Journal of Agricultural & Food Industrial Organization

Manuscript 1372

Picking Apples: Can Multi-Attribute Ecolabels Compete?

Catherine A. Durham, *Oregon State University*
Cathy A. Roheim, *University of Idaho*
Iain Pardoe, *Thompson Rivers University*

Picking Apples: Can Multi-Attribute Ecolabels Compete?

Catherine A. Durham, Cathy A. Roheim, and Iain Pardoe

Abstract

Global food markets in Europe, the U.S. and elsewhere, are experiencing a rapid growth in the number of private party and government environmental labeling programs. Most current ecolabels are defined by standards related to multiple environmental practices. This study presents an analysis of consumers' choice of food products, in this case apples with or without ecolabels, where the ecolabels present varying combinations of farm practices with implications for environmental quality. These practices include: whether or not standards are met specific to on-farm pest management; presence of stream or groundwater quality protection; presence of on-farm wildlife habitat provision; and which certifier provides the guarantee. Factors influencing consumer preferences for ecolabel attributes are evaluated as a choice-based conjoint analysis. To empirically test the effect of heterogeneity of consumers on preferences for ecolabel attributes, surveys were conducted in a stratified sample in three regions (Portland, Oregon; Minneapolis, Minnesota; Rhode Island) with a focus on sampling across shoppers at different types of markets including conventional supermarkets, farmers markets, natural food stores and food co-ops. Results show that preferences for ecolabels are most strongly driven by type of pesticide usage, in particular for non-synthetic pesticides which were identified with organic production. With an appropriate price premium, ecolabels with an alternative pest management practice and other environmental practices were preferred to conventionally produced apples. These results varied according to age and gender of respondents, and type of store at which respondents shopped.

KEYWORDS: apples, consumer preferences, conjoint analysis, ecolabels, pest management, water protection, wildlife habitat

Author Notes: Catherine Durham (cathy.durham@oregonstate.edu) is an Associate Professor in the Department of Agricultural and Resource Economics, Oregon State University located at the Food Innovation Center in Portland, Oregon. Cathy A. Roheim is Professor and Department Head, Department of Agricultural Economics and Rural Sociology at the University of Idaho, Moscow, Idaho; and Iain Pardoe is an independent statistical consultant and mathematics/ statistics instructor at Thompson Rivers University in Kamloops, British Columbia, Canada. The authors wish to thank Jill McCluskey, Robert King, Aaron Johnson and Brady P. Horn for their contributions to this project. This project was supported by the National Research Initiative of the Cooperative State Research, Education and Extension Service, USDA, #2005-35400-15240.

1. Introduction

Global food markets in Europe, the U.S. and elsewhere, are experiencing a rapid growth in the number of private party and government environmental labeling programs. These include programs which certify whether a product meets standards related to organic production, or other aspects of environmental health, animal welfare, and socially-responsible processing or farm practices. Ecolabeling programs typically evaluate the production processes and practices with regard to established environmental standards set by independent third parties (U.S. EPA 1998). If the standards are met and certified, the producer or marketer may use a specific label on its product. The label conveys to the consumer otherwise unobservable credence information concerning the product or its producer, and may be used to distinguish it from products which use methods that are less deleterious to the environment or natural resources.

At any given price, consumers choose among food products with many attributes, including nutritional, quality, value, package and production process attributes (Hooker and Caswell 1996). The addition of an ecolabel adds a bundle of environmental stewardship attributes. Ecolabeling provides an indicator of production practices that do not directly affect food quality, but rather how production practices affect the surrounding environment in which the food product is produced. Thus, the benefit derived from purchasing a product with an ecolabel is more appropriately characterized as a warm glow effect; i.e. increased utility achieved from the public good improvement to the environment (Andreoni 1990). Studies have shown that a variety of factors influence consumers' choices of products with ecolabels or environmental attributes of food products, and in some cases, willingness to pay. In papers examining ecolabeled seafood (Johnston and Roheim 2006; Johnston, Wessells, Donath, and Asche 2001) consumers' choices are shown to be a function of the price premium, socioeconomic and demographic characteristics. McCluskey, Durham and Horn (2009) show that consumers value of public good credence attributes such as animal welfare and fair trading practices can be further examined as a function of factors such as underlying environmental attitudes. Rotaris and Danielis (2011) show that younger and more educated consumers are willing to pay more for fair trade labels.

In most studies an ecolabel is generally presented as a single or bundled attribute. However in practice, ecolabels are actually defined by standards related to several separate environmental practices. There are examples of such programs related to food found in the U.S. market. These include, but are not limited to, the SalmonSafe™ ecolabel, which certifies food products from farms in the Pacific Northwest which do not harm salmon habitat; the RainForest Alliance™ ecolabel, which certifies farms that produce less water pollution, soil erosion, threats to

wildlife habitat, and other environmental and labor conditions; and the Food Alliance™, which has standards for pesticide usage, wildlife habitat preservation, water and soil conservation, domestic animal welfare, and farm labor conditions. Groups such as these succeed with effective marketing strategies and consumer education campaigns.

The purpose of this study is to present an analysis of consumers' choice of food products, in this case apples, with or without ecolabels, where the ecolabels are presented with varying combinations of farm practices with implications for environmental quality. As noted in Costa, Ibanez, Loureiro, and Marette (2009) "Determining the preferences and the premium for any characteristic is a necessary but difficult first step in discerning the usefulness of an eco-label." Results from this study may assist food producers, the food system, and ecolabeling programs such as those described above to better understand existing consumer preferences regarding their food choices, and factors contributing to those choices. Discovery of potential market segmentation derived from consumer heterogeneity, based upon regional differences, preferences of shopping venue, or socioeconomic and demographic characteristics, may lead to strategies for market promotion and educational campaigns around ecolabeling programs.

This study contributes to a growing literature investigating consumer choices for multi-attribute labels (Bond, Thilmany, and Bond 2008; Hu, Hunnemeyer, Veeman, Adamowicz, and Srivastava 2004). The attraction of such studies is in their conceptual and methodological approach—closer resemblance to actual markets, in which the consumer evaluates several attribute claims per similar food item. For example, Bond et al. (2008) evaluated consumer choices of fresh produce when competing health, nutrition and organic claims were present. This study follows in that approach, however, adds to the literature in that it analyzes multi-attribute ecolabels: namely, whether or not standards are met related to type of on-farm pest management; presence of stream or groundwater quality protection; presence of on-farm wildlife habitat provision; and which certifier provides the guarantee.

Limited research exists that evaluates consumer preferences for the label attributes examined in this study, even independently, while there are no studies the authors are aware of that examine the attributes as a multi-attribute set. Studies of consumer preferences for organic foods usually relate to pesticide usage, and it has been shown that the first attribute consumers associate with organic foods is being pesticide free (Hartman Group 2007) though the regulation is actually no use of synthetic pesticides. Among studies which focus specifically on pesticide treatment, exclusive of organic production methods, Govindasamy and Italia (1998) analyzed consumer preferences for integrated pest management (IPM) relative to conventional pesticide treatments for produce. Foster and Mourato (2000) studied consumer willingness to pay for bread in the U.K. if

produced using inputs with reduced pesticides, resulting in a joint product of fewer human illnesses and greater wildlife biodiversity on farms. A number of studies have investigated consumer preferences for bans of a specific pesticide (Bernard and Bernard 2010; Roosen, Fox, Hennessy, and Schreiber 1998; van Ravenswaay and Hoehn 1991) or evaluated pesticide free as a quality attribute (Boccaletti and Michele 2000; Misra, Huang, and Ott 1991).

An additional attribute of an ecolabel is credibility of the certification. Grolleau and Caswell (2006) present a theoretical argument that market success of eco-friendly food products requires a mix of environmental and other verifiable attributes that together signal credibility. Several researchers have documented the effects of consumers' trust in certification as an important element in credence attributes (Holland and Wessells 1998; Johnston and Duke 2007; Johnston and Swallow 1999; Johnston et al. 2001).

This paper describes an experimental design based upon conjoint analysis, addressing consumer preferences for ecolabeled apples, in which the experimental design allows for valuation of alternative multi-attribute labels. The analysis relies upon data gathered from surveys of randomly selected consumers in a stratified sample in three areas (greater Portland, Oregon/Vancouver, WA; Minneapolis/St. Paul, Minnesota; Rhode Island), intercepted while shopping at different types of food markets: conventional supermarkets, farmers markets, natural food stores and food co-ops. Such analysis of heterogeneity is of considerable importance for determination of possible market segmentation and consequent development of marketing strategies (Aguilar and Vlosky 2007; Cranfield, Henson, Northey, and Masakure 2010; Krystallis, Fotopoulos, and Zotos 2006; Loureiro and Hine 2002; Thilmany, Umberger, and Ziehl 2006).

The remainder of the paper will begin with a description of the conjoint methods and its application to the ecolabeling of apples. This is followed by a description of the data and the regression model. The results are then presented, leaving the implications and conclusions at the end.

2. Conjoint Analysis

Factors influencing consumer preferences for ecolabel attributes are evaluated as a choice-based conjoint analysis (Cohen 1997; Lancaster 1966; Louviere and Woodworth 1983; McFadden 1974). Conjoint analysis is a popular market research technique frequently used to identify consumers' attitudes and preferences for a product (Green and Srinivasan 1978; Green, Krieger, and Wind 2001; Gustafsson, Herrmann, and Huber 2007; Wittink, Vriens, and Burhenne 1994).

Conjoint analysis was first used to assess commercial appeal of consumer goods (Green and Srinivasan 1978; Green and Srinivasan 1990; Louviere and Woodworth 1983). Later the application of conjoint analysis was extended to

environmental and agricultural economics to evaluate the welfare effects of non-market goods and preference for product with novel attributes (Green and Srinivasan 1990). Conjoint analysis has been used to evaluate the willingness to pay for origin (Darby, Batte, Ernst, and Roe 2008; Fotopoulos and Krystallis 2003; Scarpa, Philippidis, and Spalatro 2005; Umberger, Feuz, Calkins, and Killinger Mann 2002), organic food products (Cicia, Giudice, and Scarpa 2001; Fotopoulos and Krystallis 2003; van der Lans, van Ittersum, De Cicco, and Loseby 2001), and labeled seafood products (Anderson and Bettencourt 1993; Dasgupta, Wirth, and Davis 2007; Halbrendt, Vaughn, and Wirth 1991; Holland and Wessells 1998; Jaffry, Pickering, Ghulam, Whitmarsh, and Wattage 2004; Johnston and Roheim 2006; Palma, Wirth, Adams, and Degner 2010; Wirth, Palma, and Love 2007). As an alternative to contingent valuation techniques, conjoint analysis allows for richness in specification of product attributes which consumers may trade-off against each other in choosing the preferred combination of attributes.

3. Application to Ecolabeled Food Products

To determine preferences for ecolabeled apples, consumers were presented with products with the following production processes: type of on-farm pest management; presence of stream or groundwater quality protection; presence of on-farm wildlife habitat provision; which certifier provides the guarantee; and price. Apples were chosen as the product for several reasons: 1) such farm practices can readily be implemented in apple orchards; 2) consumers are familiar with apples; 3) ecolabels such as the Food Alliance™ applies to products such as apples; and 4) allows for comparisons of results to previous studies evaluating credence attributes for apples (Blend and Ravenswaay 1999; Canavari, Nocella, and Scarpa 2005; Loureiro, McCluskey, and Mittelhammer 2002; Roosen et al. 1998). Table 1 shows attributes and levels of attributes.

Table 1. Attributes and Levels in the Conjoint Analysis

Product Attribute	Levels
Pest management	No Synthetic Pesticides Allowed Integrated Pest Management Conventional
Wildlife habitat provision	On-Farm Wildlife Habitat Provided (blank)
Water quality protection	Water Quality Protection Provided (blank)
Certification	Third party Certifier Government Certifier (blank)
Price	$ 0.89 $ 1.19 $ 1.49 $ 1.79

Respondents were provided with explanations for each attribute to facilitate full understanding, prior to making any choices. The explanations were derived from a combination of the USDA organic regulations and the Food Alliance certification program, as follows:

- ***"Pesticide Use*:** In the United States, all agricultural producers are only allowed to use pesticides that have been registered with the government for use on the crop. One aspect of organic farming is that it that it also requires that **NO Synthetic Pesticides** be used**,** which means that they can't be made from synthetic (man-made) chemicals, though pesticides from organic sources can be used. Another alternative to conventional pesticides is **Integrated Pest Management** (IPM). Farmers that adopt IPM determine the need for pest control based on regular field inspection and they limit their choice of pesticides to those with the least harmful effects on humans and wildlife."
- ***"Wildlife Habitat Provision:*** Ways to improve the environment for wildlife is to provide natural areas around farm fields, orchards, or pastures in which they can find food and shelter. Other practices include providing corridors along which wildlife can travel between feeding areas and to reach water sources."
- ***"Protection of Water Quality:*** There are a number of extra steps that farmers can take to protect Water Quality such as buffer strips between fields and streams, and soil contouring. These practices help prevent farm chemicals (such as pesticides and fertilizers), manure from livestock operations, or soil erosion from reaching the streams on which fish and other wildlife depend, and from reaching ground water supplies."

- ***"Certification*:** Certifications are a means of assuring that products have been produced in accordance with specific standards. To be certified for following the practices described above an inspector must visit the farm to evaluate whether the farmer meets the requirements. Sometimes the criteria have been established with the help of the US Government (**US Gov't**) and some have been set by independent organizations (**3rd party**) to promote specific goals for wildlife habitat, water quality protection, or limits on pesticide usage like those described above. Some examples include USDA Organic, which the US Government helped to establish the criteria for. An example of a 3rd party is the World Wildlife Fund's criteria for sustainable wild fisheries. The certifying organization establishes a process of inspection to ensure that the standards are met."

The base price ($0.89/lb.) was determined based on the low end of supermarket prices observed for conventional apples as of June 2006 in local supermarkets across the three regions in which the surveys were conducted. One could buy bagged apples for a lower priced per pound, and the typical non-sale price was around $0.99/lb. in Oregon and somewhat higher in Minnesota and Rhode Island. Prices increased from the base of $0.89/lb. to reflect the possible range of prices for apples with and without an ecolabel certification.

One of the first procedures involved in conjoint analysis is identification of the full set of possible combinations of attributes (Hensher et al. 1998). A full-factorial design operates by creating a product profile using all possible permutations of attribute levels. However, if the number of attributes and attribute levels increases, then the number of product profiles would increase rapidly. This makes it tedious to evaluate all the possible permutations of product profiles. To resolve this issue, a subset of the full product profiles can be assigned to each respondent, which can be used to infer each respondent's preference structures. This subset of the product profile can be developed using orthogonal fractional factorial design and was done using SAS™ (Kuhfeld 2009).

Furthermore, there are several design aspects which need to be incorporated to achieve efficiency and to create a realistic shopping situation which nearly always includes a conventional product. Some of these aspects are that choices with ecolabel attributes cannot be priced at $0.89 and the conventional alternative must be one of the lower two prices: $0.89 or $1.19. The ecolabeled choices could be priced at $1.19, $1.49, $1.79. The result was an efficient design with a total of 24 choice sets split into three subsets of eight (thus

3 versions of the survey), which was considered to be the maximum number of choice sets per subject given a rich survey instrument[1].

4. Theoretical Framework

The theoretical construct used to put an economic interpretation on results from conjoint analysis is to base it upon Lancaster's approach to consumer theory (Lancaster 1966). According to Lancaster's theory, a product's utility is an additive utility based upon the utility of the products' attributes. To measure that utility, a random utility model is typically used, which assumes that the utility U_{ij} of an individual i for a product j is composed of systematic and random components. The systematic component v_{ij} is observable and a function of the product attributes and individual characteristics. The random component ε_{ij} is unobservable influences. Thus, the random utility equation can be expressed as:

$$U_{ij} = v_{ij} + \varepsilon_{ij} \tag{1}$$

Since only the systematic component of the model above is observable, it can be specified as a function of product attributes and individual characteristics:

$$v_{ij} = \beta_j x_j + \gamma_j x_j z_i + u_{ij} \tag{2}$$

where x_j is the vector of attributes of product j, z_i is the vector of characteristics of the individual i. β_j is the marginal utility obtained due to the attributes of product j, γ_j is the change in marginal utility of attributes due to individual characteristics through interactive effects of the product attributes and individual characteristics.

5. Econometric Approach

To estimate the random utility model specified above, we assume that a rational consumer always chooses product j over product k if the utility from product j is greater than that from alternative product k. We express this for individual i as:

$$P_{ij} = \text{Prob}(U_{ij} > U_{ik}); \text{ where } k = 1,2,\ldots,J; k \neq j \tag{3}$$

where P_{ij} is probability of individual i choosing product j. To operationalize this model, one must make assumptions about the characteristics of the random components of the random utility model. In particular, the random components of

[1] Some researchers have used larger numbers of choice sets, for example Lusk and Schroder (2004a) used sixteen.

the model are typically assumed to be identically and independently distributed type-1 extreme value (Gumbel distribution) across individual characteristics and product attributes (Greene 2003).

Respondents had four choices: Product A, Product B, Product C, or do not buy. Thus a conditional logit model is used to estimate the choice probabilities (Hensher, Rose, and Greene 2005). Thus, the probability of individual *i* choosing product *j* can be written as:

$$P_{ij} = \exp(\beta_j x_j + \gamma_j x_j z_i) / \Sigma_k \exp(\beta_j x_j + \gamma_j x_j z_i) \quad (4)$$

Since the sign and not the magnitude of the estimated coefficients are directly interpretable, the marginal value, or willingness to pay (WTP), for a product attribute *j* can be calculated as:

$$WTP_j = -(\beta_j / \beta_p) \quad (5)$$

when $z_i = 0$, where β_j is the estimated marginal utility for product attribute *j*; β_p is the estimated marginal utility for price. In this model interactive variables are used in conjunction with the price variable; and the WTP in equation (5) represents the baseline individual (Lusk and Schroeder 2004b).

6. Data

The data utilized in this analysis is based upon an in-person survey of 1,500 consumers split equally across the greater Portland, Oregon/Vancouver, Washington metropolitan area, the greater metropolitan Minneapolis/St. Paul, Minnesota area, and throughout the state of Rhode Island surveyed June through August 2006. A series of conjoint questions were designed (see Figure 1) to elicit consumers' willingness to pay for ecolabel attributes. The survey also contained questions collecting information about consumers' food preferences and purchasing habits together with their households' characteristics. Respondents answered the survey on tablet and laptop computers set up at purchase locations, taking approximately 20 minutes per survey. The purpose of conducting in-person surveys at locations where consumers buy food is to obtain data directly from actual decision-makers. This mitigates potential bias resulting from the sample chosen not adequately representing the population that might purchase ecolabeled food products.

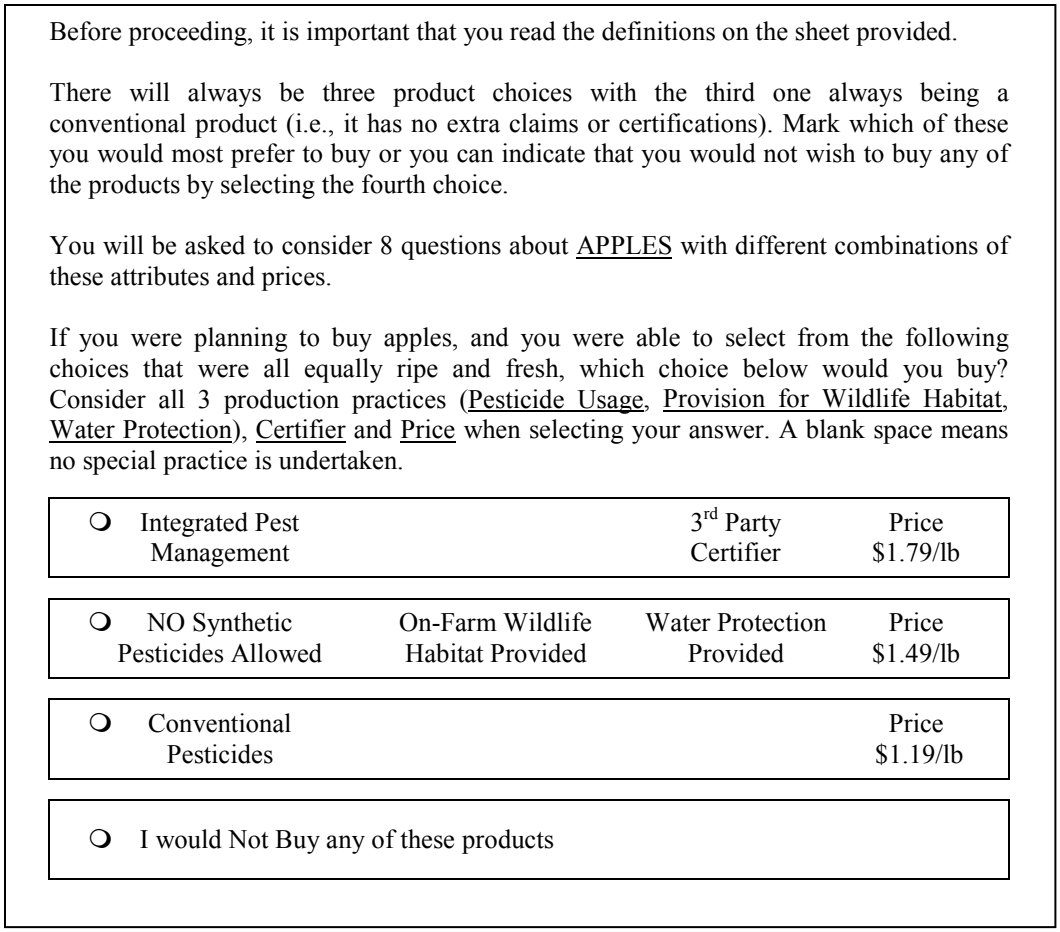

Figure 1. Example Conjoint Question

Survey locations included conventional supermarkets, farmers markets, natural food stores and food cooperatives. Each location offered both organic and conventional food products for sale and in many cases ecolabeled products. Among the states, only Oregon had a food cooperative represented (it did not have a natural food store represented). A $5 incentive was provided to encourage individuals to respond to the survey. The incentives increased the participation rate and were effective in encouraging the stores to allow the survey to be conducted on their premises. Survey locations were chosen to ensure that the population studied incorporated sufficient variation in the expected explanatory variables for ecolabel choices. Thirty-eight percent of the surveys were conducted at conventional supermarkets, 45% at farmers markets, and 17% at natural food stores or food cooperatives.

Table 2 compares the sample statistics to the population in each location. The demographic variables are well-dispersed across age, education and income.

The samples somewhat over represent higher income and education groups, and under represent lower income, age and education groups.

Table 2. Comparison of Sample to Census, by State, for Socioeconomic and Demographic Characteristics (N= 1,500)

Variable	Minneapolis/St. Paul		Portland, OR/ Vancouver, WA		Rhode Island	
	Census	Sample (n_1=500)	Census	Sample (n_2 =499)	Census	Sample (n_3 =484)
Age 18-24	12.9	8.0	11.3	14.4	14.1	11.5
Age 25-34	18.2	13.8	19.6	22.2	15.6	17.3
Age 35-44	21.2	12.4	20.1	12.8	19.2	20.2
Age 45-54	20.7	30.0	20.4	23.0	19.3	22.4
Age 55-64	13.5	20.8	14.9	19.0	14.0	16.3
Age >64	13.5	15.0	13.7	8.4	17.8	12.2
Income less than 20K	13.2	5.4	15.9	11.4	19.2	11.1
Income 20-29K	8.3	4.6	10.9	10.6	10.5	7.2
Income 30-39K	9.2	8.2	10.2	9.0	9.1	8.0
Income 40-49K	9.2	5.4	10.2	11.2	9.2	6.8
Income 50-59K	8.7	8.6	9.1	9.2	8.2	12.6
Income 60-99K	27.7	34.2	24.3	29.0	24.6	27.6
Income Over 100K	23.6	33.6	19.3	19.4	19.1	26.6
Gender (% Male)	48.9	29.4	49.0	39.7	47.1	32.6
High School	33.7	12.6	34.9	18.6	47.1	17.9
2 Year Deg./Some Coll.	31.1	14.2	33.2	21.6	23.3	15.3
Four Year Degree	23.9	38.2	20.5	37.1	18.3	34.8
Advanced Degree	11.3	35.0	11.4	22.6	11.3	32.0

Table 3 shows the sample statistics across the entire dataset. Seventy-eight percent of those surveyed are the primary shoppers in the household and 66% are female.

Table 3. Summary Statistics of the Socioeconomic and Demographic Characteristics (N=1,483)

	Description											Mean
Gender	Male											0.338
State	Oregon and Washington											0.347
	Minnesota											0.317
	Rhode Island											0.336
Store Type	Natural Food Store											0.098
	Farmers Market											0.453
	Food coop											0.069
	Conventional Supermarket											0.380
Education	Less than 4 year degree											0.337
	Four-year degree											0.367
	Advanced Degree											0.297
Age Ranges	18-24	25-29	30-34	35-39	40-45	45-49	50-54	55-59	60-64	65-69	70+	45.7
%	11.4	9.2	8.6	6.7	8.4	11.4	13.8	10.5	8.2	6.0	5.9	0.014
Income Ranges	Under $20,000	$20-29,999	$30-59,999	$40-49,999	$50-59,999	$60-79,999	$80-99,999	$100K Plus				
%	9.30	7.50	8.40	7.90	10.10	17.70	12.60	26.5				

7. The Model

Models based upon equation (2) are specified, given the different attributes of the products and average price levels. Effects coding[2] was used for product attributes, except for the *do not buy* variable. *Price* is the only main effect variable treated as continuous.

Consumer heterogeneity was accounted for with interactive variables as shown in table 2. One might hypothesize that shoppers who were intercepted at conventional supermarkets may reveal different preferences for environmental practices than those intercepted at farmers markets, natural foods stores, or food coops. It is unclear that there are any differences in preferences among geographical locations; however, the initial hypothesis is that differences do exist.

[2] In contrast to some other studies (e.g. Olynk, Tonsor and Wolf (2010)), effects coding is specified such that the attribute takes on a value of 1 when applicable, 0 if not applicable to a product, and minus 1 otherwise the latter being applied in our case to the 'do not buy' choice. This specification affects WTP calculation, in that the numerator in (6) need not be multiplied by 2.

Prior to estimation, socioeconomic and demographic variables are transformed to provide a baseline shopper at a conventional supermarket, using binary variables. This baseline consumer is a female from Rhode Island, with a 4 year college degree. Additional attributes of the baseline consumer include middle age and income; each of these was initially recorded using categorical variables. The questions about age and income groups contained 8 and 11 categories, respectively. Such categorical responses minimized time to take the survey and increased responses to the questions. However, continuous variables are preferred over categorical variables for age and income to limit the number of explanatory variables. The transformation from categorical to continuous is accomplished by first assigning the mid-point of each age and income category as its value (for example, if an individual indicated they were in the middle age category, between 45 and 49 years old, then the age value was 47). To facilitate both estimation and interpretation of model results these continuous variables are then standardized to have values similar to those of the rest of the consumer characteristics. This was done by dividing the age variable by 100 and the income variable by $100,000. These values were further standardized such that individuals in the middle age and income category (originally entered as age 47 and income $55,000) are equal to zero (by subtracting 0.47 and 0.55, respectively). Thus, baseline age income and income are 47 years and $55,000. All willingness to pay estimates for the various farm practices (main effects) are in the context of this baseline consumer.

8. Results

Table 4 contains the parameter estimates for the model with the main effects only and the model with both main effects and interactive effects. Each model is statistically significant, based upon likelihood ratio tests ($p<0.001$). The latter model is statistically superior to the main effects only model, based upon a lower Akaike Information Criterion (AIC) value (26,804 v. 27,826) incorporating the number of predictors in the models; the unrestricted model also predicts all four choices rather than only the two ecolabeled choices as the main effects only model does. Note that the model without interactive effects does not account for the stratified nature of our sample, and thus the results would be expected to overstate the relative utility of the ecolabel attributes for the conventional shopper. With the exception of certifier, each of the main effects attributes is statistically significant at the 1% level. Price has the expected negative effect, while the presence of the other ecolabel attributes increase the probability of choice relative to the base product.

Table 4. Conditional Logit (CL) Model Results

	Main Effects		Main effects w/ Interactive Effects		
Variables	Coefficients	Std. Err.	Coef.	Std. Err.	Premium
Non-Syn. Pesticides	1.381	0.031***	1.1555	0.083***	1.110
Integrated Pest Mgmt.	0.927	0.031***	0.6920	0.084***	0.665
Water Protection	0.235	0.022***	0.2208	0.060***	0.212
Wildlife Habitat Prov.	0.258	0.022***	0.2134	0.060***	0.205
Gov't Certification	0.083	0.029***	0.0285	0.079	0.027
3rd Party Certification	0.012	0.029	-0.1191	0.080	-0.114
Price	-1.113	0.044***	-1.0410	0.120***	
Do not buy	1.117	0.082***	0.2719	0.219	
Price*Age			0.9900	0.291***	
Price* Income			0.2468	0.120**	
Price*Male			-0.3515	0.097***	
Price*less than 4-yr college			0.3721	0.110***	
Price*advanced degree			-0.0344	0.117	
Price*Natural Foods Mkt			0.1622	0.172	
Price*Food Coop			0.9884	0.244***	
Price*Farmers' Mkt			0.0361	0.101	
Price*OR			-0.5215	0.120***	
Price* MN			-0.0202	0.112	
Non-Syn. Pest*Age			-0.3555	0.211*	
Non-Syn. Pest *Income			-0.0942	0.088	
Non-Syn. Pest *Male			0.0556	0.071	
Non-Syn. Pest *< 4-yr college			-0.3454	0.080***	
Non-Syn. Pest *adv. degree			0.0311	0.087	
Non-Syn. Pest*Nat. Foods Mkt			0.1312	0.128	
Non-Syn. Pest *Food Coop			-0.1595	0.191	
Non-Syn. Pest *Farmers' Mkt			0.0285	0.073	
Non-Syn. Pest *OR			0.1828	0.088**	
Non-Syn. Pest * MN			0.0673	0.081	
IPM*Age			0.1294	0.209	
IPM*Income			0.0395	0.087	
IPM*Male			0.2131	0.070***	
IPM*< 4-yr college			-0.4115	0.079***	
IPM*adv. degree			-0.0339	0.085	
IPM*Nat. Foods Mkt			-0.2824	0.125**	
IPM*Food Coop			-0.6694	0.186***	
IPM*Farmers' Mkt			0.0376	0.073	
IPM*OR			0.2609	0.086***	

IPM* MN	0.0789	0.080
Conv. Pest Mgmt*Age	0.3878	0.132***
Conv. Pest Mgmt*Income	-0.1691	0.057***
Conv. Pest Mgmt*Male	0.5228	0.044***
Conv. Pest Mgmt*< 4-yr coll.	0.0230	0.050
Conv. Pest Mgmt*adv. degree	-0.2658	0.057***
Conv.Pest Mgmt*NatFoodsMkt	-0.8553	0.091***
Conv. Pest Mgmt*Food Coop	-1.9908	0.156***
Conv. Pest Mgmt*Farmers' Mkt	-0.4000	0.046***
Conv. Pest Mgmt*OR	0.1001	0.053*
Conv. Pest Mgmt* MN	-0.0213	0.053
Water Qual Prot*Age	-0.5264	0.146***
Water Qual Prot*Income	0.0045	0.060
Water Qual Prot*Male	-0.1408	0.050***
Water Qual Prot*< 4-yr college	-0.0743	0.055
Water Qual Prot*adv. degree	0.0940	0.057
Water Qual Prot*NatFoods Mkt	0.0605	0.084
Water Qual Prot*Food Coop	0.0358	0.118
Water Qual Prot*Farmers' Mkt	0.0396	0.050
Water Qual Prot*OR	0.1093	0.061*
Water Qual Prot* MN	0.0620	0.055
Wild Hab Prov*Age	-0.4778	0.146***
Wild Hab Prov*Income	-0.0193	0.060
Wild Hab Prov *Male	-0.0463	0.049
Wild Hab Prov *< 4-yr college	-0.0838	0.055
Wild Hab Prov *adv. degree	-0.0102	0.057
Wild Hab Prov *Nat.Foods Mkt	0.2782	0.084***
Wild Hab Prov *Food Coop	0.3975	0.117***
Wild Hab Prov *Farmers' Mkt	0.1446	0.050***
Wild Hab Prov *OR	0.0999	0.060*
Wild Hab Prov * MN	-0.0701	0.055
Gov Cert*Age	-0.2152	0.192
Gov Cert *Income	0.1365	0.079*
Gov Cert *Male	-0.1742	0.064***
Gov Cert*< 4 yr. college	0.1030	0.073
Gov Cert *adv. degree	0.0511	0.077
Gov Cert *Nat. Foods Mkt	0.2197	0.113*
Gov Cert *Food Coop	0.2069	0.158

Gov Cert *Farmers' Mkt		0.1507	0.067**
Gov Cert *OR		-0.0773	0.080
Gov Cert * MN		0.0000	0.074
3rd party Cert *Age		-0.3365	0.193*
3rd party Cert *Income		0.1302	0.079
3rd party Cert*Male		-0.1907	0.064***
3rd party Cert*< 4-yr college		0.1331	0.073*
3rd party Cert *adv. degree		0.1929	0.076**
3rd party Cert *Nat. Foods Mkt		0.1487	0.113
3rd party Cert *Food Coop		0.3779	0.157**
3rd party Cert *Farmers' Mkt		0.1569	0.067**
3rd party Cert *OR		-0.0935	0.080
3rd party Cert * MN		0.0620	0.073
Number of Observations	11,864		11,864
Log-likelihood	-13904.94		-13314.00
Pseudo R-square	0.15456		0.19049
p-value	<0.00001		<0.00001

*** 1% significance level; ** 5% significance level; * 10% significance level

Consumer heterogeneity becomes apparent in a number of interesting and statistically significant differences. For the baseline consumer, the negative sign on the price coefficient indicates that a higher price for a given choice decreases the utility from that choice as expected. A male is more price sensitive than the female baseline consumer, as indicated by the negative sign on the interactive term between price and male: a higher price for a given choice decreases his utility for that choice even more than her choice. Similarly, higher prices have a more negative effect on the utility of products to an Oregon resident than to the Rhode Island baseline resident for the same choice, also indicated by the negative sign on the significant interactive term.

The highest utility for a single attribute came from a restriction to only non-synthetic pesticides (NSP). From the information provided, respondents understood that to be the pesticide usage for organic production. This result is consistent across consumers; though those with less than a 4-year college degree rate the utility of NSP significantly lower than those at higher educational levels, and consumers in Oregon significantly higher than those in Rhode Island and Minnesota. There were no other significant differences in NSP valuation. In contrast, there were a number of significant differences for both IPM and conventional pesticide treatments. Perhaps not surprisingly, shoppers at natural food markets and food coops had a statistically lower utility for conventional

pesticides and IPM than our conventional supermarket baseline consumer or our farmers' market shopper. Interestingly, shoppers in Oregon showed a higher utility from IPM than the baseline consumer in Rhode Island. Other differences included males whose responses indicate a higher utility from IPM and conventional pesticide usage than females, and those with an advance degree, who showed a lower utility from conventional pesticide usage than those with a 4-year college degree. Those with a higher income also had a lower preference for conventional pest management, while older shoppers showed a greater acceptance of conventional pesticide usage.

Compared to the baseline consumer who shops at a conventional supermarket, wildlife habitat provision was statistically significantly different and higher for those who shop at natural foods markets, food coops and farmer's markets. Such is not the case for water quality protection, however. In both cases, consumers older than the baseline consumer derive less utility from either water quality protection or habitat provision. In contrast, consumers in Oregon derive greater utility from both farm practices than do their counterparts in Rhode Island and Minnesota. Male's utility from water quality protection was significantly less than the baseline female consumer.

In contrast to the hypothesis that certification by either a third party or a government agency would be important to establish credibility of the ecolabel, the presence of either certification body was not a statistically significant factor in consumer choice for the baseline consumer. However, some heterogeneity exists among the sample. In particular, the presence of such certification was statistically different for shoppers at natural foods markets, food coops and farmer's markets relative to the baseline shopper at a conventional supermarket. There were no differences between consumers in the different regions regarding certification; however, males did not value either certifier over no certification though the female consumers did everywhere but at the conventional market. Only males shopping at food coops with an advanced degree would be estimated to place a significant value on certification, and then only for third party certification.

Table 4 also shows the premiums only for the baseline consumer, calculated based upon the model with both main and interactive effects, calculated according to equation (6). These premiums should be interpreted as premiums over the conventional apple (with conventional pesticides, no certifier, and no environmental protections), interpreted for the baseline consumer only. Of the farm practices, the premium is the largest for pest management with non-synthetic pesticides over conventional pesticides. IPM was also preferred to conventional. Protection of water quality and provision of wildlife habitat each have positive premiums though smaller than those for pest management. This coincides with findings from (Hu et al. 2004) which shows that preferences for direct benefits

from food quality or food safety attributes are stronger than preferences for indirect (or warm glow) benefits from environmental attributes. Among direct benefits Hwang, Roe, and Teisl (2005) found that pesticides rated the highest concern among eight production and process based factors with a rating between concerned and very concerned and was significantly higher than concern about artificial growth hormones, antibiotic, GM ingredients, irradiation, preservatives, artificial colors/flavors, and pasteurization. Our findings support the result that reduced pesticide usage is the most valuable of attributes. Similar to other studies that investigate certification as an attribute, certification is insignificant for baseline consumers (Johnston et al. 2001; Wessells, Johnston, and Donath 1999).

9. Predictions of Market Shares under Ecolabel Attribute Alternatives

It is worthwhile to more fully explore the implications of the model results for market development and segmentation. In this section, model parameters are used to create within-sample predictions of market shares of products under a variety of scenarios to investigate the effects of a) varying definitions of ecolabels (changing the composition of the attributes of the labels); and b) comparing market shares by consumer attributes. Using appropriate attribute values and resulting attribute-consumer characteristic interactive values, predicted choice probabilities from equation (4) were calculated. Market shares for each hypothetical product type were predicted, using the highest probability choice for each in-sample consumer.

To illustrate, Figure 2 shows a set of predictions in which alternative formulations of the definition of the ecolabels are specified to investigate changes in market shares for apples with these ecolabels at given prices. In other words, four versions of an ecolabels are ‘defined’ at particular prices, and then market shares are predicted for each ecolabeled apple. The market shares for these ecolabeled apples are compared to market shares for ‘conventional’ apples, as well as for apples with the single attribute of non-synthetic pesticide usage. The latter apples represent something close to ‘organic’ in the minds of consumers, and may be an interesting comparison to the various ecolabels. Whether realistic or not, the Hartman Group (2007) found that consumers who buy organic foods list ‘pesticide free’ (a prevalent opinion despite its inaccuracy) as their primary reason for such purchases, and as such, an interesting comparison in this exercise. The market share comparison is calculated in each of the four store types. As shown in panel A, an ecolabel with all three attributes (IPM, water quality protection (WTR) and wildlife habitat provisions (WLD)) captures most of the market share, in each of the store types, given a favorable price level of $1.19/pound. In panel D, with none of the public good attributes and only IPM, the non-synthetic pesticide “organic” apples are predicted to capture 100% of the market in the natural food stores and food coops, while the ecolabeled apple

continues to capture significant market share in the farmers' market. The conventional supermarket, in contrast, reverts to more equal market shares across apple products. In panels B and C, where only one of the two environmental farm practices are present and paired with IPM, the ecolabeled apple continues to captures higher market share. The most striking difference is in the food coop, where wildlife habitat provision has a higher attraction than water quality protection, as measured by market shares of the two definitions of the ecolabel.

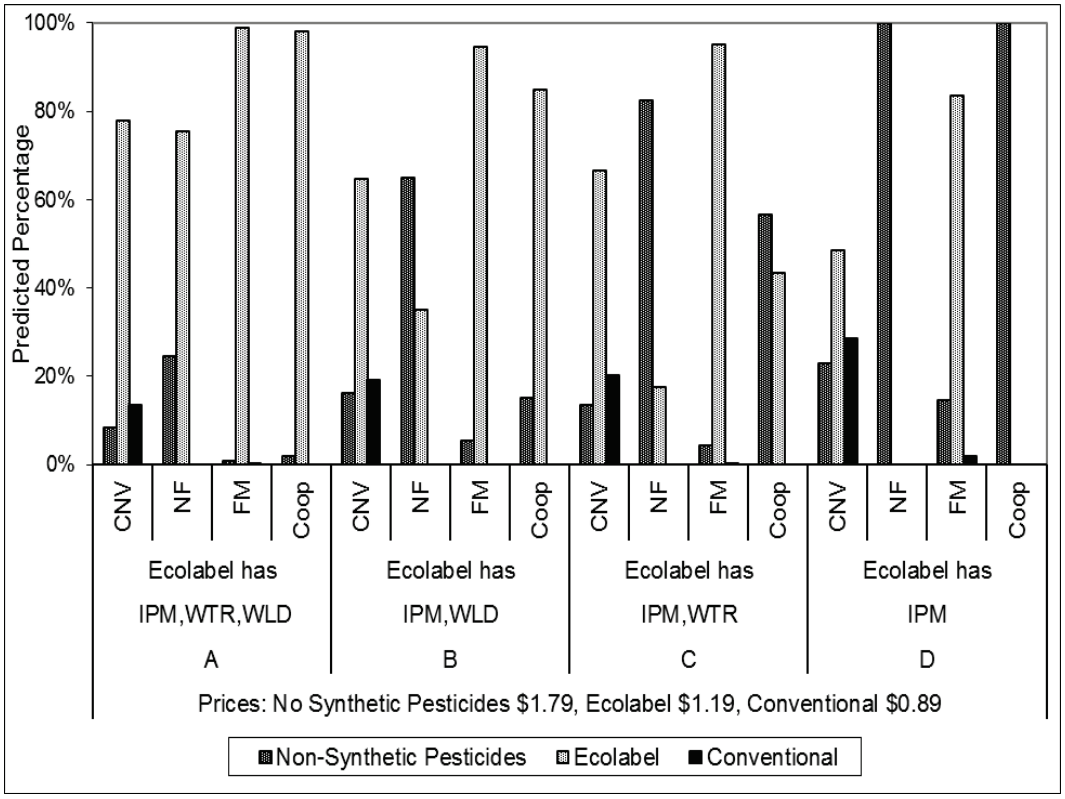

Figure 2. Choice between Ecolabeled, Conventional, and Non-Synthetic Pesticides Apples with various Ecolabel Attributes

Figure 3 demonstrates the effect of these differences at a variety of prices, revealing predicted market shares for three different apples: 1) produced using non-synthetic pesticides (labeled as NSP); 2) produced using IPM, wildlife habitat protection, and water quality protection (labeled as 'ecolabel'); and 3) produced with conventional methods, with conventional pesticides and no environmental attributes (labeled as 'conventional'). In panel A, when prices of the NSP and 'ecolabeled' products are the same, but the 'conventional' product is significantly lower, the market share of NSP and conventional apples are approximately the same at conventional supermarkets. At the natural foods market the market share

is largest for NSP apples, and largest for the ecolabeled apples at the farmer's market and the food coop. In panel B, as the price of conventional climbs slightly, conventional supermarket shoppers shift their preferences toward NSP. In panels C and D, when the prices of the ecolabeled apples drop, market shares for ecolabeled apples increase substantially in each market.[3]

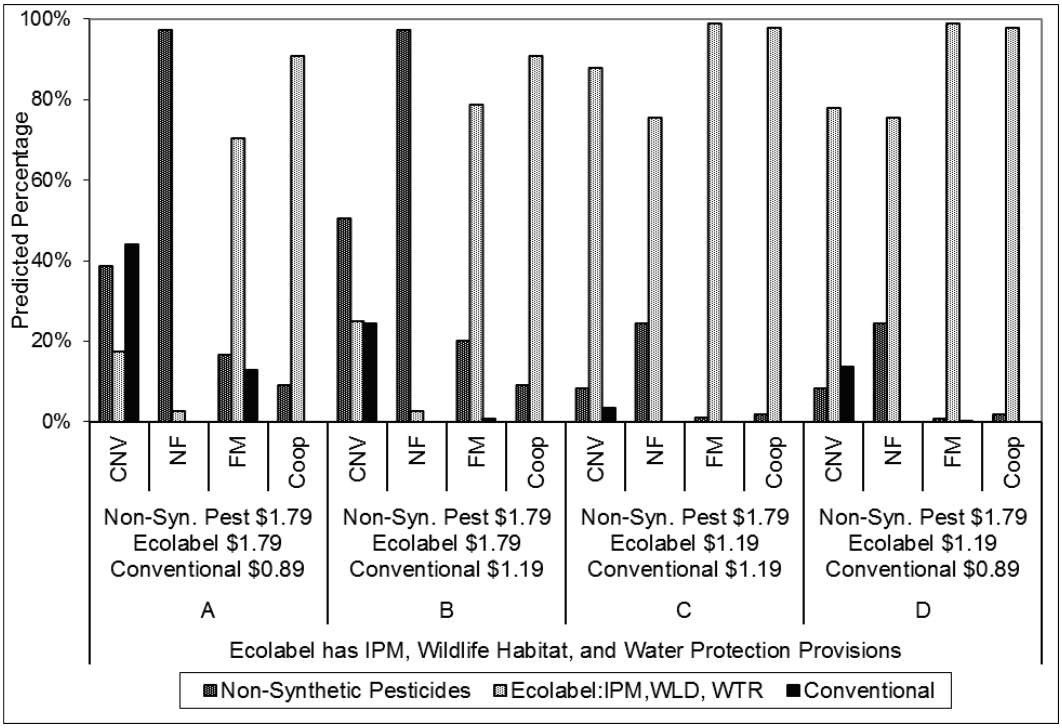

Figure 3. Choice between Multi-attribute Ecolabeled, Conventional, and Non-Synthetic Pesticides Apples with Varied Conventional and Ecolabel Prices

Finally, to provide additional insights for potential marketing strategies from the consumer heterogeneity seen in the regression results, gender deserves further attention as it was significantly different from the baseline consumer for almost every product attribute. In other words, men and women in this sample tended to view the label attributes differently. Figure 4 illustrates that men rated integrated pest management more highly than women. Thus, more men will choose the ecolabel as long as it is priced sufficiently less than the non-synthetic

[3] Note that in these scenarios the 'do not buy' choice is not predicted, though in the survey, respondents were given the 'do not buy' option. This is primarily due to setting the lowest price for the conventional choice and a moderate price for the ecolabel.

pesticide choice. The model predicts that their greater price sensitivity will move them toward conventional apples unless the price drops for the ecolabeled product (panel D).

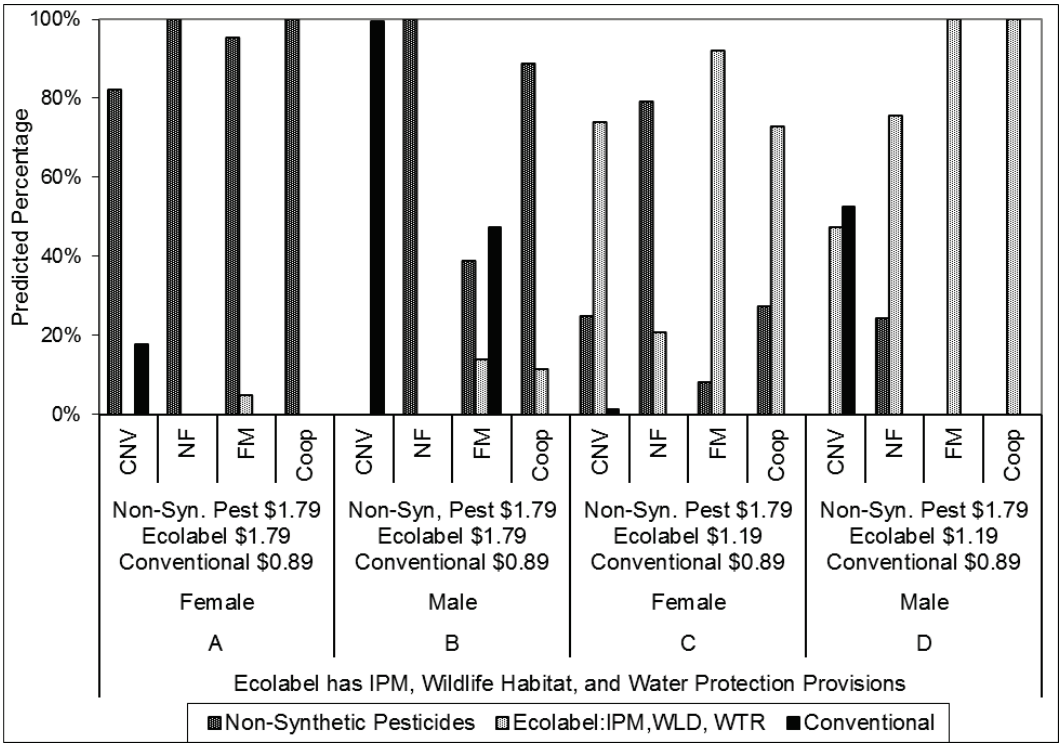

Figure 4. Choice between Multi-Attribute Ecolabeled, Conventional, and Non-Synthetic Pesticides Apples Comparing between High and Low Ecolabel Price and Gender

10. Implications and Conclusions

Food ecolabeling programs provide a service to consumers through provision of credence information otherwise unobservable to the consumer, by which the consumer may then distinguish among products. Likewise, ecolabeling programs also provide services to food producers, by marketing the label to consumers and educating consumers as to the veracity of the label. The market reward and incentive for certification by the program to the food producer, and thereby the environmental improvements, require consumers choosing the products with the label. This paper has explored both consumer attributes and attributes of ecolabels which result in greatest likelihood of choices of labeled apples. Results provide several interesting insights which indicate potential approaches to market promotion or educational campaigns. It has done so by decomposing the

components of an ecolabel, the various standards that typical food ecolabels are meant to convey to consumers, into a multi-attribute label which consumers were able to separately value in an experiment. By doing so, ecolabeling programs may see how consumers compare and contrast the relative value of individual attributes of the conveyed by the ecolabel and discern which have the greatest value.

The result of this paper builds considerably upon previous studies by evaluating a multi-attribute ecolabel which evaluates attributes with both direct benefits and purely public good benefits. To compare estimated premium values for an equivalent ecolabel, in an alternative analysis of the Food Alliance ecolabel, Loureiro, McCluskey, and Mittelhammer (2002) also evaluated consumer willingness to pay for ecolabeled apples. However, an alternative description is offered for the ecolabel than in this study, namely a single definition:

"The Food Alliance seal of approval identifies products that are grown in ways that are environmentally and socially responsible, including: a) protecting and enhancing natural resources, b) emphasizing alternatives to pesticides, and caring for the health and well-being of farm workers and rural communities."

The above description is less specific about farm practices than the descriptions used in this study, and does not allow for the consumer to indicate separate willingness to pay for each attribute of the label. Their study finds an average 4.99¢ premium over a 99¢ baseline in their January 2000 survey of conventional supermarket in Portland, Oregon. While not directly comparable to this study, it is somewhat useful to calculate the total premium of the most similar, multi-attribute ecolabeled apple over the conventional apple in this study for comparison. The estimated premium for the Oregon consumer at a conventional store ranges from 31 cents for men to 84 cents for women, compared to a baseline ranging from 89 cents to a $1.19. The premium range is due to a smaller difference in utility for men for the ecolabeled apple compared to conventional as well as greater price sensitivity.

The difference in premium between the two studies may be due to the difference in baseline consumers and time period, but it may also be due to the disaggregation in ecolabel attributes. Thus, education of consumers regarding the definition of an ecolabel – specifically, the standards that an ecolabel measures farm practices against – will affect the premiums paid for an ecolabel. At the heart of consumers' preferences for ecolabels, and consequent value of the ecolabeled food product, is the value and understanding of the information provided with the ecolabel.

11. References

Aguilar, F. X. and R. P. Vlosky, "Consumer Willingness to Pay Price Premiums for Environmentally Certified Wood Products in the U.S." *Forest Policy & Economics* 9(2007):1100-12.

Anderson, J. L. and S. U. Bettencourt, "A Conjoint Approach to Model Product Preference: The New England Market for Fresh and Frozen Salmon." *Marine Resource Economics* 8(1993):31-49.

Andreoni, J., "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving." *The Economic Journal* 100(1990):464-77.

Bernard, J. C. and D. J. Bernard, "Comparing Parts with the Whole: Willingness to Pay for Pesticide-Free, Non-GM, and Organic Potatoes and Sweet Corn." *Journal of Agricultural and Resource Economics* 35(2010):457-75.

Blend, J. R. and E. O. V. Ravenswaay, "Consumer Demand for Eco-Labeled Apples: Results from Econometric Estimation." *American Journal of Agricultural Economics* 81(1999):1072-77.

Boccaletti, S. and N. Michele, "Consumer Willingness to Pay for Pesticide-Free Fresh Fruit and Vegetables in Italy." *International Food and Agribusiness Management Review* 3(2000):297-310.

Bond, C., D. D. Thilmany and J. K. Bond, "What to Choose? The Value of Label Claims to Fresh Produce Consumers." *Journal of Agricultural and Resource Economics* 33(2008):402-27.

Canavari, M., G. Nocella and R. Scarpa, "Stated Willingness-to-Pay for Organic Fruit and Pesticide Ban: An Evaluation Using Both Web-Based and Face-to-Face Interviewing." *Journal of Food Products Marketing* 11(2005):107-34.

Cicia, G., T. D. Giudice and R. Scarpa, "Consumers' Perception of Quality in Organic Food: A Random Utility Model under Preference Heterogeneity and Choice Correlation from Rank-Orderings." *British Food Journal* 104(2001):200-13.

Cohen, S. H., "CBCA Marries the Best of Conjoint and Discrete Choice Models." *Marketing Research* 9(1997):12-17.

Costa, S., L. Ibanez, M. L. Loureiro and S. Marette, "Quality Promotion through Eco-Labeling: Introduction to the Special Issue." *Journal of Agricultural and Food Industrial Organization* 7(2009):Article 1.

Cranfield, J., S. Henson, J. Northey and O. Masakure, "An Assessment of Consumer Preference for Fair Trade Coffee in Toronto and Vancouver." *Agribusiness* 26(2010):307-25.

Darby, K., M. Batte, S. Ernst and B. Roe, "Decomposing Local: A Conjoint Analysis of Locally Produced Foods." *American Journal of Agricultural Economics* 90(2008):476-86.

Dasgupta, S., F. F. Wirth and K. J. Davis, "Selling Freshwater Prawn in Food Festivals: A Marketing Experiment in Kentucky." *Aquaculture Economics & Management* 11(2007):3-16.

Fotopoulos, C. and A. Krystallis, "Quality Labels as a Marketing Advantage: The Case of the "PDO Zagora" Apples in the Greek Market." *European Journal of Marketing* 37(2003):1350-74.

Govindasamy, R. and J. Italia, "A Willingness-to-Purchase Comparison for Integrated Pest Management and Conventional Produce." *Agribusiness* 14(1998):403-14.

Green, P. and V. Srinivasan, "Conjoint Analysis in Consumer Research: Issues and Outlook." *Journal of Consumer Research* 5(1978):103-23.

Green, P. E., A. M. Krieger and Y. Wind, "Thirty Years of Conjoint Analysis: Reflections and Prospects." *Interfaces* 31(2001):S56-S73.

Green, P. E. and V. Srinivasan, "Conjoint Analysis in Marketing: New Developments with Implications for Research and Practice." *The Journal of Marketing* 54(1990):3-19.

Greene, W. H. *Econometric Analysis*. Upper Saddle River, NJ: Prentice-Hall, 2003.

Gustafsson, A., A. Herrmann and F. Huber, "Conjoint Analysis as an Instrument of Market Research Practice." In *Conjoint Measurement: Methods and Applications*. A. Gustafsson, et al., eds. Berlin: Springer-Verlag, 2007: pp. 3-30.

Halbrendt, C. K., G. F. Vaughn and F. F. Wirth, "Conjoint Analysis of the Mid-Atlantic Food-Fish Market for Farm-Raised Hybrid Striped Bass." *Southern Journal of Agricultural Economics* 23(1991):155-63.

Hartman Group. "Sustainability from a Consumer Perspective: Presented to Co-Op America's Green Business Conference." Green America, 2007. http://www.greenamerica.org/PDF/summary_2007demeritt.pdf. Accessed March 7, 2012.

Hensher, D. A., J. M. Rose and W. H. Greene. *Applied Choice Analysis: A Primer*. Cambridge: Cambridge University Press, 2005.

Holland, D. and C. R. Wessells, "Predicting Consumer Preferences for Fresh Salmon: The Influence of Safety Inspection and Production Method Attributes." *Agricultural and Resource Economics Review* 27(1998):1-14.

Hooker, N. H. and J. A. Caswell. "Regulatory Targets and Regimes for Food Safety: A Comparison of North American and European Approaches." In *The Economics of Reducing Health Risk from Food*. Storrs, CT: Food Marketing Policy Center, 1996: pp. 1-17.

Hu, W., A. Hunnemeyer, M. Veeman, W. Adamowicz and L. Srivastava, "Trading Off Health, Environmental and Genetic Modification Attributes in Food." *European Review of Agricultural Economics* 31(2004):389-408.

Hwang, Y.-J., B. Roe and M. F. Teisl, "An Empirical Analysis of United States Consumers' Concerns About Eight Food Production and Processing Technologies." *AgBioForum* 8(2005):40-49.

Jaffry, S., H. Pickering, Y. Ghulam, D. Whitmarsh and P. Wattage, "Consumer Choices for Quality and Sustainability Labelled Seafood Products in the UK." *Food Policy* 29(2004):215-28.

Johnston, R. J. and J. M. Duke, "Willingness to Pay for Agricultural Land Preservation and Policy Process Attributes: Does the Method Matter?" *American Journal of Agricultural Economics* 89(2007):1098-115.

Johnston, R. J. and C. Roheim, "A Battle of Taste and Environmental Convictions for Ecolabeled Seafood: A Contingent Ranking Experiment." *Journal of Agricultural and Resource Economics* 31(2006):283-300.

Johnston, R. J. and S. K. Swallow, "Estimating Willingness to Pay and Resource Tradeoffs with Different Payment Mechanisms: An Evaluation of a Funding Guarantee for Watershed Management." *Journal of Environmental Economics & Management* 38(1999):97.

Johnston, R. J., C. R. Wessells, H. Donath and F. Asche, "A Contingent Choice Analysis of Ecolabeled Seafood: Comparing Consumer Preferences in the United States and Norway." *Journal of Agricultural and Resource Economics* 26(2001):20-39.

Krystallis, A., C. Fotopoulos and Y. Zotos, "Organic Consumers' Profile and Their Willingness to Pay (Wtp) for Selected Organic Food Products in Greece." *Journal of International Consumer Marketing* 19(2006):81-106.

Kuhfeld, W. "Marketing Research Methods in SAS." 2009. http://support.sas.com/techsup/technote/mr2009.pdf. Accessed January 7, 2010.

Lancaster, K., "A New Approach to Consumer Theory." *The Journal of Political Economy* 74(1966):132-57.

Loureiro, M. L. and S. Hine, "Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for Local (Colorado Grown), Organic, and Gmo-Free Products." *Journal of Agricultural and Applied Economics* 34(2002):477-87.

Loureiro, M. L., J. J. McCluskey and R. C. Mittelhammer, "Will Consumers Pay a Premium for Eco-Labeled Apples?" *Journal of Consumer Affairs* 36(2002):203-19.

Louviere, J. J. and G. Woodworth, "Design and Analysis of Simulated Consumer Choice or Allocation Experiments: An Approach Based on Aggregate Data." *Journal of Marketing Research* 20(1983):350-67.

Lusk, J. L. and T. C. Schroeder, "Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks." *American Journal of Agricultural Economics* 86(2004a):467-82.

Lusk, J. L. and T. C. Schroeder, "Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks." *American Journal of Agricultural Econonomics* 86(2004b):467–82.

McCluskey, J. J., C. A. Durham and B. Horn, "Consumer Preferences for Socially Responsible Production Attributes across Food Products." *Agricultural and Resource Economics Review* 38(2009):345–56.

McFadden, D. "Conditional Logit Analysis of Qualitative Choice Behavior." In *Frontiers in Econometrics*. P. Zarembka, ed. New York: Academic Press, 1974: pp. 105-42.

Misra, S. K., C. L. Huang and S. L. Ott, "Consumer Willingness to Pay for Pesticide-Free Fresh Produce." *Western Journal of Agricultural Economics* 16(1991):218-27.

Olynk, N., G. T. Tonsor and C. Wolf, "Consumer Willingness to Pay for Livestock Credence Attribute Claim Verification." *Journal of Agricultural and Resource Economics* 35(2010):261-80

Palma, M. A., F. F. Wirth, C. M. Adams and R. L. Degner, "Market Preferences toward Farm Raised Sturgeon in the Southeastern United States." *Aquaculture Economics and Management* 14(2010):235-53.

Roosen, J., J. A. Fox, D. A. Hennessy and A. Schreiber, "Consumers' Valuation of Insecticide Use Restrictions: An Application to Apples." *Journal of Agricultural and Resource Economics* 23(1998):367-84.

Rotaris, L. and R. Danielis, "Willingness to Pay for Fair Trade Coffee: A Conjoint Analysis Experiment with Italian Consumers." *Journal of Agricultural and Food Industrial Organization* 9(2011):1-20.

Scarpa, R., G. Philippidis and F. Spalatro, "Product Country Images and Preference Heterogeneity for Mediterranean Food Products: A Discrete Choice Framework." *Agribusiness* 21(2005):329-49.

Thilmany, D. D., W. J. Umberger and A. R. Ziehl, "Strategic Market Planning for Value-Added Natural Beef Products: A Cluster Analysis of Colorado Consumers." *Renewable Agriculture and Food Systems* 21(2006):192-203.

Umberger, W. J., D. M. Feuz, C. R. Calkins and K. Killinger Mann, "Us Consumer Preference and Willingness to Pay for Domestic Corn Fed Beef Versus International Grass Fed Beef Measured through an Experimental Auction." *Agribusiness* 18(2002):491-504.

United States Environmental Protection Agency. Office of Prevention Pesticides and Toxic Substances. 1998. "Environmental Labelling: Issues, Policies, and Practices Worldwide." Available at: http://www.epa.gov/epp/pubs/wwlabel3.pdf.

van der Lans, I. A., K. van Ittersum, A. De Cicco and M. Loseby, "The Role of the Region of Origin and EU Certificates of Origin in Consumer Evaluation of Food Products" *European Review of Agricultural Economics* 28(2001):451-77.

van Ravenswaay, E. O. and J. P. Hoehn. "The Impact of Health Risk Information on Food Demand: A Case Study of Alar and Apples." In *Economics of Food Safety*. Julie A. Caswell, ed. New York: Elsevier, 1991: pp. 155-74.

Wessells, C. R., R. J. Johnston and H. Donath, "Assessing Consumer Preferences for Eco-Labeled Seafood: The Influence of Species, Certifier and Household Attribute." *American Journal Agriculture Economics* 81(1999):1084-89.

Wirth, F. F., M. A. Palma and L. A. Love, "Purchasing Shrimp for at-Home Consumption: The Relative Importance of Credence Versus Physical Product Features." *Aquaculture Economics & Management* 11(2007):17-37.

Wittink, D. R., M. Vriens and W. Burhenne, "Commercial Use of Conjoint Analysis in Europe: Results and Critical Reflections." *International Journal of Research in Marketing* 11(1994):41-52.