest utility possible. Thus, if the ith consumer selects type j, then U_{ij} is the highest utility obtainable from among the J possible choices. Hence, the statistical model of the probability that alternative j is chosen by individual i is given by:

$$\begin{aligned} \text{Prob}(y_i = j) &= \text{Prob}(U_{ij} > U_{ia};\ a = 1, 2, \ldots, J,\ a \neq j) \\ &= \text{Prob}(\varepsilon_{ij} - \varepsilon_{ia} > \hat{U}_{ia} - \hat{U}_{ij};\ a = 1, 2, \ldots, J,\ a \neq j), \end{aligned} \tag{2}$$

where $\hat{U}_{ij} = \mathbf{X}_i\beta_j$.

[3] Nested logit and multinomial logit are competing models, both of which are widely used for analyzing site or product choice in the environmental economics literature. Empirically, both models have been estimated. We ruled out the possibility of a nested logit empirical representation because we do not have intrinsic characteristics with respect to the choice (apple type) itself.

As shown by Maddala, when the residuals are independently and identically distributed and follow a type I extreme value distribution, the difference in error terms, displayed in equation (2), has a logistic distribution. Then a multinomial logit model can represent the ith consumer's probability of selecting the jth apple choice:

$$\text{(3)} \qquad \text{Prob}(y_i = j) = \frac{e^{\mathbf{X}_i\beta_j}}{\sum_{k=1}^{J} e^{\mathbf{X}_i\beta_k}}, \qquad j = 1, \ldots, J,$$

where β_j refers to the column vector of parameters that weight exogenous variables in determining the utility of choice j; and $\mathbf{X}_i$ is a row vector of exogenous variable values corresponding to sociodemographic characteristics, perceptions, and attitudes of the ith consumer. The parameters in (3) are unidentified because more than one set of parameters can generate identical probability values. To identify the parameters of the model, constraints on the βs must be imposed. The most common constraint in multinomial logit models, and the one we adopt without loss of generality, is $\beta_1 = 0$.

Survey Data

The eco-label analyzed in this study is certified by The Food Alliance (TFA), a nonprofit, third-party certifying organization based in Portland, Oregon. TFA uses market-based incentives to promote sustainable agricultural practices in the Pacific Northwest. Farmers who reduce or eliminate pesticides, conserve the soil and water, and provide safe and fair working conditions become eligible to market their products with the TFA-approved seal. TFA-approved farmers hope to earn the recognition of environmentally conscious shoppers and garner public goodwill. TFA has the only labeling program in the Pacific Northwest that is defined by farm practices and requires third-party monitoring.

The survey was pre-tested with focus groups in December 1999, and conducted during January 2000 in the produce sections of two grocery stores in Portland, Oregon, in cooperation with TFA. Customers entering the produce sections of the grocery stores were selected randomly; the interviewers solicited every third customer who came into the produce section. In order to collect a more representative sample, including multiple segments of the shopping population, this survey was conducted during both weekends and weekdays from 10:00 a.m. to 8:00 p.m. In total, four interviewers were used. The use of more than one interviewer may result in some bias. A mitigating factor is that each of the interviewers received formal training and followed a script.

In contrast to studies using mostly telephone or mail survey data, our survey data were collected in grocery stores directly from consumers at the same time and place where actual purchase decisions are made. This strategy allowed us to obtain information from the actual shopper/decision makers and to better elicit consumers' true preferences about eco-labeled products. Furthermore, the in-store survey gave survey participants the opportunity to inspect the actual products they were being asked to consider. The grocery stores in which the survey was conducted offer a large variety of produce, including regular, TFA eco-label, and organic apples, thereby permitting consumers to consider a variety of substitutes among apple types.

Table 1. Summary Statistics for the Demographic Variables

Variable Name	Description	Frequency	Mean	Standard Deviation
Age	Age of the consumer (years)	≤ 30 = 12.63% 30 to 45 = 33.69% 45 to 60 = 39.97% > 60 = 14.0%	46.75	13.995
Female	1 if female, 0 if male		0.792	0.406
Shopper	1 if main shopper, 0 otherwise		0.878	0.321
Education	1 = some school 2 = high school diploma 3 = some college 4 = bachelor's degree 5 = advanced degree	= 0% = 9.89% = 27.11% = 42.96% = 20.07%	3.723	0.892
Children	1 if children < 18 in the household, 0 otherwise		0.363	0.481
Total Children	Number of children in the household	0 = 64.91% 1 = 17.19% 2 = 11.57% 3 = 5.26% > 3 = 1.07%	0.6050	0.966
Family Size	Number of family members in the household	1 = 11.23% 2 = 45.62% 3 = 21.40% 4 = 14.73% > 4 = 7.02%	2.636	1.136
Income	1 = < $15,000 2 = $15,000 to $30,000 3 = $30,000 to $50,000 4 = $50,000 to $70,000 5 = $70,000 to $100,000 6 = > $100,000	= 2.04% = 6.97% = 26.63% = 26.23% = 20.49% = 17.62%	4.065	1.222
Race	1 if white, 0 otherwise		0.920	0.271

In total, 285 consumers were surveyed. The majority of respondents were the primary food shoppers of the household (87%), white (92%), and female (79%). The respondents' average age was 46 years, and 36% of all respondents had children under the age of 18 living in their household. Fifty-three percent of those sampled reported incomes ranging from $30,000 to $70,000 for the 1999 calendar year,[4] and their average education included some years of college. Summary statistics and demographic variable descriptions are presented in table 1.

Our sample is comparable to the Portland City Statistics (reported in the 2000 U.S. Census, General Population Characteristics) in terms of education, number of children

[4] In order to obtain a high response rate, respondents were asked to place themselves in income categories, rather than state their precise income. Survey respondents are typically reluctant to divulge income information.

per household, and household size. However, our sample includes fewer minorities. The high percentage of female respondents was expected and desirable, since we were targeting actual shoppers.

As with all surveys, sample representativeness is a concern. Mitchell and Carson discuss four types of sample design and execution biases: population choice bias, sampling frame bias, sample nonresponse bias, and sample selection bias. With population choice bias, the population chosen does not adequately correspond to the population that will purchase apples. Our population—shoppers in the produce section at Portland, Oregon, *Thriftway* stores—had fewer minorities than the general population. The effect of population choice on our results concerning eco-labels is likely indeterminate. There may also be some degree of sample selection bias, in which the people who were more interested in eco-labels elected to participate in the survey.[5] Given the potential sources of bias, we caution that our findings may not represent those of other populations.

The survey solicited information regarding respondents' attitudes about the environment and food safety, and their familiarity with and perceptions about the TFA eco-label. Those respondents who indicated they were not knowledgeable about TFA were read a short paragraph describing the TFA seal of approval.

Information about environmental and food safety attitudes was obtained by presenting tradeoff situations between environmental quality and job creation, and between food safety and product appearance.[6] Eliciting these attitudes from tradeoff scenarios was an effective way of ensuring survey information was informative as well as useful in an empirical modeling context.[7] For example, without the tradeoff, most respondents will say they value the environment highly. The resulting lack of variation in response can lead to a lack of statistical significance of the effect of the environmental variable.

Variable definitions and summary statistics for the questions related to consumers' environmental and food safety attitudes and consumers' quality perceptions are presented in table 2. Regarding environmental and food safety attitudes, 52% of the customers assigned more importance to preserving the environment than to creation of employment opportunities, and 33% placed more importance on food safety issues than on appearance of the fruit.

Empirical Specification and Results

The choice among organic, eco-labeled, and regular apples was presented to consumers so as to remove any price effect. Therefore, the empirical specifications of the utility levels underlying the multinomial logit model make no reference to prices and were formulated as follows:

---

[5] Whitehead found that mail survey response rates and environmental values for wetlands preservation were significantly greater for an environmental interest group compared to a general population sample. Edwards and Anderson observed significant differences between the characteristics of survey respondents and nonrespondents. Sample nonresponse and selection biases are examined by Messonnier et al.

[6] The survey instrument is available upon request from the authors.

[7] The choice of tradeoffs has the potential of affecting the responses of some respondents—especially the choice of jobs versus the environment. However, a perfect choice of tradeoff for eliciting environmental attitudes probably does not exist. Tradeoff situations have been widely used in natural resources valuation and contingent valuation (CV) studies. For example, Johnston, Swallow, and Weaver conducted a CV study in which respondents expressed their preferences for packages of watershed management outcomes, where these packages were assessed against alternative institutional characteristics of the funding mechanism. Indeed, the intent of using tradeoffs was to obtain more reliable and usable responses.

Table 2. Summary Statistics for Consumer Information and Perception Variables

Variable Name	Description	Scaled Values	Mean	Standard Deviation
Environment	Importance of environmental sensitivity versus jobs	(1, 10)	6.365	1.912
Food Safety	Importance of food safety versus appearance	(1, 10)	6.975	2.701
Quality	General quality of apples in the store	(−1, 0, 1)	0.491	0.554
TFA Quality	Perceived quality of the eco-labeled apples in comparison to other apples	(−1, 0, 1)	0.461	0.533

$$(4) \qquad U_{ij} = \beta_{0j} + \beta_{1j}Children_i + \beta_{2j}Food\ Safety_i + \beta_{3j}Environment_i + \beta_{4j}TFA\,Quality_i + \beta_{5j}Family\ Size_i + \beta_{6j}Income_i + \beta_{7j}Female_i + \varepsilon_{ij}.$$

Since U_{ij} is the latent unobservable utility level obtained by the ith consumer from choosing the jth apple type, the observed apple choice is a reflection of this latent unobservable utility. A multinomial logit choice model based on the empirical representation of the latent non-observable function specified in (4) was estimated using maximum-likelihood techniques. Estimation results from the logit model are presented in table 3, and the marginal effects and asymptotic standard deviations are reported in table 4. Additional sociodemographic variables, such as race, age, and education, have been excluded from this empirical specification because they were not statistically significant.

In a multinomial logit model, the parameters associated with one of the choices must be normalized to zero. In our case, the parameters associated with the choice of regular apples were normalized to zero. The marginal effects quantify the impact of each particular explanatory variable on the probability of choosing each apple alternative. Since our explanatory variables are integer valued rather than continuous variables, we evaluated the marginal effects by calculating the probabilities associated with each choice at the different levels of the explanatory noncontinuous variable of interest, holding the rest of the variables at their mean levels. Thus, the marginal effect associated with a binary or indicator variable has been calculated as the difference in the probabilities of a particular choice, obtained when the binary variable d (for example, presence of children) equals 1 ($d = 1$), and equals 0 ($d = 0$). Suppressing the consumer identifier, and letting $\bar{\mathbf{X}}_{-d}$ denote a vector of the mean levels of all explanatory variables other than the binary variable d, the marginal effect of the binary variable d on the probability of choosing the jth alternative is then calculated as:

$$(5) \qquad \gamma_{d,j} = \text{Prob}(Y = j \mid \bar{\mathbf{X}}_{-d}, d = 1) - \text{Prob}(Y = j \mid \bar{\mathbf{X}}_{-d}, d = 0),$$

where the probabilities in (5) are calculated based on the estimated versions of (3) obtained from estimating the multinomial logit model.

For integer variables with more than two outcomes (such as food safety and environmental concerns), the marginal effects have been calculated by estimating the increment

Table 3. Multinomial Logit Model Results (n = 285)

	Estimated Coefficients	
Variable	Organic Choice	Eco-labeled Choice
Constant	-4.254***	-1.373
	(-2.94)	(-1.083)
Children	1.926**	1.121
	(2.435)	(1.516)
Environment	0.508***	0.324**
	(3.670)	(2.567)
Food Safety	0.244**	0.169**
	(2.715)	(2.091)
Income	0.329	0.166
	(1.547)	(0.853)
Family Size	-0.977***	-0.724**
	(-3.068)	(-2.504)
TFA Quality	0.721	1.006**
	(1.543)	(2.333)
Female	1.489***	1.226**
	(2.668)	(2.486)

Notes: Double and triple asterisks (*) denote significance of coefficients at $\alpha = 0.05$ and 0.01, respectively. Numbers in parentheses are t-statistics.

Table 4. Marginal Effects of the Multinomial Logit Model

		Apple Choices		
Variable	Interval Points	Organic	Eco-label	Regular
Constant	P(1) - P(0)	-0.596	0.625*	-0.032
		(1.544)	(0.347)	(0.365)
Children	P(1) - P(0)	0.188***	-0.125	-0.606***
		(0.059)	(0.079)	(0.085)
Environment	P(10) - P(1)	0.356***	0.049***	-0.399***
		(0.020)	(0.012)	(0.017)
Food Safety	P(10) - P(1)	0.158***	-0.038**	-0.120***
		(0.008)	(0.019)	(0.024)
Income	P(6) - P(1)	0.205***	-0.111***	-0.094***
		(0.033)	(0.013)	(0.019)
Family Size	P(6) - P(1)	-0.306***	-0.125***	0.431***
		(0.051)	(0.030)	(0.078)
TFA Quality	P(1) - P(-1)	-0.065***	0.208***	-0.144**
		(0.014)	(0.043)	(0.065)
Female	P(1) - P(0)	0.078***	0.020	-0.098
		(0.023)	(0.045)	(0.097)

Notes: Single, double, and triple asterisks (*) denote significance of marginal effects at $\alpha = 0.1$, 0.05, and 0.01, respectively. Numbers in parentheses are asymptotic standard deviations. The notation P(j) - P(k) denotes the difference in choice probability when the integer-valued explanatory variable is evaluated at the levels j and k, respectively.

or difference in the probability of selecting a particular apple type when moving sequentially between one integer value to the next, holding the rest of the variables at their mean levels. Analogous to (5), the marginal effects on the probability of choosing the jth alternative induced by an integer-valued variable d that takes the value $\{1, 2, \ldots, m\}$ are calculated as:

$$\gamma_{d,j,r} = \text{Prob}(Y = j \mid \bar{\mathbf{X}}_{-d}, d = r) - \text{Prob}(Y = j \mid \bar{\mathbf{X}}_{-d}, d = r - 1), \quad r = 2, 3, \ldots, m. \tag{6}$$

The total effect from the lowest to the highest integer value is reported. The asymptotic variances of the marginal effects were calculated using the conventional delta method (see Mittelhammer, pp. 287–89).

From table 4, results indicate the probability of purchasing organic apples relative to the probability of purchasing alternatives is increased when consumers have children under the age of 18 and have strong environmental and food safety attitudes. At the same time, family size has a significant negative effect on the probability of choosing organic apples. Although family size and the presence of children under 18 are correlated (with a correlation coefficient of 0.714), the latter variable provides new information. Shoppers with large families are more likely to have an economizing mindset, inducing the purchase of low-cost items. Consequently, although the three apple products were offered at the same price, this predisposed mindset may have influenced some consumers' choices.

Consistent with the notion that the eco-label alternative is less desirable when compared with organic apples for certain consumers, some of the factors shown to have a positive and significant effect on the probability of organic choice have a negative impact on the probability of the eco-label choice.

One reason why eco-labeled apples may be a less desirable choice as compared to organic apples for consumers with children is that organic products may be perceived as safer for children because of lower pesticide residues. (The TFA eco-label uses reduced levels of pesticides.) Similarly, consumers with strong attitudes about food safety and the environment are less likely to choose eco-labeled apples. Perhaps the food safety and environmentally conscious consumers who would be favorably disposed toward purchasing eco-labeled apples consider organic apples to be safer and more environmentally friendly.

This is particularly evident when examining the magnitudes and signs of the marginal effects associated with the food safety attitude variable (table 4). The marginal effect associated with food safety is positive and significant for organic apples, while it is negative and significant for eco-labeled apples. The perceived quality of eco-labeled apples has a positive and significant effect on the probability of choosing eco-labeled apples. This finding is consistent with the conjecture that eco-labeled apples satisfy a niche market for consumers who may not be as willing to trade off quality of the fruit for higher environmental or food safety benefits compared with organic consumers.

As seen from table 4, the variables which are statistically significant and also increase the probability of choosing organic apples, such as the presence of children and environmental and food safety attitudes, also have a negative and statistically significant effect on the probability of selecting the regular apple choice. In addition, family size, which negatively affects the organic choice, has the opposite effect on the choice of the regular product. Also, the perceived quality of eco-labeled apples significantly decreases the probability of selecting regular apples.

Testing Relative Preferences for the Eco-label

Because the choice of apples was presented to the consumer without a price differential, the observed choices represent consumers' revealed preference rankings of the alternatives. The ranking of choices appears consistent with the notion that the most environmentally and food-safety-concerned consumers prefer organic apples. At the other extreme, consumers who have little or no concern about the environment or food safety prefer regular apples. In this context, the eco-label alternative may represent an intermediate choice for those consumers with some concern for the environment and food safety. The conjecture of intermediacy of preferences is explained and statistically tested below.

As noted previously, the coefficients of the multinomial logit cannot be interpreted as the direct effects of the respective explanatory variables on the probability of choosing each particular apple type. Rather, they represent the direct effects each of the explanatory variables has on (unobservable, latent) levels of utility. Thus, in order to test the conjecture of intermediacy, we used the marginal effects implied by the multinomial logit model.

Pairwise tests of the rank ordering were conducted, across choice alternatives, of the marginal effects evaluated at the lowest and highest values of the environment and food safety variables, as well as of the presence of children less than 18 years old. The latter tests were performed under the auxiliary conjecture that a notable degree of consumers' environmental and food safety attitudes may be directed toward concern for their children. Conventional wisdom suggests all three variables should have different effects on preferences for environmentally friendly products compared with conventional products.

The pairwise hypotheses of the rank ordering of marginal effects were specified for each of the three variables as follows:

$$H_0: \gamma_{d,organic} - \gamma_{d,eco\text{-}label} \leq 0, \tag{7}$$

$$H_0: \gamma_{d,eco\text{-}label} - \gamma_{d,regular} \leq 0. \tag{8}$$

If both hypotheses are rejected, then $\gamma_{d,organic} > \gamma_{d,eco\text{-}label} > \gamma_{d,regular}$, and the marginal effect of the eco-label alternative is at an intermediate level, falling between the contributions associated with the regular and organic alternatives. Results of these pairwise *t*-tests on the marginal effects are reported in table 5. The *t*-tests corresponding to the marginal effects are evaluated from the highest to the lowest values of the corresponding integer-valued explanatory variables. We can reject each of the pairwise tests of the rank ordering of marginal effects depicted in equations (7)–(8) at the 5% level of a type I error. In fact, all but one of the hypotheses can be rejected at the 0.01 level, supporting the conjecture that eco-labels are an intermediate choice for consumers.

Conclusions

In this analysis, we considered factors which induce certain consumers to buy eco-labeled apples as opposed to organic or regular apples. Based on our findings, eco-labeled and organic apples sometimes both appeal to consumers with similar attitudes toward food safety and environmental quality, and this type of consumer would prefer to buy organic when both products are offered at equal prices. When attempting to enter environmentally friendly niche markets, it might behoove apple producers and retailers to

Table 5. Hypothesis Test Results for the Marginal Effects

Hypothesis	*t*-Statistic	*P*-Value	Reject at $\alpha = 0.05$?
Presence of Children Under 18:			
H_0: $\gamma_{1,organic} - \gamma_{1,eco\text{-}label} \leq 0$	5.195	0.000	Yes
H_0: $\gamma_{1,eco\text{-}label} - \gamma_{1,regular} \leq 0$	5.271	0.000	Yes
Food Safety Attitudes:			
H_0: $\gamma_{2,organic} - \gamma_{2,eco\text{-}label} \leq 0$	2.927	0.001	Yes
H_0: $\gamma_{2,eco\text{-}label} - \gamma_{2,regular} \leq 0$	2.703	0.003	Yes
Environmental Attitudes:			
H_0: $\gamma_{3,organic} - \gamma_{3,eco\text{-}label} \leq 0$	2.211	0.013	Yes
H_0: $\gamma_{3,eco\text{-}label} - \gamma_{3,regular} \leq 0$	14.160	0.000	Yes

consider that organic apples may be an established and often preferred substitute by consumers.

A multinomial logit model was estimated to analyze consumers' preferences for apples and to analyze the factors affecting the decision to buy eco-labeled apples. We found the presence of children under 18 in the household, higher food safety concerns, and attitudes about the environment increase the likelihood a consumer will prefer an organic product. In contrast, family size and perceived quality of eco-labeled apples lower this likelihood. From our findings, we conclude that many consumers who would be favorably disposed toward purchasing eco-labeled apples consider organic apples to be an even safer and more environmentally friendly alternative, and thus will buy organic if the products are offered at equal prices.

The quality of eco-labeled apples perceived by consumers has a significant positive effect on the probability of purchasing eco-labeled apples. According to a former coordinator of an environmental certification program, the fact that quality perceptions are extremely important for eco-labeled products is already known and appreciated by industry participants.[8] In addition, the presence of children in the household, income, and higher food safety preferences decrease the likelihood of choosing eco-labeled apples.

As expected, the presence of children in the household, food safety concerns, environmental attitudes, and perceived quality of the eco-labeled apples have a negative effect on the likelihood of choosing regular apples, while household size has a positive effect.

Statistical evidence supports the conjecture that eco-labeled apples are an intermediate choice between organic and regular apples, with respect to certain consumer characteristics. In particular, consumers who have children and strong environmental and food safety concerns will prefer organic apples, while people without children and with weaker environmental and food safety concerns will prefer regular apples.

To the extent these findings apply more generally, apple producers who are considering entering environmentally friendly niche markets would be wise to carefully examine the costs of production of both eco-labeled and organic apples. If production costs are not significantly lower for eco-labeled apples, then organic may be the better alternative for

[8] Personal communication with Craig Hollingsworth, former Coordinator of Partners with Nature, February 2001.

attracting the "green" consumer. This study underscores the importance and complexity of the interactions among consumer attitudes, sociodemographic realities, relative prices, and the ultimate actual value of eco-labels to consumers, which lead to the realized value of labeling to apple producers.

Although insights are provided from analyzing preferences for organic, eco-labeled, and regular apples, this research is subject to some caveats. First and most important, our results are based on a snapshot of *Thriftway* consumers from the Pacific Northwest and at a single point in time.

It would be interesting to analyze whether our results hold for a broader sample of U.S. consumers and other food choices. It may be the case that given the high concentration of apple production in the Pacific Northwest, consumers in our sample are less concerned about pesticide residuals on apples than their counterparts in other areas of the country. The rationale for this conjecture comes from Slovic, who suggests risk is influenced by two major factors: dread risk and unknown risk. Pesticide residue on apples should rank lower for unknown risk for Pacific Northwest consumers since apple production is highly concentrated in the Pacific Northwest.

An additional focus for future research would be to examine whether perceptions toward eco-labeling programs change over time, assessing whether the eco-label image will improve and become a closer substitute for organic apples.

[*Received January 2001; final revision received October 2001.*]

References

Blend, J. R., and E. O. van Ravenswaay. "Consumer Demand for Eco-labeled Apples: Results from Econometric Estimation." *Amer. J. Agr. Econ.* 81(1999):1072–77.

Chang, H., and H. W. Kinnucan. "Advertising, Information, and Product Quality: The Case of Butter." *Amer. J. Agr. Econ.* 73(1991):1195–1203.

Edwards, S. F., and G. D. Anderson. "Overlooked Biases in Contingent Valuation Surveys: Some Considerations." *Land Econ.* 63(1987):168–78.

Ethier, G. R., G. L. Poe, W. D. Schulze, and J. Clark. "A Comparison of Hypothetical Phone and Mail Contingent Valuation Responses for Green-Pricing Electricity Programs." *Land Econ.* 76(2000): 54–67.

Johnston, R., S. K. Swallow, and T. F. Weaver. "Estimating Willingness to Pay and Resource Tradeoffs with Different Payment Mechanisms: An Evaluation of a Funding Guarantee for Watershed Management." *J. Environ. Econ. and Manage.* 38(1999):97–120.

Johnston, R. J., C. R. Wessells, H. Donath, and F. Asche. "Measuring Consumer Preferences for Eco-labeled Seafood: An International Comparison." *J. Agr. and Resour. Econ.* 26,1(July 2001):20–39.

Kim, S., R. M. Nayga, and O. Capps, Jr. "The Effect of New Food Labeling on Nutrient Intakes: An Endogenous Switching Regression Analysis." Selected paper presented at the annual meetings of the AAEA, Nashville TN, 1999.

Maddala, G. S. *Limited-Dependent and Qualitative Variables in Econometrics.* London/New York: Cambridge University Press, 1997.

Mathios, A. D. "The Importance of Nutrition Labeling and Health Claim Regulation on Produce Choice: An Analysis of the Cooking Oils Market." *Agr. and Resour. Econ. Rev.* 27(1998):159–68.

Messonnier, M. L., J. C. Bergstrom, C. M. Cornwell, R. J. Tealsley, and H. K. Cordell. "Survey Response-Related Biases in Contingent Valuation: Concepts, Remedies, and Empirical Application to Valuing Aquatic Plant Management." *Amer. J. Agr. Econ.* 82(2000):438–50.

Mitchell, R. C., and R. T. Carson. *Using Surveys to Value Public Goods: The Contingent Valuation Method.* Washington DC: Resources for the Future, 1989.

Mittelhammer, R. C. *Mathematical Statistics for Economics and Business.* New York: Springer-Verlag, 1996.

Mittelhammer, R. C., G. G. Judge, and D. J. Miller. *Econometric Foundations.* New York: Cambridge University Press, 2000.

Nimon, W., and J. Beghin. "Are Eco-labels Valuable? Evidence from the Apparel Industry." *Amer. J. Agr. Econ.* 81(1999):801–11.

Slovic, P. "Perception of Risk." *Science* 236(1987):280–85.

Teisl, M. F., B. Roe, and A. S. Levy. "Eco-Certification: Why It May Not Be a 'Field of Dreams.'" *Amer. J. Agr. Econ.* 81(1999):1066–71.

Vandeman, A. M., and B. Hayden. "New Law Paves Way for Expanding Organic Market." *Food Review* 20(1997):28–32.

van Ravenswaay, E. O., and J. R. Blend. "Using Eco-labeling to Encourage Adoption of Innovative Environmental Technologies in Agriculture." Staff Paper No. 97-19, Dept. of Agr. Econ., Michigan State University, East Lansing, 1997.

Wessells, C. R., R. J. Johnston, and H. Donath. "Assessing Consumer Preferences for Eco-labeled Seafood: The Influence of Species, Certifier, and Household Attributes." *Amer. J. Agr. Econ.* 81(1999): 1084–89.

Whitehead, J. C. "Environmental Interest Group Behavior and Self-Selection Bias in Contingent Valuation Mail Surveys." *Growth and Change* 22(1991):10–21.