Journal of Agricultural and Applied Economics, 41,1(April 2009):47–60

Consumer Acceptance and Willingness to Pay for Blueberry Products with Nonconventional Attributes

Wuyang Hu, Timothy Woods, and Sandra Bastin

Consumer acceptance and willingness to pay for three nonconventional attributes associated with six processed blueberry products was examined through an in-store conjoint experiment survey. Both credence and experience attributes were considered, including whether the products were produced locally, and whether they were organic or sugar-free. The results indicate heterogeneity in consumer preference and willingness to pay for different attributes across product categories. Local products and organic formulations generally received positive willingness to pay across all products. This information has implications for blueberry growers and retailers who are trying to create and position value-added products for maximum revenue.

Key Words: blueberries, conjoint experiment, Kentucky, willingness to pay

JEL Classifications: D12, Q13

The demand for agricultural products is often driven by consumer taste, an increasing need for product information, and concerns for implications of agricultural production on the environment and society (Cortez and Senauer; Teisl, Bockstael, and Levy; Grolleau and Caswell). These factors are closely related to rising consumer attention to a healthful diet and to foods that provide additional features in addition to the basic nutrients. As more individuals recognize blueberries as a type of healthful food, market demand has been soaring around the world. In the United Kingdom, sales of blueberries have seen triple-percentage increases over the past few years (Food and Drink Europe). As the world's largest producers and consumers for blueberries, United States and Canada account for over 90% of world production and the output keeps rising rapidly (Lehnert). Given the growing importance of blueberries in the food market and the growth in the variety of value-added products available, it seems prudent to examine how consumers react to blueberry products and, in particular, the nonconventional attributes associated with these products.

This study focuses on consumer preferences and willingness to pay (WTP) for popular processed blueberry products. A conjoint experiment survey of a representative sample of Kentucky consumers is used to assess consumer acceptance and WTP for six products: pure blueberry jam, blueberry-lime jam, blueberry yogurt, blueberry fruit rollups, blueberry dry muffin mix, and blueberry raisinettes. This study is different from past literature in two

Wuyang Hu is assistant professor, and Timothy Woods is professor, Department of Agricultural Economics, University of Kentucky, Lexington, KY. Sandra Bastin is associate professor, Department of Nutrition and Food Science, University of Kentucky, Lexington, KY.

Funding from the New Crop Opportunity Center at the University of Kentucky is acknowledged. The authors are grateful to editor Jeffrey Gillespie and two anonymous referees for valuable comments. All remaining errors are the authors'.

major aspects. First, past studies on horticultural products, especially on fruits, have commonly been dedicated to investigating relevant consumer demand for fresh fruits (e.g., Yue, Alfnes, and Jensen; Darby et al.). The current analysis instead focuses on well-known processed products that use the fruit as a major ingredient. Blueberries are highly perishable as fresh fruits but are commonly used as ingredients in a variety of food items (U.S. Highbush Blueberry Council). Market research on processed blueberry products may help to obtain a better understanding of consumer demand and WTP for blueberries, leading to improved market positioning and revenues.

Second, in the context of the six processed blueberry products considered, this article explores consumer relative WTP for three nonconventional attributes, including an organic product feature, a Kentucky-grown claim, and a sugar-free claim. These attributes are not directly related to conventional food attributes such as taste or flavor but, as some researchers found, may have important implications to consumer WTP and product market share (Hu, Cox, and Edwards; Bernard, Zhang, and Gifford). There are few past studies that examine multiple nonconventional food attributes in a multiproduct context. Combining with these three nonconventional attributes, the six processed blueberry products offer many opportunities to add value to fresh blueberries. Thus, information on consumer acceptance and WTP for attributes associated with these products will be useful for retailers in understanding customer demand, and will send an important message to producers about future development of value-added products.

Attributes Considered and the Conjoint Experiment

Selection of the attributes considered in the survey was established by interacting closely with the general public through formal focus group discussions and other informal conversations. Along with the increasing use of modern food production technologies, such as the use of hormone, irradiation, genetic modification, or even nanotechnology, substantial concerns and uncertainties have been expressed by consumers about the food they purchase (Fischer, Frewer, and Nauta). As an alternative to many of these new technologies, organic production has reemerged and organic food has taken a large portion of market sales. The U.S. Market for Organic Foods and Beverages estimates that by 2009 the organic food and beverages market will generate more than $32 billion in sales. Some researchers estimated that the growth rate of the organic food and beverage market was close to 20% a year (Packaged Fact). Fundamentally, this rapid market growth rate of organic food and beverage is fueled by American consumers' developing demand for such products. Some studies have shown that the majority of Americans have some experience of consuming organic foods or beverages. This group of consumers is also highly diverse in terms of demographic characteristics and economic status (Whole Foods Market; Baxter).

In economic terms, the organic attribute is a type of credence attribute requiring efficient information dissemination and trust from consumers on such information normally recognized on product labels. Past studies have shown consumers may attach a significant value to the label of organic production in various food categories (e.g., Loureiro and Hine; Canavari, Nocella, and Scarpa; and Bernard, Zhang, and Gifford). Given these positive reactions to organic food, it is important to see whether there might be a price premium associated with the processed blueberry products in this study and determine its magnitude.

Another type of credence attribute considered in the current analysis is whether the products are Kentucky-grown. Similar to the organic feature, consumers cannot evaluate this attribute through normal consumption of the food but rather must rely on proper labeling (Darby et al.). In the Commonwealth of Kentucky, the locally produced initiative is branded as the Kentucky Proud program. Similar programs (with various levels of intensity and scope) exist in almost all 50 states of the U.S. Studies show that consumers often attach additional values to food produced locally (e.g., Giraud, Bond, and Bond; Darby et al.). There may be different reasons behind this premium, but the locally produced label is a growing sector in food marketing. A sign of this buy-local trend is the boom of farmers markets and specialty food stores across the country where locally produced foods are typically sold. The existence of a higher WTP for local products has implications for how producers and processors merchandize. A very similar approach can be taken to evaluate the premium associated with other products in Kentucky or in other states.

The third nonconventional attribute considered is the sugar-free feature. This attribute may be regarded as an experience attribute since consumers may discover this feature by consuming the product. The Dietary Guideline for Americans, published every five years by the U.S. government (Dietary Guidelines), clearly reminds the public that excess intake of sugar has the potential to increase body weight and can also be attributed to deteriorating dental health. The guideline also points out that, in general, Americans are consuming too much added sugar in the diet. A natural approach to attract consumers who are conscious about the health implications of sugar is to introduce sugar-free products into the market. The campaign on sugar-free foods has been applied for some time, but it has rarely been targeted on products containing real fruits such as blueberries. This study fills the gap by examining consumer WTP for the six blueberry products with potential sugar-free characteristics.

Considering these attributes, the conjoint experiment design was applied for each of the six products. The approach of conjoint analysis has been widely applied to elicit respondents' stated choice behavior (Johnston and Duke; Carlsson, Frykblom, and Lagerkvist 2007b) and has proven to be a useful tool in food choices (Hu, Veeman, and Adamowicz; Hu, Cox, and Edwards; Darby et al.; Carlsson, Frykblom, and Lagerkvist 2007a; and Lusk, Fields, and Prevatt). For each product, four attributes were used in the design: whether organic, whether produced in Kentucky, whether sugar-free, and price. The first three attributes all had two levels present or absent and there were four levels of the price. The price of a product is highly correlated with the package size. Therefore, package sizes for each of the products were selected to reflect the size of comparable products consumers already often see in the market. Unlike other attribute variables, once determined, packaging size remains unchanged for each product throughout the conjoint experiment. The price, on the other hand, varied across different products in the experiment.

Table 1 shows the packaging size considered for each type of product and corresponding price levels. Different categories of products and packaging sizes may be sold at different prices. For example, jam is usually more expensive than yogurt based on an ounce-to-ounce comparison. The prices chosen for each product consider the differences in both product category and packaging size. Consumer WTP for each type of product (and each attribute associated) may vary across individuals. The range of prices used in the conjoint experiment should be wide enough to cover the potential WTP (Hanemann and Kanninen). Prior to the implementation of the survey, careful market evaluation and pretesting were conducted to ensure that both lower and higher end possible prices were included. Four levels

Table 1. Size of Packaging and Price Levels in Conjoint Design

		Price Levels Considered (in USD)			
Product	Packaging	1	2	3	4
Pure blueberry jam	10 oz	2.75	3.25	3.75	4.25
Blueberry-lime jam	10 oz	2.75	3.25	3.75	4.25
Blueberry yogurt	32 oz	1.75	2.25	2.75	3.25
Blueberry fruit rollups	0.8 oz	0.60	0.90	1.20	1.50
Blueberry dry muffin mix	10 oz	1.75	2.25	2.75	3.25
Blueberry raisinettes	4 oz	4.25	5.00	5.75	6.50

of prices were used to maintain the balanced statistical property of the conjoint experiment while maintaining simplicity (Louviere, Hensher, and Swait). Several other studies adopted the same strategy (e.g., Hu, Veeman, and Adamowicz).

Given the four attributes considered for each product, a D-optimal fractional factorial design was applied and generated eight profiles for each product. This design allows the main and first-order interaction effects not to be confounded (Louviere, Hensher, and Swait). Other studies have successfully used this type of design and generated reliable results (e.g., Lusk, Fields, and Prevatt). Four choice sets were constructed based on these profiles with each choice set containing two alternatives resembling two profiles with respective prices. A third "empty" alternative was added to each choice set, the alternative which when chosen allows the respondents to express that they would not choose either one of the first two alternatives. Then respondents were advised to choose one and only one alternative within each choice set. Figure 1 gives a sample choice task. Since six processed blueberry products are considered in this study, it is time consuming and tedious to ask each respondent to complete all four choice sets for each of the six products in an in-store survey. A split sample strategy was adopted in the survey process in which respondents were randomly assigned to evaluate two products (each contains four choice sets). Thus, each person would only need to indicate their preferences in eight choice occasions.

Survey and Data Collection

An in-store intercept survey approach was adopted to collect the data. Other survey approaches were considered but, for various practical reasons described below, the in-store intercept survey approach was deemed to be the best fit. One of the major advantages of in-store surveys compared with mail surveys is that they often allow the researcher to collect a relatively large sample in a short period of time. The newly emerging computer-assisted data collection method may also generate a large sample size quickly (e.g., Hu, Veeman, and Adamowicz). Such a technique presents an interesting option for future data collection.

The data collecting effort involved gathering information on consumers and their choices of the six products discussed in this study. Prior to the survey, intensive focus group discussions and pilot investigation were conducted. Focus groups containing the general public as well as food scientists were used to determine whether the attributes and levels considered for the blueberry products are indeed sensible to them and easy to understand. Survey wording and layout were also modified following the discussions to improve readability. A pilot study using a small convenient sample was used to test the basic empirical results suggested by the survey. The pilot study revealed that individuals were making trade-offs among the attributes considered in the survey—a signal showing they were involved during the survey process.

Fielding of the survey occurred between May and September in 2007. This time frame was purposely chosen to match the peak fresh blueberry production season in Kentucky. Although practically it is not essential to have the survey time coincide with the production, sales of fresh and processed blueberry products do seem to be positively correlated with the local production season. Matching the survey effort

Pure Blueberry Jam (10 oz)

Option A	Option B	Option C
Organic	Not Organic	I will not choose either A or B
Sugar-Free	Sugar-Free	
Not Kentucky Product	Not Kentucky Product	
$4.25	$3.25	
❑	❑	❑

I would like to choose (choose only one)

Figure 1. Sample Choice Task

with this time frame provided a better depiction of market potentials. Presenting survey questionnaires at stores while fresh blueberries were largely available helped respondents to establish a connection with the product involved, thus helping them answer the survey questions.

Surveys were conducted in four locations in northern and central Kentucky. Major local grocery stores were chosen in each survey region. These stores typically feature a large range of different types of food. Trained university staff and students intercepted adult shoppers (at least 18 years of age) at these stores to complete the survey. Survey time varied from weekdays to weekends and from midday to evenings to ensure comprehensive coverage of grocery shoppers. At each store, a booth was set up where sample products referred to in the survey were displayed. Each respondent was fully debriefed on the purpose of the study and received a five-dollar gift certificate at the store upon completion of the survey.

Moderators at each location observed a high response rate among individuals approached. A total of 604 completed questionnaires were collected. Of this group, 557 responses were usable for the purpose of the study. Table 2 presents descriptive statistics of several key demographic variables of the sample as well as the average of Kentucky. The sample is fairly representative of the average household size when compared with the overall population characteristics of Kentucky. Since the sample only included individuals who are adults, sample age and education level are expected to be slightly higher than state average. The sample is also slightly biased toward higher income families and has a significantly higher representation of females. Given that the survey was done at grocery stores, this higher percentage of female participants was expected.

The survey questionnaire contains three sections and on average took respondents about five minutes to complete. The first section asked questions on respondents' general food consumption habits and past experience with fresh blueberries or blueberry products. The second section contained the conjoint experiment where respondents could indicate their product choices. The last section included questions on demographic information. Prototype products with the corresponding package size were included in the display. Although respondents were not allowed to sample the products on display, this practice helps them to establish visual connections with the products being discussed. The on-display products were also made to correspond to the packaging size of the six products in the study. This was intended to help the respondents make trade-offs in their product choice decisions and not to worry about converting prices to per unit measures.

In a stated preference study, incentive incompatibility may bias the analysis. To reduce this problem, some researchers have proposed the "cheap talk" approach (Cummings and Taylor) where respondents typically have to read a relatively long script in the survey emphasizing the consequences of their choices if these choices were to be made in real life. Nevertheless, since in this study respondents had to complete the survey while they were standing in the grocery store often with their shopping carts, long reading material in the survey is not practical (and this was verified by the pilot testing). Instead, the surveyors verbally encouraged the respondents to indicate their choices as if they were actually

Table 2. Descriptive Statistics of Sample Demographic Variables

	Mean	Std. Dev.	State Avg.	Description
MALE	0.330	0.470	0.49	Dummy variable; male = 1
AGE	42.944	16.423	35.9	Continuous variable; actual age
INCOME	52,926.370	38,170.512	46,214	Continuous variable; pretax household income
EDU	14.668	2.700	—	Continuous variable; years of formal education
HSIZE	2.654	1.387	2.47	Count variable; size of household
n = 557				

shopping for their households. Respondents were also reminded constantly during the survey that if they were not certain about the size of the product being discussed, they could refer to the sample products displayed on the table in front of them. The next section describes models that can be used to analyze the choice data suggested by the conjoint experiment.

Models

Suppose when individual i faces a choice alternative j (a blueberry product) in the t-th choice set with attribute levels represented by vector $\mathbf{X}_{ij}$, the individual will choose alternative j as preferred alternative if and only if the utility associated with alternative j is greater than other available alternatives under the same produce category. Random utility theory allows one to express the indirect utility (U_{ijt}) associated with alternative j for individual i in the t-th choice set as (McFadden):

$$(1) \qquad U_{ijt} = \mathbf{X}_{ijt}\boldsymbol{\beta} + e_{jt}$$

where $\boldsymbol{\beta}$ is a vector of unknown parameters to be estimated and e_{jt} is an error term reflecting the randomness of this utility expression. Following McFadden, if the error term is assumed to follow an iid maximum extreme value type I distribution, the utility maximization process leads to the choice probability of individual i choosing alternative j in the t-th choice set in the form of a conditional logit model:

$$(2) \qquad P_{ijt} = \frac{\exp(\mathbf{X}_{ijt}\boldsymbol{\beta})}{\sum_{k=1}^{J}\exp(\mathbf{X}_{ikt}\boldsymbol{\beta})}.$$

In addition to product attribute variables, other factors may also be important in determining utilities associated with various products. A natural extension of the above model would be to consider respondent individual characteristics. This demographic information is likely to function through product attributes. Thus, interaction terms can be created between respondent demographic variables and attribute variables, and these interaction terms can be included within vector $\mathbf{X}_h$ (Colombo, Calatrava-Requena, and Hanley). This modification, however, does not avoid the restrictive substitution pattern suggested by the IIA property underlying a conditional logit model (Louviere, Hensher, and Swait). Several different approaches have been used in the literature to address this issue and, among them, the mixed logit specification holds a promising position (e.g., Hu, Veeman, and Adamowicz; Hu et al.; Carlsson, Frykblom, and Lagerkvist 2007a). This model is often used to explore the unobserved heterogeneity involved in choices.

Following Train, in a mixed logit model, the unknown parameters $\boldsymbol{\beta}$, rather than fixed, are assumed as random variables themselves and may take different values across the sampled respondents. This specification introduces uneven impact to the relative importance of two alternatives within a choice set and therefore does not suggest the IIA property. Suppose the distribution of random parameters $\boldsymbol{\beta}$ can be specified as $\boldsymbol{\beta} \sim \mathrm{H}(\boldsymbol{\theta}, \boldsymbol{\nu})$, where $\mathrm{H}(\cdot)$ indicates some probability distribution function. Function $\mathrm{H}(\cdot)$ can be individual distribution functions for each random parameter β or can be a joint function for some or all random parameters $\boldsymbol{\beta}$. Parameters $\boldsymbol{\theta}$ and $\boldsymbol{\nu}$ represent the mean and variance of the underlying distribution $\mathrm{H}(\cdot)$ or other relevant parameters depending on specific types of distribution represented by $\mathrm{H}(\cdot)$. Consequently, instead of $\boldsymbol{\beta}$, $\boldsymbol{\theta}$ and $\boldsymbol{\nu}$ are the actual parameters to be estimated. These parameters may or may not be independent based on the specification of $\mathrm{H}(\cdot)$. Given the random parameter context the choice probability becomes:

$$(3) \qquad P_{ijt} = \int \frac{\exp(\mathbf{X}_{ijt}\boldsymbol{\beta})}{\sum_{k=1}^{J}\exp(\mathbf{X}_{ikt}\boldsymbol{\beta})} h(\boldsymbol{\beta})d\boldsymbol{\beta}$$

where $h(\boldsymbol{\beta})$ is the (joint) density function for random parameters $\boldsymbol{\beta}$. Nonrandom coefficients are to be estimated along with $\boldsymbol{\theta}$ and $\boldsymbol{\nu}$. The integral involved in this probability expression can be approximated by simulation. Many commercial statistical packages now incorporate this type of simulation and this study used NLOGIT4.0.

Choice Model Results

Table 3 reports the estimation results of the conditional logit models applied to all six

Table 3. Conditional Logit Model Estimation Result

	Pure Jam		Lime Jam		Yogurt	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
NONE	−1.610***	0.374	−0.399	0.410	−0.401	0.301
ORGANIC	0.313***	0.084	0.266***	0.100	0.366***	0.100
KY	0.622***	0.116	0.904***	0.121	0.506***	0.125
SUGARF	0.404***	0.127	0.235*	0.125	0.564***	0.132
PRICE	−0.447***	0.097	−0.372***	0.104	−0.441***	0.106
n	202		183		172	
Adj. ρ^2	0.055		0.058		0.054	
	Fruit Rollups		**Dry Muffin Mix**		**Raisinettes**	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err
NONE	0.249	0.234	−1.400***	0.316	−1.068***	0.384
ORGANIC	0.316***	0.102	0.136	0.089	0.176*	0.096
KY	0.379***	0.124	0.862***	0.117	0.528***	0.116
SUGARF	0.342***	0.129	−0.230*	0.130	0.400***	0.122
PRICE	−0.529***	0.175	−0.532***	0.104	−0.358***	0.067
n	184		198		202	
Adj. ρ^2	0.027		0.047		0.043	

*, **, and *** represent significant at the 10%, 5%, and 1% significance levels respectively.

products. Because the survey adopted a split sample design, the number of respondents assigned and completing the four choice sets under each product is different. Model fit, as suggested by the adjusted ρ^2 statistics, appears not to be very high across the different product WTP models but is quite reasonable for discrete choice models of this nature (Louviere, Hensher, and Swait). The parameter estimates reveal some consistent patterns of consumer preference for the six products, although there are also some striking differences. In the context of a conditional logit model one cannot directly compare the magnitude of coefficients across different models, but the signs and statistical significance of these coefficients can be compared. First, the price variable has a significant negative coefficient across all six products, indicating that, holding other factors constant, consumers will be less likely to choose a product if its price is higher.

Variable NONE is an alternative specific constant representing the third alternative in each choice set, in which respondents could indicate that they would not choose either of the first two alternatives offered. The significant negative coefficient associated with this variable under pure blueberry jam, dry blueberry muffin mix, and blueberry raisinettes, suggests that if consumers are not able to choose any of these products respectively, their utility will be significantly reduced. This indicates that consumers in general would like to purchase these three products, and this reduction in utility is a signal of the relative tradeoffs consumers make when evaluating the attributes of various alternatives. If the combination of attributes (qualitative and price) in the first two alternatives offered in a choice set is not desirable, the respondent will have the opportunity to choose the last option. For blueberry-lime jam, blueberry yogurt, and blueberry fruit rollups, variable NONE is insignificant. This suggests that consumers in general do not feel strongly affected by not being able to purchase these products. Results from the mixed logit model discussed below offer more insights on this parameter.

Consumers, in general, show preference for organic products as manifested by the strong positive coefficient associated with variable ORGANIC in the majority of the six products. This offers further support for the current development of organic food products. However, it is also noticeable that variable ORGANIC is not significant for dry blueberry muffin mix and is only marginally significant for blueberry raisinettes. This information may be particularly useful for blueberry growers and retailers in that positive consumer response toward the organic feature may not be shared by all products. If these stakeholders wish to develop organic food strategies for their products, they will need to ensure that the cost and benefit analysis favors such strategies.

The variable KY represents the statement that a blueberry product is produced in Kentucky. It is clear from the result that, holding other factors constant, consumers are strongly in favor of a local product based on the significant positive coefficient of this variable in all six products. This result is promising for producers and retailers in the state. Following this observation, an obvious value-added marketing strategy for blueberry products is to develop a system that allows the products to be labeled as Kentucky-grown to attract consumers and meaningfully differentiate from other similar products produced elsewhere. Nevertheless, a caution needs to be called upon of generalizing this particular result to markets outside the boundary of Kentucky. The sample was collected within Kentucky. How likely consumers from other states would be to pay for Kentucky grown products, or in a more general sense, how out-of-state consumers value products from a particular state such as Kentucky, is less well known. More comprehensive studies of these consumers are required to answer these questions.

The last attribute, the sugar-free claim, is represented by the variable SUGARF. The impact of this attribute to consumers is expected to be positive given the clear health benefit of reduced sugar intake in an average American's diet. In four of the six products, this sugar-free attribute has a strongly significant positive impact on consumer utilities. As indicated by a marginally significant coefficient, consumers do not appear to differentiate whether it is sugar free for blueberry-lime jam and, surprisingly, they prefer nonsugar-free blueberry dry muffin mix. As can be seen from this study, this result is more likely to be product specific. Sugar content may be directly linked to the image of a product. Consumers may feel certain products should normally not be sugar-free, and if this is the case (as in muffin mix in this study), the sugar-free claim will introduce negative impact to the utility. This also strengthens the argument that growers and retailers should conduct careful consumer research before investing in various production and marketing activities. The outcome of a potentially costly strategy may be ineffective or even negative in generating sales for some products.

The next step is to incorporate additional respondent-specific information to better explain their choice behavior and willingness to pay. This is achieved through the mixed logit models. As has been shown in the relevant literature, the mixed logit model is highly flexible and allows a large variety of model specifications. Various specifications supported by the mixed logit framework were also evaluated in this study. Nevertheless, in the process, consideration was given to ensure not only using this framework to better explain choice behavior but also maintaining generally consistent model structures across all six products. The main reason for the second goal is to allow parameter estimates and suggested WTP measures to be compared across products, while minimizing potential differences introduced by model specifications.

After some trials, one general specification is kept throughout the estimation under all six products. This general specification assumes the alternative specific constant for the third alternative in each choice set (neither set A nor B) has a random coefficient while all other attributes, including the price, have fixed coefficients. The random coefficient is assumed to follow a normal distribution. Furthermore, several key demographic variables were used as covariates to the attribute variables and enter the estimation as interacted terms with the attribute variables. To assist succinct presentation and comparison of the models and to simplify WTP calculation discussed later, many interacted variables were considered, but only significant variables are included in the final models. Results of these models under each product are presented in Table 4. All models are estimated through simulated maximum likelihood with 120 Halton draws.

It can be seen from Table 4 that adding demographic-interaction variables and specifying a random parameter structure for the alternative specific constant significantly improves the model fit. All models have the adjusted ρ^2 statistic higher than 0.1 and several have this statistic value well above 0.2, indicating a moderate to very good fit (Louviere, Hensher, and Swait). The coefficient of alternative specific constant NONE is significant and negative in all products except blueberry fruit rollups. While this is slightly different from that in the conditional logit model (where NONE is also insignificant for blueberry-lime jam and blueberry yogurt), a consistent observation is that consumers *on average* may not show much concern much about not being able to choose/purchase blueberry fruit rollups.

Judging only through the mean estimate of the coefficient associated with variable NONE, one can only make observations on consumer behavior on average. This is because in the current mixed logit framework, all standard deviation estimates of this coefficient are also significant. These coefficients are labeled as NONE-S.D. These highly significant standard deviation estimates suggest that there is considerable heterogeneity in consumer views on these products. Take blueberry fruit rollups, for example; the insignificant mean but significant standard deviation estimate indicate that while about 50% consumers would suffer a utility loss by not being able to choose/purchase

Table 4. Mixed Logit Model Estimation Result

	Pure Jam		Lime Jam		Yogurt	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
NONE	−2.776***	0.481	−1.739***	0.563	−1.567***	0.471
NONE-S.D.	2.106***	0.273	3.204***	0.384	3.134	0.413
ORGANIC	0.322***	0.085	0.286***	0.102	−0.302	0.619
ORGANIC-Age					−2.547***	0.670
ORGANIC-Edu					1.148***	0.394
KY	0.194	0.298	1.235***	0.150	0.649***	0.150
KY-Age	1.205*	0.646				
SUGARF	0.346**	0.146	−0.073	0.163	0.530***	0.169
PRICE	−0.407**	0.168	−0.585***	0.123	−0.558***	0.126
PRICE-Age	−0.624**	0.308				
PRICE-Income	0.032**	0.014				
n	202		183		172	
Adj. ρ^2	0.121		0.196		0.205	
	Fruit Rollups		**Dry Muffin Mix**		**Raisinettes**	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
NONE	−0.996	0.627	−3.210***	0.501	−2.493***	0.589
NONE-S.D.	5.963***	0.939	2.886***	0.369	4.073***	0.496
ORGANIC	−0.887	0.638	−0.780	0.477	0.664***	0.253
ORGANIC-Age	−2.238***	0.713			−1.097**	0.558
ORGANIC-Edu	1.401***	0.413	0.622**	0.317		
KY	0.609***	0.168	1.209***	0.145	0.775***	0.145
SUGARF	0.187	0.190	0.758	0.623	0.194	0.166
SUGARF-Edu			−0.935**	0.404		
PRICE	−0.798***	0.229	−0.782***	0.124	−0.483***	0.083
n	184		198		202	
Adj. ρ^2	0.287		0.152		0.227	

*, **, and *** represent significant at the 10%, 5%, and 1% significance levels respectively.

blueberry fruit rollups, the other half would be happy not to engage in such a choice. A similar interpretation can also be extended to other products by jointly considering the mean and standard deviation estimates. This result also shows the importance of understanding consumer heterogeneity in their choices. The mixed logit, as well as the interacted variables discussed below, allow such differentiation among consumers and offer opportunities for more tailored marketing strategies depending on consumer preference.

Interaction variables between demographic and product attribute variables are represented in Table 4 by hyphenation. The implied impacts of the attribute variables through jointly considering the interacted variables and the original attribute variables in Table 4 are consistent with those in the conditional logit models. The significant interaction variables further show how different individuals, depending on their demographic characteristics, may or may not like a certain attribute. Direct interpretation of each coefficient of these demographic interacted variables is feasible, but a more comprehensive explanation can be obtained through the suggested WTP measures by looking at marginal values associated with various attributes while considering demographic differences.

Marginal Values

Marginal values in the context of a mixed logit model can be calculated by taking the opposite of the ratio between the coefficient of an attribute variable and the coefficient of price. A general formula is given as:

$$\text{(4)} \qquad \text{Marginal value} = \check{S} - \frac{\beta_{\text{attribute}} + \boldsymbol{\beta_D} * \mathbf{D}}{\beta_{\text{price}} + \boldsymbol{\beta_D} * \mathbf{D}},$$

where $\beta_{\text{attribute}}$ and β_{price} are coefficients associated with an attribute and the price variable respectively; term $\boldsymbol{\beta_D} * \mathbf{D}$ appears when the attribute or price also contains demographic interacted variables. $\mathbf{D}$ is a vector of demographic variables used in interacted terms and $\boldsymbol{\beta_D}$ is the vector of corresponding coefficients in the mixed logit models. Since the marginal values are nonlinear functions of estimated coefficients, their significance tests do not necessarily yield the same results as individual attribute coefficients. Following Hu, Veeman, and Adamowicz, standard deviations are also calculated for the mean estimates of these marginal values.

As suggested in Table 4, there are mostly three demographic variables having a significant impact on consumer preference: age, household income, and years of education. The level of each demographic variable must be determined to produce marginal values given in the expression in Equation (4). These three demographic variables are continuous and a possible method is to use the sample mean in calculation. In other words, in expression (4), vector $\mathbf{D}$ can be fixed at the sample mean. This approach, however, will miss the purpose of introducing interaction variables into the analysis. The goal is to find how different consumers may value the attributes differently when they are associated with different products. On the other hand, the three continuous variables enable a countless number of combinations, that is, consumer profiles. Evaluating every possible combination is infeasible in the context of this paper. In this study, we chose two levels within each variable and considered combinations formed by these levels. For age, 25 and 55 were chosen, representing younger and older generation consumers. For household income, \$35,000 and \$85,000 were chosen, and for education junior high school (9 years in school) and college education (16 years in school) were considered.

Table 5 reports these marginal values. In addition to marginal values reflecting consumer heterogeneity, values calculated at the sample average level are also given for comparison purpose. These values clearly show that different consumers have very different values associated with the different attributes corresponding to different blueberry products. For pure blueberry jam, younger and lower income consumers would like to pay \$0.78 for an organic product and another \$1.16 if the product is produced in Kentucky. Although no significant differences were observed between consumers in their taste on blueberry-lime jam, consumers in general are willing to pay \$0.52 and \$2.20 for organic and Kentucky-grown

Table 5. Marginal Attribute Values Suggested under Mixed Logit Models

	Pure Jam (10 oz)		Lime Jam (10 oz)	
	Mean	Std. Dev.	Mean	Std. Dev.
	Sample Average Age = 42.9; Income = 52.9K		All Profiles	
NONE	−5.60**	0.78	−2.94**	0.61
ORGANIC	0.67**	0.25	0.52**	0.24
KY	1.46**	0.38	2.20**	0.54
SUGARF	0.76*	0.45	−0.09	0.30
	Age = 25; Income = 35K			
NONE	−6.46**	1.82		
ORGANIC	0.78*	0.46		
KY	1.16**	0.53		
SUGARF	0.89	0.73		
	Age = 55; Income = 85K			
NONE	−6.04**	2.45		
ORGANIC	0.72	0.59		
KY	1.90	1.23		
SUGARF	0.81	1.31		

	Yogurt (32 oz)		Fruit Rollups (0.8 oz)	
	Mean	Std. Dev.	Mean	Std. Dev.
NONE	−2.83**	0.69	−1.25	1.25
ORGANIC (Sample Average: Age = 42.9; Edu = 14.7)	0.55**	0.27	0.30	0.40
ORGANIC (Age = 25; Edu = 9)	0.19	0.54	−0.25	0.49
ORGANIC (Age = 55; Edu = 16)	0.25	0.30	0.17	0.35
KY	1.21**	0.39	0.82	0.57
SUGARF	1.04**	0.59	0.32	0.82

	Dry Muffin Mix (10 oz)			Raisinettes (4 oz)	
	Mean	Std. Dev.		Mean	Std. Dev.
NONE	−4.14**	0.47	NONE	−5.16**	0.80
ORGANIC (Sample Average: Edu = 14.7)	0.18	0.13	ORGANIC (Sample Average: Age = 42.9)	0.41**	0.23
ORGANIC (Edu = 9)	−0.28	0.28	ORGANIC (Age = 25)	0.83**	0.33
ORGANIC (Edu = 16)	0.28	0.15	ORGANIC (Age = 55)	0.13	0.27
KY	1.57**	0.25	KY	1.64**	0.36
SUGARF (Sample Average: Edu = 14.7)	−0.78**	0.17	SUGARF	0.44	0.41
SUGARF (Edu = 9)	−0.09	0.39			
SUGARF (Edu = 16)	−0.95**	0.18			

* and ** indicate significant at the 10% and 5% significance level, respectively.

attributes, respectively. For blueberry yogurt, although it appears from the coefficient estimates that younger and more educated consumers would like to pay more for an organic product, their WTP is not significantly different from zero. The Kentucky-grown and sugar-free attributes however, are associated with sizable values of $1.21 and $1.04, respectively.

Based on coefficient estimates for blueberry fruit rollups, consumers who are younger and more educated are likely to prefer the organic feature, and overall they prefer a Kentucky-grown product. However, WTP estimates show that these effects may not be significant enough to translate into dollar values. In terms of blueberry dry muffin mix, a Kentucky-grown label may also bring a significant additional value of $1.57 to a product. Consumers in general are not attracted by the sugar-free feature for muffin mix. In fact, individuals with a college degree must be compensated by $0.95 to make them choose a sugar-free package of blueberry dry muffin mix. Finally, for blueberry raisinettes, younger consumers are more likely to enjoy an organic product with a WTP of $0.83. Similar to other products, a Kentucky-grown label may help the value of the product by as much as $1.64 per 4-oz package.

Conclusion and Implications

This study examines how Kentucky consumers may prefer and value various attributes across different blueberry products. New trends in consumer demand highlight the significance of several attributes not directly related to the taste or flavor of a product. In this analysis, three nonconventional attributes are considered: organic, Kentucky-grown, and sugar-free. These attributes were also associated with six familiar processed blueberry products: pure blueberry jam, blueberry-lime jam, blueberry yogurt, blueberry fruit rollups, blueberry dry muffin mix, and blueberry raisinettes. Given that the majority of past studies on fruits have focused on fresh products, this study offers a different perspective in understanding consumer preferences. This perspective is consistent with the highly perishable nature of blueberries. Using a conjoint stated choice survey conducted in Kentucky, this analysis is able to assess consumer willingness to pay for the three nonconventional attributes in this multiple-product context.

The results indicate that Kentucky consumers are generally enthusiastic about the three attributes considered. The study finds strong evidence that, depending on their personal characteristics, the sampled consumers differ in terms of preferences and willingness to pay for various attributes. For example, for younger and midaged consumers with low to moderate income, the attribute Kentucky-grown is valued much higher than the organic feature for pure blueberry jam. Similar contrasts exist for other products as well. It is also found that consumer preferences and WTP are different across product categories. For the surveyed consumers, a Kentucky-grown label receives the most support among the three attributes across different consumer profiles and product categories. Being organic may attract certain consumers, but is not as broadly valued, especially for blueberry fruit rollups and dry muffin mix. Sugar-free may be a valuable feature to some consumers for some products, but it may also be associated with negative values in some product categories, such as blueberry dry muffin mix, among highly educated individuals.

Given the quickly increasing expenditure on fresh and processed blueberries by American consumers, a study like this is important to understand future market conditions of this horticultural crop. A sensible marketer may consider marketing strategies that are well-tailored to different consumers in different market channels and may adjust that distribution and merchandising strategy across product categories. Producers and marketers should note that consumers may be willing to pay a significant amount for some nonconventional attributes of their products, attributes which are often not related to the taste and flavor of a product. Since this study directly considers processed blueberry products, it provides a natural ground for exploring value-added strategies that producers may undertake to increase profit. U.S. value-added agriculture accounted for over $80 billion in 2004 (Erickson et al.) and is still increasing at a fast pace each year (Arno). The importance of value-added operation has been recognized by many producers, and efforts have been made by every state to increase returns for farmers by discovering value-added strategies. Equipped with the knowledge of consumer WTP and information on the producers (e.g., Eastwood et al.), a more detailed cost and benefit analysis may be conducted to evaluate various plans of adding value to fresh blueberry products through further processing and/or attributing the nonconventional features.

[Received December, 2007; Accepted July, 2008.]

References

Arno, K. (2005) "Taking Value-Added Foods to Market." Blethen Maine Newspapers Inc. April 13,

2005. Internet site: http://business.mainetoday.com/selfemployment/savvy/050413foodmakers.shtml (Accessed April 10, 2007).

Baxter, B. (2006) "Who's Buying Organic?: Demographics 2006." Heartbeat Taking the Pulse of the Marketplace, May 17, 2006. Internet site: http://www.hartman-group.com/products/HB/2006_05_17.html (Accessed November 20, 2007).

Bernard, J.C., C. Zhang, and K. Gifford. "An Experimental Investigation of Consumer Willingness to Pay for Non-GM Foods When an Organic Option is Present." *Agricultural and Resource Economics Review* 35(2006):374–85.

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.

Carlsson, F., P. Frykblom, and C.J. Lagerkvist. "Consumer Benefits of Labels and Bans on GM Foods—Choice Experiments with Swedish Consumers." *American Journal of Agricultural Economics* 89(2007a):152–61.

———. "Consumer Willingness to Pay for Farm Animal Welfare: Mobile Abattoirs Versus Transportation to Slaughter." *European Review of Agriculture Economics* 34(2007b):321–44.

Colombo, S.J., J. Calatrava-Requena, and N. Hanley. "Testing Choice Experiment for Benefit Transfer with Preference Heterogeneity." *American Journal of Agricultural Economics* 89(2007):135–51.

Cortez, R., and B. Senauer. "Taste Changes in the Demand for Food by Demographic Groups in the United States: A Nonparametric Empirical Analysis." *American Journal of Agricultural Economics* 78(1996):280–89.

Cummings, R.G., and L.O. Taylor. "Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method." *The American Economic Review* 89(1999):649–65.

Darby, K., M.T. Batte, S. Ernst, and B. Roe. "Willingness to Pay for Locally Produced Foods: A Customer Intercept Study of Direct Market and Grocery Store Shoppers." Paper presented at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23–26, 2006.

Dietary Guidelines for Americans. (2005) USDA. Internet site: http://www.health.gov/dietaryguidelines/dga2005/document/default.htm (Accessed April 10, 2007).

Eastwood, D.B., J.R. Brooker, C.R. Hall, A.J. Rhea, E.A. Estes, and T.A. Woods. "Changing Produce Marketing Barriers: A Comparison Among Three Southern States." *Journal of Agricultural and Applied Economics* 35(2003): 297–304.

Erickson, K.W., S.C. Blank, C.B. Moss, and A.K. Mishra. "Regional Changes in the Distribution of Net Value Added in U.S. Agriculture, 1960–2002." Paper presented at the Western Agricultural Economics Association Annual Meeting, Honolulu, HI, June 30–July 2, 2004.

Fischer, A., L.J. Frewer, and M. Nauta. "Towards Improving Food Safety in the Domestic Environment: Assessing Individual Differences in the Safety Efficacy of Domestic Food Handling Practices." *Risk Analysis* 26(2006): 1323–38.

Food & Drink Europe (2005) "Blueberry Boom in Britain Driven by Health Benefits." Internet site: http://www.foodanddrinkeurope.com/news/ng.asp?id=60073-blueberry-boom-in (Accessed April 10, 2007).

Giraud, K.L., C.A. Bond, and J.J. Bond. "Consumer Preferences for Locally Made Specialty Food Products Across Northern New England." *Agricultural and Resource Economics Review* 34(2005):204–16.

Grolleau, G., and J.A. Caswell. "Interaction Between Food Attributes in Markets: The Case of Environmental Labeling." *Journal of Agricultural and Resource Economics* 31(2007): 471–84.

Hanemann, W.M., and B. Kanninen. "The Statistical Analysis of Discrete Response." *Valuing the Environment Preferences: Theory and Practice of the Contingent Valuation Method in the US, EC and Developing Countries*. I. Bateman and K. Willis, eds. Oxford, UK: Oxford University Press, 1999.

Hu, W., L.J. Cox, and Q.A. Edwards. "The Market Potential for Gift Baskets of Hawaiian Food Products in China." *Agribusiness International Journal* (Toronto, Ont.) 23(2007):553–65.

Hu, W., M.M. Veeman, and W.L. Adamowicz. "Labeling Genetically Modified Food: Heterogeneous Consumer Preferences and the Value of Information." *Canadian Journal of Agricultural Economics* 53(2005):83–102.

Hu, W., M.M. Veeman, W.L. Adamowicz, and G. Gao. "Consumers' Food Choices with Voluntary Access to Genetic Modification Information." *Canadian Journal of Agricultural Economics* 54(2006):585–604.

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):1098–1115.

Lehnert, D. (2008) "Blueberry Production is Skyrocketing Worldwide." The Fruit Growers News. Internet site: http://www.fruitgrowersnews.com/pages/arts.php?ns=908 (Accessed July 1, 2008).

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.

Louviere, J.J., D.A. Hensher, and J.D. Swait. *Stated Choice Methods: Analysis and Application.* Cambridge, UK: Cambridge University Press, 2000.

Lusk, J.L., D. Fields, and W. Prevatt. "An Incentive Compatible Conjoint Ranking Mechanism." *American Journal of Agricultural Economics* 90(2008):487–98.

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

Packaged Facts (2004) "The U.S. Market for Organic Food and Beverages: The Mainstreaming of a Trend." Internet site: http://www.packagedfacts.com/Organic-Food-Beverages-977845/ (Accessed April 10, 2007).

Teisl, M.F., N.E. Bockstael, and A. Levy. "Measuring the Welfare Effects of Nutrition Information." *American Journal of Agricultural Economics* 83(2001):133–49.

Train, K. *Discrete Choice Methods with Simulation*. Cambridge, U.K.: Cambridge University Press, 2003.

U.S. Highbush Blueberry Council (2002) Internet site: http://www.blueberry.org/blueberries.htm (Accessed April 10, 2007).

Whole Foods Market. (2005) "Nearly Two-Thirds of Americans Have Tried Organic Foods and Beverages" Press release, November 18, 2005. Internet site: http://www.wholefoodsmarket.com/company/pr_11-18-05.html (Accessed April 10, 2007).

Yue, C., F. Alfnes, and H.H. Jensen. "Discounting Spotted Apples: Investigating Consumers' Willingness to Accept Cosmetic Damage in an Organic Product." Working Paper 06-WP 436, Center for Agricultural and Rural Development, Iowa State University, 2006.