Product Differentiation and Market Segmentation in Applesauce: Using a Choice Experiment to Assess the Value of Organic, Local, and Nutrition Attributes

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Recently, there has been much interest among horticultural producers concerning the marketing of organic and locally produced food. A consumer survey was administered that asked respondents to choose an applesauce product from a list of products differentiated by price, and by labels that described fat content, nutrition content, and whether the product was grown organically and/or locally. Our analysis indicates that consumers were willing to pay more for locally grown applesauce compared to applesauce that was labeled USDA Organic, Low Fat, or No Sugar Added. Furthermore, we find evidence that increased knowledge of agriculture decreases the willingness to pay for organic and locally grown applesauce.

***Key Words*:** applesauce, choice experiment, consumer demand, fruit and vegetable markets, local food, multinomial logit model, organic, Pennsylvania, willingness to pay.

Labels continue to be a key strategy for differentiating products in food markets. In recent years, label usage that promotes product attributes has expanded and become increasingly important for many foods, including fruits and vegetables. Products sold in grocery stores are often differentiated by labels that make reference to health claims, nutrient content, information describing production methods, and geographical indicators. Organic labels are commonly used for both fresh and processed fruits and vegetables. Products that are differentiated as locally produced are more likely to be fresh fruits and vegetables, while nutrition information is mandated for processed fruits and vegetables. However, in some cases there may be opportunities to market processed fruits and vegetables that are locally produced or to include nutrition information on fresh fruits and vegetables. Geographical indicators are traditionally important for wine, meat, and, in some cases, dairy products. However, given the expansion of promotional efforts by many states, geographical information that describes where food is produced appears to be increasingly important for marketing fruit and vegetable products.

Given the variety of labeling options, consumer response to label information may have important implications for product differentiation strategies. We developed a choice experiment to examine consumers' willingness to pay (WTP) for selected attributes in a processed fruit product, namely applesauce. Applesauce is an interesting product to examine here because it can include a variety of

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labels. Furthermore, the per capita consumption levels of processed fruit products declined during the period from 1998 to 2007 (USDA-NASS 2008), and there is much interest in ways to increase sales in this category. As part of a survey that was conducted in Pennsylvania (PA) and that included several questions regarding food and agriculture, respondents were presented with four hypothetical purchasing situations; in each situation respondents were given four product options with different combinations of price and attributes. The four attributes were USDA Organic, PA Preferred, No Sugar Added, and Low Fat. This study examines consumer preferences for these applesauce attributes as a way of evaluating strategies for differentiating products made from Pennsylvania apples.

Previous work has examined consumer demand for food products in niche markets, and several studies have assessed consumers' WTP for product attributes including organic, locally grown, and various nutritional claims.[1] Much work has been completed that examines consumer demand for organic and local attributes in fresh produce, milk, and meat products; yet relatively little research has examined these issues for processed fruit and vegetable products. Furthermore, we include choices that allow consumers to consider organic, local, and nutrition attributes in one choice experiment so that consumer valuation of these attributes can be compared directly for applesauce. Following earlier research, our survey was used to collect detailed demographic information about the respondents that was incorporated into the analysis. As a result, estimates of consumer WTP for applesauce attributes are reported for consumer market segments, and the differences among those segments are examined.

Consumer Response to Labels Placed on Food Products

Understanding how consumers respond to food labels is an area of research that has attracted much attention recently. This research has been driven, in part, by increased sales of organic and local products, and by the heightened awareness of nutritional properties in food products. Sales of organic foods grew by approximately 20 percent per year during the 1990s (Dimitri and Greene 2002); there is some discussion that more recent growth in organic markets has slowed, but evidence suggests that organic food sales continued to increase in the range of 10 percent to 20 percent per year between 2000 and 2005 (Klonsky and Richter 2007). Growth in demand for local food is highlighted by the increase in the number of farmers' markets and Community Supported Agriculture (CSA) programs in the United States. The number of farmers' markets increased from 1,775 in 1994 to 4,385 in 2006 (USDA-AMS 2007) and the number of CSA programs increased from 50 in 1990 to over 1,900 in 2008 (Hartman Group 2008). Nutritional food labels became mandatory in the United States as part of the Nutritional Labeling and Education Act (NLEA) in 1990. The law requires food manufacturers to list the nutritional content in a standardized serving size and provides a mechanism for evaluating health claims that are placed on food products. Given the health benefits associated with consumption of processed fruit and vegetable products, applesauce stands to gain from increased label use that describes nutrition attributes.

Several studies have examined individual-level choices driving the increase in consumption of organic foods in the United States and elsewhere, using information collected through surveys. Loureiro, McCluskey, and Mittelhammer (2001) conducted an intercept survey of grocery store shoppers to examine the relationship between sociodemographic characteristics and consumer preferences for organic, eco-labeled, and conventionally produced apples. Apples from the three groups were offered at equal prices, sizes, colors, and varieties. Organic and eco-labeled apples attracted consumers with children, higher incomes, and a concern for the environment, while conventional apples were preferred by consumers without children and with less food safety and environmental concerns. Overall, eco-labeled apples were determined to be an intermediate choice between organic and conventional apples; "green" consumers, those with characteristics shared by buyers in the organic and eco-labeled market, were more likely to purchase organic apples. Survey work

[1] Loureiro and Hine (2002), among others, included various product attributes in consumer surveys; however, the consumer purchase decision between organic, local, and nutrition attributes has not been closely examined for processed fruit and vegetable products.

conducted by McEachern and Willock (2004) in the United Kingdom revealed that the main drivers of organic meat purchasing activity were higher perceived standards of animal welfare, health benefits, and farm experience.

There is some indication that growth in organic sales has reached a peak in key markets, while sales of locally produced foods are expected to increase over the next decade (Cloud 2007). Some industry experts have argued that a "locally grown" designation would be an equally lucrative differentiation strategy compared to "organic," with much lower up-front costs. However, evidence shows that consumers of both organic and local food products are interested in the environmental implications of food choices (e.g., Pretty et al. 2005, Thilmany, Bond, and Bond 2008), suggesting that local fruit and vegetable products compete with organic products.

In the United States, locally grown food is often defined as being produced within 100 miles of where it is marketed; in other cases locally grown food is associated with production in a specific state.[2] In an effort to capture a greater share of the "local" market segment, many states have developed branding programs to differentiate their products from those grown or produced outside the state. Some of these programs were initially funded by state grants under the Emergency Agricultural Assistance Act of 2001. As of 2006, 43 states had branding programs for agricultural products, up from 23 in 1995 (Patterson 2006). Annual budgets for the promotional programs ranged from $8,300 in Montana to $25 million in California; the "PA Preferred" program in Pennsylvania had a budget of $295,000 in 2002 (Patterson 2006).

The agricultural economics literature includes several papers that examine the impact of state-level promotional campaigns (e.g., Brooker and Eastwood 1989, Govindasamy et al. 2004, Giraud, Bond, and Bond 2005, Patterson 2006), and results indicate that they generate positive returns for agricultural producers. However, locally produced food products have only recently gained momentum in grocery stores, and research examining the value of the "local" attribute in specific food items is still being developed. Loureiro and Hine (2002) conducted a survey in the produce departments of Colorado grocery stores to determine consumers' willingness to pay for locally grown, organic, and genetically modified organism-free (GMO-free) potatoes. The survey also collected data that described respondents' ages, income, education, sex, family size, and value placed on fresh and nutritious food. Here the analysis provided baseline WTP estimates for the product attributes and also marginal WTP estimates for specific consumer characteristics. Results showed that consumers were willing to pay an additional 9 cents per pound for the Colorado-grown potatoes, 7 cents more per pound for the organic potatoes, and 6 cents more per pound for GMO-free potatoes. Consumers concerned about nutrition were willing to pay an extra premium of between 0.5 cents and 1 cent per pound for organic, GMO-free, and locally produced potatoes. Respondents with higher education and income levels were willing to pay an extra premium of approximately 2 cents per pound for organic and GMO-free potatoes.

Mandating nutritional information on food products spurred a number of studies that examined the link between nutrition labels, health claims, and consumer choice for various food products. Research has shown that nutrition and health claim labels have had a positive but relatively limited impact on consumer choices and overall dietary quality. However, in certain cases, labels on food products that included a health claim have had significant effects on sales volume (Nayga 2002).

Ippolito and Mathios (1990) studied the impact of nutrition information in the market for breakfast cereals during a period when health claims about fiber were developed. Here the results highlighted a strong relationship between health claim information and consumer behavior, and attributed much of the consumer response to coordinated advertising efforts by key suppliers. The degree of market power among firms in a sector may enable a more coordinated advertising effort for a health claim; although generic advertising of health attributes in fruits and vegetables is common, the amount of health-related advertising for specific fruit and vegetable products is small. Furthermore, because the dietary benefits of fruit

[2] Darby et al. (2008) found that strawberry consumers in Ohio associate the term "local" with products that are grown in the state; Giraud, Bond, and Bond (2005) found evidence that consumers in northern New England consider "local" to include products from Maine, New Hampshire, and Vermont. In a large state like California, the term "local" may be used to describe production at a less aggregated level.

and vegetable products are well-known, there may be little consumer response (or even a negative response) to health claims and additional nutritional information.

Brown and Schrader (1990) found a significant link between cholesterol information and egg consumption in the 1980s. Kinnucan et al. (1997) examined health information events and generic advertising expenditures for meat products; results indicated that health-information elasticities were larger than own-price elasticities in the U.S meat sector. Mathios (1998) used grocery store scanner data and nutrition label information to investigate consumer purchase behavior for cooking oils; the NLEA eliminated use of explicit health claims in this market due to the overall level of fat in cooking oil products. Model estimates show that removal of health claims in the cooking oil market led to increased sales of products with higher saturated fat content. These findings suggest that consumers respond to health claims; in the last example, removing health claims steered consumers towards less healthy products. Overall, a better understanding of the impact of health claims and nutrition information in this market segment would be of great interest to food manufacturers.

Methodology: Stated Choice Models

Our modeling framework adopts the choice experiment technique. The choice experiment in our application follows models that were introduced by Batsell and Lodish (1981) and Louviere and Woodworth (1983). Since their introduction, choice experiments have been widely used in the agricultural economics literature to examine consumer demand for attributes in various food products. For example, choice experiments were employed by Umberger et al. (2002), Lusk and Schroeder (2004), and Loureiro and Umberger (2007) to assess consumers' WTP for attributes in beef; by Alfnes et al. (2006) to investigate salmon consumption in Norway; and by Mtimet and Albisu (2006) to examine Spanish wine consumption patterns. Our model builds upon much of the earlier work in this arena and extends the research to include choices about local, organic, and nutrition attributes in a processed fruit product. In addition, we estimate the effects of consumer characteristics on the marginal utilities of product attributes, which have been included in relatively few applications of the choice experiment methodology to agricultural products, with Kallas, Gómez-Limón, and Arriaza (2007) being a notable exception.

A choice experiment is comprised of several choice sets; a choice set presents a purchase situation to a respondent with a menu of product options (and often includes the option of not making a purchase). Choice sets typically include two or more products, each with varying combinations of product attributes and price, and survey participants choose the option in the choice set that maximizes their expected utility. Stated choice methods are typically used for three reasons. First, this approach allows respondents' preferences to be collected without directly observing actual purchases. Second, data can be collected using telephone or mail surveys that are less expensive than intercept surveys and interviews. Third, stated choice experiments enable the evaluation of hypothetical scenarios and estimation of preferences for products that do not exist in the marketplace.

The analysis used here is based on Lancaster's "New" consumer theory (Lancaster 1966) and random utility theory. Lancaster (1966) proposed that a good's utility can be decomposed into utilities for attributes found in the product. Random utility theory states that the utility for the *i*th individual and the *j*th product, denoted as U_{ij}, is the sum of a systematic component, denoted V_{ij}, and a random component, denoted ε_{ij}. Uncertainty enters equation (1) through the random component, which contains unobservable influences of individual characteristics or product attributes as well as measurement error.

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

The systematic component includes attributes for product *j* and characteristics about individual *i*; the product attributes and individual characteristics are both observable. We further break down the systematic component of utility, namely V_{ij}, into product-specific and consumer-specific subcomponents in equation (2). Here $\boldsymbol{x_j}$ is a vector of attributes for product *j* and $\boldsymbol{z_i}$ is a vector of characteristics for consumer *i*. The marginal utilities of attributes in product *j* are denoted as β'_j and the additional marginal utilities of the attributes in

alternative j for individual i are denoted as δ'_j. The consumer characteristics must only enter the utility function for a subset of product alternatives (Louviere, Hensher, and Swait 2000).

$$U_{ij} = \beta'_j \boldsymbol{x_j} + \delta'_j \boldsymbol{z_i} + \varepsilon_{ij} \quad (2)$$

Following a standard theoretical framework, consumers choose product quantities to maximize their utility. The probability that consumer i will choose product j is denoted as P_{ij}; equation (3) shows that individual i will choose product j if the utility from product j is greater than that from an alternative product k.

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

Assuming that the random components are identically and independently distributed type-I extreme values across the individuals and products, we use the multinomial logit (MNL) model shown in equation (4) to estimate the choice probabilities.

$$P_{ij} = \text{Prob}(U_{ij} > U_{ik}, j \neq k) = \frac{e^{\beta'_j \boldsymbol{x_j} + \delta'_i \boldsymbol{z_i}}}{\sum_k e^{\beta'_k \boldsymbol{x_k} + \delta'_k \boldsymbol{z_i}}} \quad (4)$$

The calculation used to represent the consumers' WTP for a product attribute is shown in equation (5). The baseline WTP for product attribute j by consumer i, denoted as WTP_{ij}, is calculated as the negative ratio between the estimated marginal utility for product attribute j, denoted as β_j, and the estimated marginal utility for the monetary attribute, denoted as β_{Price}. The numerator in equation (5) also includes an additional measure of the marginal utility for product attribute j that is specific to consumer i. Here characteristics for consumer i, denoted as z_i, are combined with the additional marginal utilities of the attributes in alternative j for individual i, denoted as δ_j.

$$WTP_{ij} = -\left(\frac{\beta_j + \delta_j z_i}{\beta_{Price}} \right) \quad (5)$$

Results from equation (5) are used to quantify the implicit price changes associated with a unit increase in the selected product attributes; each WTP_{ij} calculation represents the part worth of attribute j for consumer characteristic i. Earlier work has found that the WTP for organic, local, and nutrition attributes in food products was positive and often important; we examine all of these attributes in applesauce to better understand their relative importance to consumers and to identify market segmentation strategies for processed fruit and vegetable manufacturers.

The Survey

Our 13-page survey was mailed to 3,000 residents in Pennsylvania in 2005 to collect information on a range of issues related to agriculture and food. The first mailing consisted of the questionnaire, a cover letter, a postage-paid return envelope, and a small cash incentive. A postcard reminder and two subsequent follow-up mailings, including duplicate copies of the survey form, were used to increase response rates. Of the 3,000 addresses in the sample, 290 were undeliverable. A total of 1,521 persons from the 2,710 valid addresses returned usable answered questionnaires, resulting in a 56 percent response rate.

Surveys were sent to residents in 65 counties in Pennsylvania; the counties that included Philadelphia and Pittsburgh were excluded because previous mail survey efforts in these metropolitan centers resulted in extremely low response rates. Table 1 includes sociodemographic characteristics of our sample, the 65 counties of Pennsylvania included in the study, and all 67 counties of Pennsylvania. The results in Table 1 reveal that sociodemographic characteristics in the 65-county population are similar to those in the 67-county population. Our sample is older and more educated than either population, yet the large sample size and breadth of questions included in the survey allows us to explore the relationships between consumer characteristics and preferences for food product attributes.

A large component of the survey was devoted to objectively measuring how much respondents knew about agriculture and food. Sixty questions covered topics related to agricultural production practices, social and economic impacts of agricul-

Table 1. Sociodemographic Characteristics of the Sample and Two Populations

Sociodemographic Characteristics [a]	Study Sample	Population of 65 Sampled Counties	Population of All 67 Counties
		percent	
Gender			
Male	53	48	47
Female	47	52	53
Age			
Less than 45 yrs	25	47	47
45–59 yrs	36	26	26
60 yrs & over	39	27	27
Education			
< High school grad	8	17	18
High school grad	29	40	38
Some post high school	30	21	22
College grad & over	33	22	22

[a] Population figures are for "adults" in the relevant counties. *Source:* U.S. Census Bureau

ture, agriculture and the environment, and food and nutrition. In addition to answering the knowledge-based questions, respondents were asked to indicate their level of certainty about each response. Scores on the 60 questions were aggregated, and each respondent was assigned a score between –2.5 and 2.5 for all knowledge-related questions. An incorrect answer in which the respondent was "very certain" received a score of –2.5; an incorrect response in which the respondent was "somewhat certain" received a score of –1.5; and an incorrect response in which the respondent was "not at all certain" received a score of –0.5. Correct responses received positive scores determined similarly (for further details see Rossman 2007).

Table 2 summarizes selected respondent characteristics. The first column provides frequency information for the total sample. Of the total usable sample of 1,521 cases, 47 percent were female, 64 percent had some college education, the average household size was 2.52 people, 31 percent of households included children, and 34 percent included at least one person over the age of 65. Overall, 53 percent of respondents had frequently purchased either food items at roadside stands or farmers' markets, or purchased food that had been grown locally, and 32 percent of the sample indicated that they occasionally or frequently purchased foods that were labeled "organic." Table 2 also shows that the average overall knowledge score was 0.31 for the entire sample, reflecting that on average, respondents answered questions correctly but were not very confident in their responses. Respondents were more certain about their responses to the food and nutrition questions, but here they answered correctly only about half of the time, and the average score was 0.10.

Reported purchasing behaviors related to locally produced and organic food (shown in Table 2) were used to define four market segments. Approximately 35 percent of the respondents are characterized as non-local and non-organic (or conventional) food consumers; 33 percent are characterized as local and non-organic consumers; 12 percent are characterized as organic and non-local consumers; 20 percent are characterized as local and organic consumers. The demographic characteristics of the four segments are listed in separate columns in Table 2 and highlight some interesting results.

To better understand differences among these market segments, an unordered MNL regression was estimated. Several consumer characteristics were included as potential right-hand side variables, and the stepwise selection option in the SAS logistic procedure was used to determine the final model. Table 3 shows the odds ratio estimates for the resulting model. Respondents who are college graduates are more likely to be in the two organic market segments. Men are much less likely to be in any of the non-conventional segments. Consumers who received higher agricultural knowledge scores or who grow fruits and vegetables were more likely to be in one of the "local" segments, but these characteristics were not statistically significant in

predicting presence in the "organic, no local" market segment. Consumers who live in suburban areas were more likely to be in one of the organic segments, and consumers who are over 60 were more likely to purchase locally grown but not organic food. These market segments were used as explanatory variables in the analysis described below.

Choice Sets

One question in the mail survey included a choice experiment for differentiated applesauce products. An example of a choice set included in our experiment is shown in Figure 1; here the respondent is asked to select which of four applesauce products differentiated by price and product attributes they

Table 2. Summary of Respondent Characteristics

Characteristic	Total Sample	No Local, No Organic	Local, No Organic	Organic, No Local	Local and Organic
Number of respondents	1,521	510	488	178	300
Share of respondents	100%	35%	33%	12%	20%
Female	47%	40%	51%	51%	52%
Education					
Did not complete high school	8%	8%	9%	7%	6%
Completed high school	29%	31%	34%	21%	22%
Some college	30%	30%	32%	21%	31%
Completed a 4-year college degree	16%	15%	14%	29%	16%
Graduate work or graduate degree	17%	17%	11%	21%	26%
Age					
Less than 40 years	24%	24%	20%	33%	24%
40-59 years	36%	36%	34%	37%	38%
60 years and over	40%	40%	46%	30%	38%
Household Composition					
Average number of people in the household	2.52	2.54	2.45	2.47	2.64
Percent of households with 2 or less people	61%	61%	64%	57%	60%
Children under 18 present	31%	32%	27%	33%	37%
65 and older present	34%	32%	40%	28%	30%
Residency classification					
Rural	42%	40%	50%	30%	41%
Suburban	44%	45%	36%	59%	45%
City	14%	16%	14%	12%	13%
Agricultural experience					
Have lived or worked on a farm	39%	36%	43%	33%	41%
Had some formal agricultural education	23%	19%	25%	20%	28%
Currently grow fruits or vegetables	51%	43%	56%	52%	56%
Agricultural knowledge scores					
Overall	0.31	0.28	0.33	0.28	0.35
Food and nutrition questions only	0.10	0.07	0.08	0.11	0.19
Behavior					
Frequently purchase food at roadside stand or farmers' market, or food that was locally grown	53%	0%	100%	0%	100%
Occasionally or frequently purchase food that was labeled "organic"	32%	0%	0%	100%	100%

SITUATION 1: If the following types of applesauce were available, which ***one*** would you buy?

Figure 1. An Example of a Choice Set Used in the Consumer Survey

would buy. Respondents were presented with four choice sets, and each choice set included four applesauce products. The prices of the products ranged from $1.59 to $2.49, in 30-cent increments. This price range was designed to overlap with prices of 24-ounce applesauce products observed in grocery stores at the time the survey was distributed.

Although many choice experiments allow respondents the option to select none of the products presented, we did not allow respondents to "opt-out" for two reasons. First, the choice experiment was included near the end of our survey, following five pages of objective questions about agriculture, food, and nutrition, and many subjective questions about respondents' experiences and attitudes. We were concerned that the response rate for the choice experiment would be low due to respondent fatigue. The choice experiment required some thought because of the number of attributes included, and including the option of not buying a product may have provided respondents with an easy way to quickly complete the survey. Second, applesauce is a commonly purchased product in the Northeast. Perez, Lin, and Allshouse (2001) found that per capita consumption of processed apple products and applesauce is higher in the Northeast relative to the national average. The exclusion of an "opt-out" in a survey has the potential to bias results. The direction of any bias here remains unknown, and the magnitude of any bias is expected to be larger for food products that are not commonly purchased or those in niche markets.

Table 4 provides an overview of the options in each choice set and the percent of respondents who selected attributes within a choice set. The percent of respondents selecting products labeled as USDA Organic ranged from 33 percent in the first choice set to 52 percent in the last choice set. Selection of options with the PA Preferred attribute varied more, from 24 percent in the third choice set to 88 percent in the second choice set. Between 40 percent and 60 percent of respondents selected the No Sugar Added attribute, while only 12 percent to 37 percent of the respondents selected the Low Fat option. Some respondents chose an applesauce product with the same characteristic in all four

Table 3. Odds Ratio Estimates from Unordered Multinomial Logit Model

Consumer Characteristic	Odds Ratios[a]		
	Local, No Organic	Organic, No Local	Local and Organic
College graduate	0.74	2.23*	1.49*
Male	0.49*	0.57*	0.39*
Agriculture knowledge score	1.86*	0.81	1.97*
Grows fruits or vegetables	1.61*	1.39	1.59*
Lives in suburban area	0.74*	1.50*	1.02
60 or older	1.36*	0.69	0.98

[a] Odds ratios reflect the likelihood of a respondent with the noted characteristics being in the market segment noted, relative to the likelihood of being in base segment ("No Local, No Organic").

Note: * Indicates that the 95 percent confidence interval of the odds ratio does not include 1.

Table 4. Frequency of Attributes Present in Consumers' Product Selections

Choice Set	Attribute *(percent)*			
	USDA Organic	PA Preferred	No Sugar Added	Low Fat
1	33	37	53	37
2	45	88	47	12
3	47	24	60	24
4	52	70	40	30

Table 5. Coefficient Estimates from Two Multinomial Logit Regressions

Explanatory Variables		Product Attribute Model	Product Attribute and Consumer Characteristics Model
Product Attribute	**Consumer Characteristic Interaction**		
USDA Organic	None	0.08 **	0.08
	Local, No Organic		0.16 *
	Organic, No Local		0.59 ***
	Local and Organic		0.48 ***
	Knowledge score		0.19 *
PA Preferred	None	0.65 ***	0.54 ***
	Local, No Organic		0.11
	Organic, No Local		0.14
	Local and Organic		0.22 *
	Knowledge score		0.25 *
No Sugar Added	None	0.32 ***	0.17 ***
	Local, No Organic		–0.09
	Organic, No Local		0.41 ***
	Local and Organic		0.49 ***
	Food and nutrition knowledge score		0.37 ***
Low Fat	None	–0.74 ***	–0.64 ***
	Local, No Organic		–0.26 ***
	Organic, No Local		0.00
	Local and Organic		0.02
	Food and nutrition knowledge score		0.15 **
Price	None	–1.73 ***	–1.73 ***
	Local, No Organic		⁻ 0.47 **
	Organic, No Local		⁻ 0.33
	Local and Organic		0.60 **
	Knowledge score		–1.49 ***
Summary Measures of Model Performance			
Log-likelihood ratio		2,155 ***	2,230 ***
Percent of correct predictions			
Overall		72	73
Selected products		44	47
Non-selected products		81	82

Note: * Indicates significance at the 90 percent level, ** significance at the 95 percent level, and *** significance at the 99 percent level.

choice sets; the most frequently selected attribute in all four choice sets was No Sugar Added, which was consistently selected by 31 percent of respondents, followed by PA Preferred, which was selected by 9 percent of respondents. Only 5 percent of respondents chose the applesauce with the USDA Organic or Low Fat attribute in each of the four choice sets. The consistent choices made by different respondents highlight the importance of market segmentation in understanding consumer preferences for applesauce attributes.

Empirical Results

The choice data were more formally analyzed using two MNL models to estimate coefficients introduced in equation (4). The first model included only the product attributes as explanatory variables; the estimated coefficients and summary statistics are included in the first column of Table 5. Together, the five product attributes have a statistically significant influence on a product being selected, as indicated by the likelihood ratio of

2,155 (significant at the 1 percent level of confidence). As an alternative measure of model performance, the percent of correct predictions was calculated and is shown at the bottom of Table 5. The product attributes model correctly predicted 72 percent of all product choices, 44 percent of the selected applesauce products, and 81 percent of the applesauce products not selected. The second model incorporated product attributes and consumer characteristics to better understand the interaction effects in the different market segments. Results for the second model are shown in the right-hand column in Table 5. The likelihood ratio for the expanded model is 2,230 and the model did a slightly better job of predicting respondents' choices.

The estimated coefficients indicate that the presence of USDA Organic, PA Preferred, or No Sugar Added attributes increases the likelihood of a product being chosen, while a higher price decreases the likelihood of selection. The Low Fat attribute was expected to have an insignificant impact on the likelihood of a product being selected, since applesauce is naturally low in fat; however, the results show a negative and statistically significant impact on the likelihood of the Low Fat attribute being selected.[3] Of the four non-price attributes, PA Preferred was by far the most important for increasing consumer utility, followed by the No Sugar Added attribute, and then USDA Organic.

Observed market behavior and previous studies of consumer food choices indicate that preferences for organic and locally produced food vary among consumers. Respondents' self-reported behavior regarding local and organic purchasing patterns varied substantially, as shown in Table 2. Accordingly, we would expect product selections to vary across consumer segments. Because of the relatively large sample size used here, we had sufficient degrees of freedom to incorporate consumer characteristics in the empirical model. In the second model, we added interactions between product attributes and dummy variables for the three market segments that had frequently purchased either locally grown food, organic food, or both in the last year.[4] In addition, interactions between product attributes and knowledge scores were included. Food and nutrition knowledge scores were interacted with the No Sugar Added and Low Fat attributes since both reveal information about the nutrient composition of the product. The overall agricultural knowledge score was included with USDA Organic and PA Preferred attributes, and price. Results from this expanded model help us to understand which consumers might be more, or less, likely to select particular product attributes and how consumer WTP for attributes varies across market segments.

Including respondents' market segments and knowledge scores changed the influence of product attributes on the likelihood of a product being selected in several non-trivial ways. For consumers who did not frequently purchase local or organic food in the last year (the base consumer segment), the presence of the organic attribute actually decreases the likelihood of a product being selected; this result was even stronger among those who had purchased local (but not organic) food frequently. To the extent that these consumers receive high knowledge scores, the negative effect is mitigated and perhaps even dominated by the positive influence that knowledge scores have on organic product selection. Another mitigating factor is previous purchases of organic food. Not surprisingly, consumers who previously purchased organic food were more likely to select organic options. Because these estimates control for price effects, the negative coefficients on the organic attribute suggest that organic labels may be perceived negatively by non-organic consumers.

The PA Preferred attribute continued to have a positive, large, and statistically significant effect on the likelihood of a product being selected by all consumers. This effect was even greater among consumers with relatively high agricultural knowledge scores and those who had frequently

[3] The negative effect of a "Low Fat" claim on the likelihood of a product being selected could represent an "annoyance factor" among consumers concerned about superfluous information on the label (as pointed out by a reviewer), or a negative perception of low-fat food alternatives as having less flavor. Kiesel and Villas-Boas (2008) found that shelf labels indicating low-fat content reduced sales for a product that normally contains relatively high levels of fat (microwaveable popcorn). French et al. (1999) found similar responses for low-fat snack alternatives.

[4] Including consumer characteristics that tend to be correlated with local and organic purchases (such as gender, education, presence of children in household, and income) resulted in a smaller number of usable observations. Some coefficient estimates violated economic theory or intuition, and some were fragile with respect to specification choices, a likely result of multicollinearity among consumer characteristics. As a result, we opted to include each respondent's presence in one of the four market segments as a proxy for several relevant consumer characteristics.

purchased both local and organic food in the last year. The presence of the No Sugar Added attribute increased the likelihood of product selection for all consumers. Consumers who had high knowledge scores in the food and nutrition category were even more likely to choose the No Sugar Added options. Purchasers of local food were only more likely to purchase the No Sugar Added options when they had also frequently purchased organic food. The Low Fat attribute continues to have a negative and statistically significant impact on the likelihood of a product being selected; even more so among consumers who had frequently purchased locally produced food in the last year. Those with more nutritional knowledge were more likely to ignore this information.

When all non-price attributes were held constant, higher-priced products were less likely to be chosen. One of our motivations for including an evaluation of agricultural knowledge and a stated-choice experiment in the same survey instrument was to assess whether knowledge about agriculture influenced a consumer's price sensitivity. Our initial hypothesis was that consumers who have a better understanding of the complexities of the food system would make choices less driven by price. The analysis indicates the opposite, that respondents with a high overall knowledge score were even more sensitive to prices in the selection of products. One possible explanation is that respondents who have higher overall knowledge scores are less inclined to pay a high price unless they are getting some additional benefits (which they might be better suited to evaluate). Or, they may be less likely to use price as an indicator of quality. The negative effect of price on the likelihood of product selection is mitigated among consumers who purchase local but not organic food frequently.

Consumers' Willingness to Pay for Product Attributes

The coefficient estimates from Table 5 are used to calculate WTP measures following equation (5). A negative WTP indicates that the respondent would have to be compensated in order to choose a product with the attribute. Because the final model allows consumers in different segments with different amounts of knowledge to have different marginal utilities, the WTP is calculated for each market segment at three alternative levels of knowledge. The WTP measures are shown in Table 6 for the four market segments; within each market segment results are provided for three knowledge levels (25th percentile, Average, and 75th percentile). The four product attributes are listed as columns in Table 6.

Results indicate that WTP estimates vary across product attributes and consumer segments. Because consumers with higher knowledge scores had higher marginal utilities of income, the WTP for product attributes decreases as knowledge increases. This is a somewhat paradoxical result. More knowledgeable consumers are more likely to select each of the four product attributes but are willing to pay less for them (in most cases, only slightly less). The PA Preferred attribute had the highest WTP for all consumer segments. The lowest WTP was among the segment with relatively high knowledge scores that had not purchased organic or local food in the last year; the estimated WTP was 27 cents, a price premium of approximately 15 percent relative to the range of prices included in the choice sets. The highest WTP was 62 cents for consumers in the fourth market segment (those who had made both local and organic food purchases) with lower knowledge scores. While the segments of consumers who had not purchased organic food occasionally or frequently in the last year would need to be compensated to accept the organic trait, other consumers were willing to pay as much as 35 cents for the organic attribute, about a 20 percent premium.

Implications and Conclusion

This analysis helps to expand our knowledge of consumer demand for differentiated products. While consumer demand for organic and locally grown attributes of fresh produce, milk, and meat products has been the subject of many studies, this article focused on a processed fruit product. The effects of labels on processed fruit products are not well studied, yet these products can easily accommodate labeled information regarding nutritional traits as well as organic and locally grown attributes. Because all of these product attributes were included, their relative importance can be compared directly. We find that the locally grown

Table 6. Willingness to Pay for Product Attributes by Consumer Characteristic

Consumer Characteristic	Product Attribute[a]			
	USDA Organic	PA Preferred	No Sugar Added	Low Fat
No Local, No Organic with knowledge scores at				
25th percentile	−0.04	0.31	0.04	−0.38
Average	−0.01	0.28	0.09	−0.29
75th percentile	0.00	0.27	0.12	−0.24
Local, No Organic with knowledge scores at				
25th percentile	−0.16	0.49	−0.01	−0.68
Average	−0.10	0.42	0.06	−0.51
75th percentile	−0.06	0.38	0.11	−0.40
Organic, No Local with knowledge scores at				
25th percentile	0.35	0.47	0.33	−0.46
Average	0.31	0.41	0.35	−0.34
75th percentile	0.29	0.39	0.36	−0.29
Local and Organic with knowledge scores at				
25th percentile	0.33	0.62	0.46	−0.52
Average	0.28	0.51	0.45	−0.36
75th percentile	0.26	0.45	0.42	−0.28

[a] Prices of products presented in choice sets ranged from $1.59 to $2.49.

designation had the largest positive effect on the likelihood of a product being selected, with the highest WTP estimates—a result that was consistent across the four market segments considered. The No Sugar Added attribute was the second most valuable attribute. All market segments had positive WTP for No Sugar Added, although there was substantially more variation in the WTP estimates across market segments.

Another contribution of this paper is the insight we are able to gain into the variation of preferences across market segments through the estimation of segment-specific marginal utilities and WTP measures. For several attributes, their presence had significantly different marginal utilities for consumers in different market segments. For instance, if we look only at segments of consumers who had not purchased organic food in the last year, the marginal utility of the PA Preferred attribute did not meaningfully differ between consumers who had frequently purchased local food and those who had not (i.e., preferences for the PA Preferred attribute were similar in the "No Local, No Organic" and the "Local, No Organic" market segments). In contrast, not all organic consumers were necessarily more likely to select the PA Preferred option relative to the base consumer group. Only consumers in the last segment ("Local and Organic") were more likely than other consumer segments to choose PA Preferred.

For other product attributes, the choices made by frequent purchasers of local foods vary depending on whether or not they are also frequent purchasers of organic foods (i.e., there are substantial differences between the "Local, No Organic" segment and the "Local and Organic" segment). In contrast, the preferences revealed by respondents who had purchased organic food recently were much more homogeneous. With the exception of the PA Preferred attribute, consumers in the "Organic, No Local" and "Local and Organic" segments were not significantly different.

These results may be useful in developing product differentiation and target market strategies for processed fruit products and perhaps beyond. The negative WTP for the Low Fat attribute underscores a challenge in product differentiation, namely the role consumer perceptions play in product choices. Because all applesauce is naturally low in fat, simply adding "Low Fat" to the label would be expected to have little effect on product selection. Given the proliferation of nutritional attributes highlighted on food labels, we might expect it to be perceived as a benefit, with a positive influence on the likelihood of selection and a positive WTP. In this case, calling attention to an attribute that is true of the product category but perhaps not widely known by consumers appears to have created a negative perception and reduced the likelihood of a product being chosen. An alternative might be to highlight that applesauce is naturally low in fat, but such information would apply to all applesauce, so it would be an ineffective differentiation strategy.

The overwhelming preference for the locally grown attribute presents another product differentiation challenge. Designating that a product is processed locally from locally grown inputs may boost demand. However, most fruit and vegetable processing is geographically concentrated around areas where the raw product is grown (which also tends to be geographically concentrated). Thus, it could likely be the case that all (or nearly all) products would qualify for the locally grown designation for some product categories, while for other product categories, none (or nearly none) would qualify. In the first case, a locally grown label would not effectively differentiate a product. If the locally grown designation is present on all product offerings in a category, it seems likely that the consumer WTP for that label would deteriorate over time. In the second case (very little existing local production), then the high WTP for the local attribute may encourage production in areas where production is less efficient. As a result, a share of the price premium consumers are willing to pay for locally grown will be offset by cost inefficiencies. Decisions regarding labeling a locally grown attribute must take into consideration the short- and long-term net payoff (incorporating cost implications), as well as the potential importance of the presence of products within a category that do not bear the local designation.

The USDA Organic and No Sugar Added attributes provide other dimensions for product differentiation. However, the appeal of these attributes is narrower, with consumers in particular market segments having significantly lower WTP than consumers in the target market segments. For consumers who have purchased organic food in the past year, WTP for both the USDA Organic and the No Sugar Added traits were higher than for the other two market segments. This suggests that these attributes should probably be "bundled" (i.e., there should be a No Sugar Added option in an organic line of applesauce).

Consumers in the segments that had not purchased organic foods in the past year had to be compensated to accept the organic trait. Because the analysis controls for the effects of prices, the negative WTP suggests some kind of negative perception of the trait among a subset of consumers. This should be taken into consideration by companies considering adding an organic option to their product line. It may be more advantageous to offer the organic option under a new brand name, so the negative perception of organic does not negatively affect demand for existing conventional products.

Consumer choices are influenced by a number of factors with complex interactions. In addition, the influences and the ultimate choices vary considerably among consumers. This article has shed some light on the effects of product attributes on consumer choices among applesauce products, and how those effects vary among four market segments. While further study would be required to determine if the relationships found here apply to other products or other consumers, several findings reveal issues worth considering in product differentiation and market segmentation strategies.

References

Alfnes, F., A.G. Guttormsen, G. Steine, and K. Kolstad. 2006. "Consumers' Willingness to Pay for the Color of Salmon: A Choice Experiment with Real Economic Incentives." *American Journal of Agricultural Economics* 88(4): 1050–1061.

Batsell, R.R., and L.M. Lodish. 1981. "A Model and Measurement Methodology for Predicting Individual Consumer Choices." *Journal of Marketing Research* 18(1): 1–12.

Brooker, J.R., and D.B. Eastwood. 1989. "Using State Logos to Increase Purchases of Selected Food Products." *Journal of Food Distribution Research* 20(1): 175–183.

Brown, D.J., and L.F. Schrader. 1990. "Cholesterol Information and Shell Egg Consumption." *American Journal of Agricultural Economics* 72(3): 548–555.

Cloud, J. March 2, 2007. "Eating Better than Organic." *Time Magazine*.

Darby, K., M.T. Batte, S. Ernst, and B. Roe. 2008. "Decomposing Local: A Conjoint Analysis of Locally Produced Foods." *American Journal of Agricultural Economics* 90(2): 476–86

Dimitri, C., and C. Greene. 2002. *Recent Growth Patterns in the U.S. Organic Foods Market*. Agriculture Information Bulletin Number 777. U.S. Department of Agriculture, Economic Research Service, Market and Trade Economics Division and Resource Economics Division. Washington, D.C.

Giraud, K.L., C.A. Bond, and J.J. Bond. 2005. "Consumer Preferences for Locally Made Specialty Food Products Across Northern New England." *Agricultural and Resource Economics Review* 34(2): 204–216.

Govindasamy, B. Schilling, K. Sullivan, C. Turvey, L. Brown, and V. Puduri. 2004. "Returns to the Jersey Fresh Promotional Program: The Impacts of Promotional Expenditures on Farm Cash Receipts in New Jersey." *Food Policy Institute Publication Number RR-0404-006*. Rutgers: The State University of New Jersey.

French, S.M., M. Story, P. Hannan, K.K. Breitlow, R.W. Jeffrey, J.S. Baxter, and M.P. Snyder. 1999. "Cognitive and Demographic Correlates of Low-fat Vending Snack Choices Among Adolescents and Adults." *Journal of the American Dietetic Association* 99(4): 471–474.

Hartman Group. 2008. *Pulse Report: Consumer Understanding of Buying Local*. Bellevue, WA.

Ippolito, P.M., and A.D. Mathios. 1990. "Information, Advertising and Health Choices: A Study of the Cereal Market." *RAND Journal of Economics* 21(3): 459–480.

Kallas, Z., J.A. Gómez-Limón, and M. Arriaza. 2007. "Are Citizens Willing to Pay for Agricultural Multifunctionality?" *Agricultural Economics* 36(3): 405–419.

Kiesel, K., and S.B. Villas-Boas. 2008. "Another Nutritional Label—Experimenting with Grocery Store Shelf Labels and Consumer Choice." CUDARE Working Paper No. 1060. Department of Agricultural and Resource Economics, University of California, Berkeley.

Kinnucan, H.W., H. Xiao, C. Hsia, and J.D. Jackson. 1997. "Effects of Health Information and Generic Advertising on U.S. Meat Demand." *American Journal of Agricultural Economics* 79(1): 13–23.

Klonsky, K., and K. Richter. 2007. Statistical Review of California's Organic Agriculture: 2000 to 2005. University of California Agricultural Issues Center. Davis, CA.

Lancaster, K. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74(2): 132–157.

Loureiro, M.L., J.J. McCluskey, and R.C. Mittelhammer. 2001. "Assessing Consumer Preferences for Organic, Eco-Labeled, and Regular Apples." *Journal of Agricultural and Resource Economics* 26(2): 404–416.

Loureiro, M.L., and S. Hine. 2002. "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(3): 477–487.

Loureiro, M.L., and W.J. Umberger. 2007. "A Choice Experiment Model for Beef: What U.S. Consumer Responses Tell Us About Relative Preferences for Food Safety, Country-of-Origin Labeling and Traceability." *Food Policy* 32(4): 496–514.

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

Louviere, J.J., and G.C. Woodworth. 1983. "Design and Analysis of Simulated Consumer Choice or Allocation Experiments: An Approach Based on Aggregate Data." *Journal of Marketing Research* 20(4): 350–367.

Lusk, J.L., and T.C. Schroeder. 2004. "Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks." *American Journal of Agricultural Economics* 86(2): 467–482.

Mathios, A.D. 1998. "The Importance of Nutrition Labeling and Health Claim Regulation on Product Choice: An Analysis of the Cooking Oils Market." *Agricultural and Resource Economics Review* 25(2): 159–168.

McEachern, M.G., and J. Willock. 2004. "Producers and Consumers of Organic Meat." *British Food Journal* 106(7): 534–552.

Mtimet, N., and L.M. Albisu. 2006. "Spanish Wine Consumer Behavior: A Choice Experiment Approach." *Agribusiness* 22(3): 343–362.

Nayga, R.M. 2002. "Looking for the Nutritional Label: Does It Make a Difference?" *Choices* 17(4): 39–42.

Patterson, P.M. 2006. "State-Grown Promotion Programs: Fresher, Better?" *Choices* 21(1): 41–46.

Perez, A., B. Lin, and J. Allshouse. 2001. *Demographic Profile of Apple Consumption in the United States*. Fruit and Tree Nuts Situation and Outlook Number FTS-292. U.S. Department of Agriculture, Economic Research Service. Washington, D.C.

Pretty, J.N., A.S. Ball, T. Lang, and J.I.L. Morison. 2005. "Farm Costs and Food Miles: An Assessment of the Full Cost of the UK Weekly Food Basket." *Food Policy* 30(1): 1–19.

Rossman, W.J. 2007. *The Influence of Consumer Knowledge and Characteristics on Applesauce Selection: Evidence from a Survey of Pennsylvania Residents*. M.S. Thesis, Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University.

Thilmany, D., C.A. Bond, and J.K. Bond. 2008. "Going Local: Exploring Consumer Behavior and Motivations for Direct Food Purchases." *American Journal of Agricultural Economics* 90(5): 1303–1309.

Umberger, W.J., D.M. Feuz, C.R. Calkins, and K. Killinger-Mann. 2002. "U.S. Consumer Preference and Willingness-to-Pay for Domestic Corn-Fed Beef Versus International Grass-Fed Beef Measured Through an Experimental Auction." *Agribusiness* 18(4): 491–504.

USDA-AMS. 2007. *Number of Operating Farmers Markets*. Available at http://www.ams.usda.gov (accessed January 2009).

USDA-NASS. 2008. *Agricultural Statistics*. U.S. Department of Agriculture, National Agricultural Statistics Service. Available at http://www.nass.usda.gov/Publications/Ag_Statistics/2008/2008.pdf (accessed January 2009).