The Relative Importance of Search versus Credence Product Attributes: Organic and Locally Grown

Ferdinand F. Wirth, John L. Stanton, and James B. Wiley

Organic foods and local foods have come to the forefront of consumer issues, due to concerns about nutrition, health, sustainability, and food safety. A conjoint analysis experiment quantified the relative importance of, and trade-offs between, apple search and experience attributes (quality/blemishes, size, flavor), credence attributes (conventional vs. organic production method, local origin vs. product of USA vs. imported), and purchase price when buying apples. Quality is the most important apple attribute. Production method—organic versus conventional—had no significant impact on preferences.

Key Words: conjoint analysis, organic, locally grown, credence attributes

Two significant trends have been developing in the area of fresh fruit and vegetables. Organic foods and local foods have come to the forefront of consumer issues in the past 5 years. These trends have been influenced by issues related to nutrition, health, sustainability, and food safety. As consumers have become increasingly concerned with the quality, safety, and production features of food, the demand for food products with credence attributes (e.g., origin, organic, locally grown, environment-friendly) on product labels has been garnering increased attention (Dentoni et al. 2009). Studies suggest that credence attributes impact consumer buying intentions. Certain segments of the population are willing to pay more for food products carrying a label identifying specific credence features, including safety and quality characteristics, certified as being present by a trusted source (Mabiso et al. 2005).

No area has been more affected by these trends than fresh fruits and vegetables. Although organic foods have received a lot of corporate attention because of fast growth rates, the growth has been from a very low base and the absolute amount is still quite low. In 2008, according to a Nielsen Report, organic sales of fresh produce were only 6 percent of the total fresh produce sales, and only about one percent of total supermarket sales were organic. Additionally, the current economic crisis has made the price differential more of a barrier to purchase.

In contrast to organic, buying local has become more in vogue. Whether fact or myth, consumers have seen buying local fresh products as assurance of food safety and as insurance against foodborne illness, and because of the lack of transit, locally grown produce is perceived to be fresher and tastier. Supermarkets are identifying the farmers and producers in advertising, in in-store promotional material, and on their website. Some stores are listing how far their food travels to the store.

Ferdinand F. Wirth is Associate Professor and John L. Stanton is Professor in the Department of Food Marketing at Saint Joseph's University in Philadelphia, Pennsylvania. James B. Wiley is Senior Cochran Research Fellow at Temple University in Philadelphia, Pennsylvania.

This paper was presented as a selected paper at the workshop "The Economics of Local Food Markets," organized by the Northeastern Agricultural and Resource Economics Association (NAREA), in Atlantic City, New Jersey, June 15–16, 2010. The workshop received financial support from the U.S. Department of Agriculture's Economic Research Service, the Farm Foundation, and the Northeast Regional Center for Rural Development. The views expressed in this paper are the authors' and do not necessarily represent the policies or views of the sponsoring agencies.

The authors wish to recognize a number of organizations and individuals that supported the research and assisted in its conduct. The Pennsylvania Institute for Food Marketing Education and Research (PIFMER) provided the funding to perform this research for the Pennsylvania Department of Agriculture and the Pennsylvania Apple Marketing Program. The staff of the Center for Food Marketing at Saint Joseph's University provided assistance in the conduct of every phase of the research. Finally, the authors want to thank the anonymous reviewers from the Northeastern Agricultural and Resource Economics Association for their diligent efforts to improve this manuscript.

The objective of this study is to determine the relative strength of two credence attributes, organic and locally produced, within the context of other fresh apple search and experience attributes. Specifically, the study addresses which credence attribute has the higher impact on consumers' preference for the product.

A conjoint analysis experiment quantified the relative importance of, and trade-offs between, apple physical search and experience attributes (sweetness,[1] quality/blemishes,[2] size, crispness), credence attributes (conventional vs. organic production method, local origin vs. product of USA vs. imported), and purchase price on purchase intention when buying apples.

Background on Credence Attributes

Consumers demand high quality, safety, and freshness in their fruits and vegetables. Quality is a multidimensional attribute, with certain quality dimensions (color, odor, taste) readily discernible by consumers (Anderson and Anderson 1991). These readily discernible dimensions are known as search and experience attributes. "Search" attributes refer to visual attributes of products (such as size, color, and blemishes) for which consumers can seek pre-purchase information, while "experience" attributes (such as taste) are ones that are ascertained on the basis of consuming the product (Nelson 1970, 1974, Stigler 1961).

Consumers increasingly have had to rely on credence attributes in responding to concerns regarding the safety and freshness of fresh foods. Credence attributes, unlike search and experience attributes, are quality features of a product that cannot be ascertained by direct experience (e.g., free-range, fair trade, organic, place of origin, and locally grown), so consumers cannot know with certainty if a credence attribute is actually present within a product. Credence attributes cannot be evaluated by consumers before purchase or after consumption without incurring prohibitively high information costs (Anderson and Anderson 1991, Darby and Karni 1973). Numerous studies have determined that credence attributes have a positive impact on consumers' attitudes toward a product, and consequently, influence consumers' buying intentions (Dentoni et al. 2009, Gao, Schroeder, and Yu 2010, Wirth, Love, and Palma 2007).

Ford, Smith, and Swasy (1988, p. 240) summarized the operational definitions of search, experience, and credence attributes that comprise the Search-Experience-Credence (SEC) attribute framework. "Search qualities are those that can be verified easily prior to purchase by actual inspection of the good; experience qualities are those that can only be verified after purchase and consumption of the product; and credence qualities are those that cannot be verified even after purchase and consumption."

Two significant food trends that rely on credence attributes have been developing over the past few years: consumer preferences for organically grown foods and for locally produced foods. Certain segments of the population are willing to pay more for food products carrying a label identifying organic production (Mabiso et al. 2005). Many of the factors leading to interest in organic foods undoubtedly also encourage consumption of local produce, e.g., concern for health, erosion of confidence in the conventional industry, concern with chemicals and pesticides in commercial food, and desire for increased taste and flavor. Studies have shown that "local" or "locally grown" attribution affects consumers' willingness to pay for food products (Darby et al. 2008, Froehlich, Carlberg, and Ward 2009).

Organic Foods

Consumption of organic foods and beverages has increased substantially over the past decade, increasing from $3.6 billion in 1997 to $21.1 billion in 2008. While organic sales account for only about 3 percent of total U.S. food sales, most Americans purchase organic products at least occasionally (Food Institute 2009). Roughly one in four people consume an organic product at least once every two weeks, although organic consumers tend to eat many more non-organic versions of the top organic products. Fruit is the number one organic food category, with organic bananas holding the top spot, followed by organic

[1] Since subjects did not taste the apples, "sweetness" is a description based on industry standards. Therefore it was not classified as an experience attribute.

[2] The word "quality" is used with consumers as they are not as familiar with the meaning of "blemishes." This was discovered in the focus groups described in the methodology section. The word "quality" is used throughout this paper because it was the actual word used by consumers; it was actually represented by the percentage of blemishes.

apples as the second most popular organic fruit. However, organic consumers eat 10 times more non-organic fruit than organic fruit. In 2002 the U.S. National Organic Program streamlined the certification process for domestic and international trade of organic products. Foods sold in the United States as organic must meet production standards set by the U.S. Department of Agriculture.

There is a large existing body of knowledge about virtually every aspect of organic products, including fruits and vegetables. Rather than provide an exhaustive review, this section will briefly describe two studies: one that provided important insights into consumer preferences for organic produce in general, and one that examined preferences for organic apples.

Raab and Grobe (2005) interviewed 673 Oregon food shoppers to assess knowledge and perceptions about organic food. They reported that 77 percent of households had purchased organic food in the previous six months. Positive words associated with organic included chemical-free, natural, healthier, more nutritious, and earth-friendly. Cost was identified as a negative perception of organic; there is a common perception that organic foods are difficult to find and much more expensive than conventional food.

Yue et al. (2005) used an ordered probit model to study the consumer trade-off between cosmetic appearance and organic production methods in order to provide estimates of consumers' willingness to pay for organic apples in the fresh fruit markets. The authors concluded that consumers make a trade-off between production technology and cosmetic appearance of apples, although cosmetic damage weighs significantly in their decision. When there are "too many" blemishes on the surface of organic apples, consumers would rather buy conventional ones with better appearance, even if the spots are merely a cosmetic problem. The presence of cosmetic damage reduces the grade and market value of organic apples. At the same time, the costs of producing organic apples are likely to be higher than for producing apples by conventional growing methods since producers are likely to apply organic pesticides more frequently than conventional pesticides. The relatively low consumer acceptance of cosmetic damage to apples narrows the margin of error for organic growers and makes decision making for organic growers challenging.

Locally Grown Foods

A second major trend impacting the fresh produce industry is the "locally grown" movement. In contrast to organic foods, no standards exist for local foods in the United States. The boundary for defining foods as local can include food grown within a county, within neighboring counties, within a state, and within neighboring states (Zepeda and Leviten-Reid 2004). Wal-Mart, the biggest food retailer in the United States, considers anything local if it is grown in the same state in which it is sold. Whole Foods, the biggest retailer of natural and organic foods, considers local anything produced within seven hours of one of its stores (Schmitt 2008).

While there has been much research on consumer preferences for organic foods, less research has been published on consumer interest in locally grown food, despite the increasing demand and availability. Zepeda and Leviten-Reid (2004) reported that some consumers define local foods in terms of distance, often using driving time as a measure, with a one-day's drive being a frequent distance boundary, rather than political boundaries. A Hartman Group (2008a) nationwide consumer survey indicated that consumer interest in locally produced foods is driven by the belief that local foods are healthier than non-locally grown foods. Half the responding consumers defined local as within 100 miles, while 37 percent defined it as within the same state.

Zepeda and Li (2006) reviewed consumers' motivations to purchase locally produced foods. They suggested that proximity is associated with freshness and improved quality. Proximity also means that food travels less distance, implying lower fuel costs, a potentially important motivator for consumers with environmental concerns. Other attitudes associated with buying local include the desire to support local farmers and the local economy. Monetary costs for local foods and indirect search costs may also affect demand for local foods. If local foods are available at a consumer's regular shopping venue, search costs are minimal.

Darby et al. (2008) surveyed 530 Ohio shoppers and used stated preference data from a choice-based conjoint analysis experiment to examine issues surrounding consumer demand for locally produced fresh strawberries. The results failed to show any significant difference between "grown

nearby" versus "grown in Ohio." The authors did demonstrate that consumer demand exists for locally produced foods and that this demand is independent of other attributes, such as freshness and anti-corporate images, often naturally associated with locally produced foods.

Dentoni et al. (2009) used structural equation modeling to demonstrate that the "locally grown" credence attribute has both direct and indirect effects on consumers' attitudes toward fresh apples. The direct effect was the impact of locally grown on consumers' attitudes, without any mediation. Indirect effects were the impacts of locally grown on attitudes mediated by consumers' inference that other desirable product attributes, such as freshness, were present in the locally grown product. The researchers concluded that some consumers value locally grown as a cue for freshness, an experience attribute, or as a cue for environmental friendliness, another credence attribute.

James, Rickard, and Rossman (2009) used a choice experiment and multinomial logit models to assess how consumers value several credence attributes (organic, local, no sugar, low fat) appearing on applesauce labels. No search or experience attributes were included in the choice experiment. The researchers found 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. The results also suggested that increased knowledge of agriculture decreased willingness to pay for both organic and locally grown applesauce.

Previous Apple Conjoint Studies

Conjoint analysis has been widely used in produce market research to evaluate preferences for fruit and vegetable products at all levels of the marketing chain and to provide information useful for understanding product differentiation and generating marketing strategies. In the earliest application of conjoint analysis to the apple industry, Manalo (1990) assessed the importance of five apple search and experience attributes in the preferences of 208 New Hampshire consumers. The five apple attributes and attribute levels were as follows: size (small, medium, large), color (uniformly red, uniformly green, red-green combination), crispness (crisp, mealy), flavor (sweet, tart), and price ($0.79/lb, $0.89/lb, $0.99/lb). No credence attributes were included in the Manalo design. The most important apple attributes were the search attributes, with crispness being the most important, almost twice as important as size and color. The least important attributes were flavor (the experience attribute) and price. The conjoint analysis confirmed Manalo's survey findings that consumers do not give much importance to price, at least when price is within the range of apple prices normally found in stores.

Wang and Sun (2003) utilized conjoint analysis to assess the market potential for organic apples in a survey of 519 Vermont consumers. Apple attributes included in the analysis were purchase price (0.99/lb, 1.29/lb, 1.59/lb, 1.89/lb) and three credence attributes: production method (organic vs. conventionally grown), location (Vermont vs. other states), and certification (Northeast Organic Farming Association [NOFA], USDA, or not certified). No search or experience attributes were included in the design. The authors found that, overall, price was the most important attribute, more important than any credence attributes, followed in importance by production method and location. Sixty-seven percent of respondents indicated that they would pay slightly more for organic produce. One-quarter of respondents would pay between one and five cents more for a dollar's worth of organic produce. Only 8 percent stated that they would pay 21 cents more for a dollar's worth of organic produce.

Materials and Methods

The project objectives of evaluating the relative importance of search, experience, and credence attributes in consumers' apple purchase preference decisions were accomplished through a comprehensive two-step consumer market research approach blending focus groups with a survey of Pennsylvania residents, supported by secondary information available from academic research studies and trade associations. The complementary nature of the methods often leads to more robust findings than are possible when each research method is employed independently. This integrated research process consisted of the following:

1. Preliminary focus groups. Two preliminary focus groups with Pennsylvania residents were undertaken to identify key attitudes, perceptions,

and concerns over purchasing of Pennsylvania apples and organic fruits and vegetables, and to ensure that the researchers were using the most pertinent terminology and had identified issues that may be specific to the Pennsylvania apple consumer. Focus groups are a useful research tool to clarify a research problem area and more fully develop the context and nature of a perceived problem or research topic (Sterns and Ricks 1999). The main value of the focus groups was to learn the type of language that is used to describe buying habits with respect to local food, organic food, and apples in general. For example, it was found that consumers in these groups thought of the amount of blemishes in the fruit as "quality."

2. Quantitative online survey of Pennsylvania residents. An online survey was developed and administered to an eRewards panel of 1,218 Pennsylvania residents who are primary household food shoppers. The survey instrument was comprised of two primary aspects:

- Traditional attitude, trial, and usage (AT&U) data and demographics collected and analyzed using conventional methods and/or replicating previous work on organic fruits.
- A conjoint or trade-off analytic experiment in which respondents rated their preference for six apple products consisting of different levels of seven key apple search, experience, and credence attributes.

Questionnaire Development

A questionnaire was developed for online administration to a sample of 1,200 Pennsylvania households.[3] The final questionnaire, developed using results from the focus groups, consisted of 56 (in some cases multipart) questions, grouped into four sections. The first section was a screener to ensure that participants were from Pennsylvania, were in the correct age range, were the primary food shopper, and had purchased fresh fruit in the past 6 months. The second section provided a more detailed description of the respondents in terms of various socio-demographic groups— such as income, education, race, and ethnicity—and general food shopping behavior. The third section included questions on attitudes and behaviors toward organic food, local foods, and food safety. The fourth section addressed issues on the various trade-offs of apple attributes including local vs. distant, price, flavor, etc., and included the conjoint experiment.

The questionnaire was converted into an HTML file for uploading to SurveyMonkey.com, a survey-hosting company, for online administration. SurveyMonkey.com provided a link for the questionnaire and real-time reporting of the number of completed surveys. No panel members could complete the questionnaire more than one time. SurveyMonkey.com provides descriptive statistical analysis; in addition, results for each respondent are automatically stored in a database that is available for download and further analysis.

Questionnaire Administration

E-mail is becoming a more accepted mode of disseminating online surveys, as studies have shown that over 50 percent of U.S. households now have access to the Internet. A common way to administer an e-mail survey is to send an invitation by e-mail to individuals inviting them to take the survey. A link to the web address containing the survey is included in the e-mail invitation for the respondent to access the survey.

Compared to snail mail, e-mail survey results are comparable in the data gathered and response rate obtained. Shortcomings in Internet/e-mail surveys come in the form of potential coverage errors, sampling errors, non-response errors, and measurement errors (Champ, Boyle, and Brown 2003, Bachmann, Elfrink, and Vazzana 1996). A discussion of the benefits, shortcomings, and limitations of using online surveys is available in Berrens et al. (2003), Couper (2000), and Knapton and Myers (2005).

For this project, e-Rewards Inc., a Dallas-based online sample provider, was selected to perform the e-mail broadcast of the questionnaire, including links to the online questionnaire located at SurveyMonkey.com. The e-Rewards' North American Market Research Consumer Panel currently consists of more than 2.5 million individuals. Approximately 100,800 (4.0 percent) of e-Rewards consumer panel members are Pennsylvania residents.

[3] Note that the sample plan called for 1,200, but the nature of the online survey provided a total of 1,218 usable surveys.

Conjoint Analysis

The online survey included a conjoint analysis experiment to quantify the relative importance of various apple attributes to consumers. Conjoint analysis, a popular marketing research tool for designing new products, is a multivariate market research technique that can aid in sorting out the relative importance of a product's multidimensional attributes (Green and Wind 1975). Conjoint analysis is a decompositional method that estimates the structure of buyers' preferences for a product's attributes, given the buyers' overall evaluations of a set of alternative products that are pre-specified in terms of levels of different attributes (Green and Srinivasan 1978). Detailed information on the development and applications of conjoint analysis is available at Green and Rao (1971), Green (1974), and Green and Wind (1975).

In conjoint analysis, a product is viewed as a combination of attributes and attribute levels. These attributes reflect important product characteristics hypothesized to have high impact on a buyer's product purchase behavior. Attribute levels correspond to different points along these characteristics and should span the realistic range of each attribute. A major advantage of conjoint analysis is the high degree of realism in portraying consumer choices. Consumers are asked to express their preferences for products that are described as combinations of attributes being offered at various prices, in the same fashion that consumers have to choose from various products in the marketplace (Baker 1999, Hair et al. 2006).

The design of a conjoint analysis experiment includes two basic steps. First, the attributes and attribute levels that define the conjoint design must be carefully selected. Together, the number of attributes and their associated levels comprise the design specifications for the conjoint analysis experiment (Wirth and Davis 2003). Table 1 summarizes the seven search, experience, and credence attributes (and attribute levels) selected for the conjoint analysis experiment in this study, based upon *a priori* knowledge of apple marketing, a review of past apple marketing studies, and focus groups with 16 Pennsylvania apple-purchasing consumers. Quality was described verbally based upon number of blemishes, and also illustrated with pictures of blemish-free apples and apples that had *very few* blemishes and *few* blemishes. Price is included in most conjoint studies because it is a principal element in the assessment of value for many products (Hair et al. 2006).

Table 1. Apple Attributes and Attribute Levels in Consumer Conjoint Analysis Experiment

Attribute	Attribute Level
Quality	Blemish-free
	Very few blemishes
	Few blemishes
Size	Small
	Medium
	Large
Flavor	Sweet
	Tart
Texture	Crisp
	Mealy
Price/lb	$0.99
	$1.99
	$2.99
Origin	PA-grown
	Grown in USA
	Grown outside USA
Production Method	Organic
	Conventional

Several potentially important apple product attributes, such as apple variety, color, and nutritional value, were deliberately omitted from the study in order to limit the number of tasks required of the survey respondents. The researchers identified nine major varieties of apples (and many minor varieties) popular for fresh eating within the sample geographical area. Color is a complex, variety-dependent attribute, with many varieties having one base skin color and a completely different color blush or highlights. There are also significant color variations within some apple varieties. Nutritional value is an important attribute for consumers when comparing apples with alternative fruits, but nutritional value is generally quite uniform across apple varieties.

Once the attributes and attribute levels have been selected, they must be combined into apple products, with each apple product consisting of one level of each of the seven attributes. The conjoint experiment employs a full-profile approach,

in which respondents rate a set of apple products. In a full-factorial design, in which every possible combination of attribute levels is rated, the number of products to be rated quickly becomes very large and the task becomes unrealistic for the survey participant. For this study, the possible number of attribute level combinations would result in 648 ($3\times3\times3\times3\times2\times2\times2$) different apple products. A fractional-factorial design was used instead, in which an orthogonal subset of attribute level combinations is selected. Only 48 apple products were required to represent the apple attributes and attribute levels described in Table 1, as opposed to the 648 products for a full-factorial design. Since 48 apple products is still too many for a respondent to evaluate, the study utilized a Balanced Incomplete Block Design (BIBD) in which the 48 apple products were separated into eight choice sets consisting of six apple profiles per set. Table 2 shows the complete design.

Survey participants were then asked to rate six apples on a scale of 0 to 10, where 0 was assigned to an "extremely unlikely to purchase" combination of product attribute levels, and 10 was an apple that consists of an "extremely likely to purchase" combination of apple product attribute levels. The rating instructions included two "training" products defined by combinations of attribute levels expected to be most desirable (rating = 10) and least desirable (rating = 0) by most consumers.

Conjoint Model Specification and Estimation

In conjoint analysis, a buyer's utility for a product, represented by the preference rating, is the sum of the buyer's utilities for each product attribute. In the econometric specification of consumer preferences, the product attributes are combined to formulate an additive conjoint preference model that can be expressed as the following general relationship:

(1) Rating = f (quality, price, size, origin, flavor, production method, texture),

where the rating equals the preference rating given to the apple products by survey respondents.

The specification of the conjoint preference model, as described by Wirth and Davis (2003), involves two steps. First, the functional form for each product attribute must be specified. Next, the functional forms for each attribute are combined into a conjoint preference model for estimation.

There are three possible ways to model a buyer's utility function for each product attribute: a part-worth, or dummy variable function model, a linear vector model, and a quadratic ideal-point model. The most commonly used attribute utility model is the part-worth model, which requires separate estimates of the impact or part-worth of each level of an attribute. Green and Srinivasan (1978) provide a detailed theoretical discussion of the three functional forms.

For this study, the part-worth function model was used to model all seven apple product attributes because it provides the greatest flexibility in allowing different shapes for the utility function along each of the product attributes. The part-worth function model posits that for a set of t attributes, where y_{jp} denotes the level of the pth attribute for the jth product, the preference S_j is given by

$$S_j = \sum_{p=1}^{t} f_p(y_{jp}), \tag{2}$$

where f_p is the function denoting the part-worth of different levels of y_{jp}. In practice, $f_p(y_{jp})$ is estimated only for the selected set of attribute levels, with values for intermediate levels obtained by linear interpolation (Green and Srinivasan 1978).

As an alternative to traditional dummy variable coding, this study used "mean deviation coding," a technique that is equivalent to traditional dummy variable coding from a mathematical point of view. The intercept represents the mean preference rating, and dummy variable coefficients measure deviation from the mean rating (Harrison, Ozayan, and Meyers 1998, Wirth and Davis 2003). The advantage of using "mean deviation coding" is the ability to calculate coefficients for all levels of attributes. The kth base level for each dummy variable is represented as –1 instead of 0. This constrains the coefficients for all levels of each attribute to sum to 0. Coefficients for each base level kth dummy variable are not explicitly estimated in the model, but they can easily be calculated as the negative sum of the $k-1$ level coefficients.

Table 2. Conjoint Apple Design of 48 Choice Sets

	Levels						
	3	3	3	2	3	2	2
Profile	Price	Origin	Quality	Production	Size	Crisp	Flavor
1	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0
33	2	0	0	0	0	0	0
10	0	1	1	0	0	1	0
12	0	1	1	0	1	0	0
26	1	1	1	0	0	1	0
28	1	1	1	0	1	0	0
42	2	1	1	0	0	1	0
44	2	1	1	0	1	0	0
4	0	1	1	0	1	0	1
5	0	1	0	1	1	1	0
6	0	0	1	1	1	0	1
20	1	1	1	0	1	0	1
21	1	1	0	1	1	1	0
22	1	0	1	1	1	0	1
36	2	1	1	0	1	0	1
37	2	1	0	1	1	1	0
38	2	0	1	1	1	0	1
9	0	2	0	0	2	0	1
11	0	0	2	0	1	1	1
13	0	1	0	1	1	1	1
14	0	2	1	1	1	0	0
15	0	1	2	1	0	0	1
16	0	0	1	1	2	1	0
25	1	2	0	0	2	0	1
27	1	0	2	0	1	1	1
29	1	1	0	1	1	1	1
30	1	2	1	1	1	0	0
31	1	1	2	1	0	0	1
32	1	0	1	1	2	1	0
41	2	2	0	0	2	0	1
43	2	0	2	0	1	1	1
45	2	1	0	1	1	1	1
46	2	2	1	1	1	0	0
47	2	1	2	1	0	0	1
48	2	0	1	1	2	1	0
2	0	1	1	0	2	1	1
3	0	2	2	0	1	1	0
7	0	1	2	1	2	0	0
8	0	2	1	1	0	1	1
18	1	1	1	0	2	1	1
19	1	2	2	0	1	1	0
23	1	1	2	1	2	0	0
24	1	2	1	1	0	1	1
34	2	1	1	0	2	1	1
35	2	2	2	0	1	1	0
39	2	1	2	1	2	0	0
40	2	2	1	1	0	1	1

In an orthogonal design, the mean deviations (effects coding) and dummy coding estimates are all linear functions of the mean attribute ratings. That is, one gets from one set of values to another with a linear transform $y = a + bx$. The *absolute values* of parameter estimates are not particularly meaningful. Choice is conceived to be driven by *differences* between preference values. Taking differences, the a cancels out, and expressing importance as a percentage of the total, the b's cancel out. In other words, the "importance" measure is invariant to choice of scale. Likewise, the rank preference order for profiles is invariant to choice of scale.

The measurement scale properties of the dependent variable (product preference) determine the choice of model estimation method (Harrison, Ozayan, and Meyers 1998). This study used a 0 to 10 preference rating scale. Rating scales have several advantages over rankings, including flexibility to handle larger experimental designs. Parameter estimation methods for an intervally scaled rating as the dependent variable are ordinary least squares (OLS) and minimizing sum of absolute errors (MSAE) regression. Between the two methods, the OLS procedure has the important advantage of providing standard errors for the estimated parameters (Green and Srinivasan 1978), and OLS was used in this study to estimate the conjoint preference model shown in equation (1).

The fundamental application of the conjoint preference model is the calculation of feature utility values and features' relative importance from the estimated parameters. For variables specified using the part-worth utility model, the estimated mean attribute rating for each attribute level provides a direct measure of utility. Since all attribute utility results are expressed in a common unit, utility ranges can be compared from feature to feature to calculate their relative importance (expressed as percentages) in the preference rating. The relative importance of each apple attribute is estimated as the range of utility over all levels of that attribute, expressed as a percentage of the sum of the utility ranges for all attributes.

In the conjoint model, each level of each attribute is considered an independent variable even though many combinations of these variables are logically impossible. It is customary to calculate the relative importance of the attributes based on the calculated utilities of all attribute levels without regard to their individual levels of significance (Harrison, Ozayan, and Meyers 1998), and that practice is observed here. The calculated relative importance of each attribute is generally affected very little by this convention.

Results and Discussion

Completed online surveys were obtained from 1,218 e-Rewards panel members who are Pennsylvania residents and primary household food shoppers. The average time to complete the survey was 26 minutes.

Respondent Profile

The consumers in this study were the primary food shopper in their families, with 100 percent of the sample purchasing at least 50 percent of all the family groceries, and 79 percent of the respondents purchasing more than three-quarters of the family groceries. Additionally, 100 percent of respondents purchased fresh fruit in the past 6 months. Almost all (96 percent) of the respondents were between 21 years and 65 years. The distribution of ages is not likely to have an impact on the results as no age group was disproportionally sampled.

The distribution of racial groups is slightly higher in the white group. The Pennsylvania 2000 Census was 85.4 percent white, while the sample was 92.3 percent white, and that understates black Pennsylvania residents (sample of 3 percent versus 19 percent in the census). There is also a slight underestimation of Hispanics (sample 1.5 percent versus 3.2 percent in the census). It is important to note that the objective of the study was not to break down the results by racial groups, and the various racial and ethnic groups are in fact represented in the study.

Typical Shopping Outlets

Table 3 shows the distribution of shopping venues for the sample. Responding consumers seem to have purchased their foods in the typical assortment, with almost all families (96.3 percent) shopping at supermarkets, which is consistent with generally accepted standards. The number of people shopping at farmers markets and roadside

Table 3. Distribution of Food Shopping Venues for Sample

In the past year in which stores shown below have you made any food purchase?		
Outlets	Number	%
Super Center (Wal-Mart, Target, etc.)	882	72.4%
Supermarket	1,173	96.3%
Small grocery store or neighborhood market	687	56.4%
Health food store	254	20.9%
Community farmers market	567	46.6%
Roadside stand	473	38.8%
Other (please specify):	38	3.1%
Total	1,218	100.0%

stands is not inconsistent with government reports. According to Lloyd Day, Administrator of the U.S. Department of Agriculture's Agricultural Marketing Service (AMS), "More and more consumers are discovering the wide array of fresh, locally grown produce available at farmers markets" (USDA 2008). Day continued: "Another reason for their popularity is food buyers like the opportunity to interact with the producers." He pointed out that since 1994, when AMS began to track farmers markets, the number of farmers markets nationwide has grown by nearly 3,000. Specific statistics showing how many consumers visit roadside stands and farmers markets are not maintained by USDA.

In order to ensure that the sample was not skewed to either non-organic buyers or organic buyers, the percentage who bought organic at least occasionally was measured. The sample had 78 percent of the sample buy organic fruits and vegetables at least occasionally. This number is consistent with the findings published by the Hartman Group (2008b), where 69 percent of U.S. adult consumers buy organic products at least occasionally. If there was a skew it was in favor of organic foods.

Conjoint Analysis of Apple Preferences

The consumer always wants a lower price and better quality, and always wants a more flavorful apple. Since very few of us get to buy our ideal apple, we are often forced to trade off between the various apple attributes. A key question regarding the importance of attributes is: Which attributes are consumers willing to give up in order to gain more of another attribute?

The results of the conjoint analysis are shown in Table 4. This table indicates the extent to which a consumer will trade off any one attribute for any other attribute. The strength of this trade-off is represented by the column titled Partial Eta Squared. The higher the partial eta squared, the more willing the consumer is to trade off from a lower level to a higher level of that attribute.

The results indicate that crispness is the attribute consumers are least willing to trade off to gain on other attributes. This result may not be unexpected given that only the words "crisp" and "mealy" were used, and that subjects could not actually make a judgment by tasting. While the authors tried to find alternative descriptions for the opposite of crisp, "mealy" was the best choice. Thus the attribute could also be interpreted as meaning that the consumer will trade off all other attributes for a non-mealy apple. This is also statistically significant.

The next attribute that consumers are not willing to give up or trade off is quality. Consumers prefer apples with the fewest blemishes and are less willing to trade off the other attributes if it means accepting more blemishes. Again, this is statistically significant.

Price is next in significance when considering consumers' willingness to trade off between apple attributes. The authors believe it is very relevant that price appears only after the quality of the apple in term of crispiness and blemishes, which may be interpreted as meaning that consumers are willing to pay for apples that meet their standards.

For the sample as a whole, production method —organic versus conventional—had the least differential impact on preference, and was not statistically significant. In practical terms, this means that adding "organic" to an apple's characteristics will not compensate for lower quality, blemishes, or an adverse level of any other attribute.

In contrast to organic, it is important to note that origin was statistically significant. Although further down the list, consumers did say that, other things being equal, they would prefer a Pennsylvania-grown apple.

Table 4. Conjoint Preference Model Least Squares Regression Estimation Results for Seven Apple Attributes (dependent variable = preference rating)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected model	7,898.3	29	272.4	32.3	0	0.114
Intercept	120,079.8	1	120,079.8	14,253.1	0	0.661
Price	1,270.3	2	635.2	74.5	0	0.012
Origin	595.2	2	297.6	34.9	0	0.009
Quality	1,662.7	2	831.4	97.6	0	0.026
Production	0.4	1	0.4	0.1	0.8	0
Size	422.1	2	211.1	24.8	0	0.007
Crisp	2,963.5	1	2,963.5	347.8	0	0.045
Flavor	89.5	1	89.5	10.5	0	0.001
Error	61,619.0	7,314	8.4			
Total	231,767.0	7,344				
Corrected total	69,517.4	7,343				

Note: R squared = 0.114 (adjusted R squared = 0.110).

Table 5 provides the calculated utility values for each level of each apple attribute. The magnitudes of the attribute-level utilities indicate that a blemish-free apple is strongly preferred over an apple with blemishes. A large apple is the most preferred size, slightly preferred over a medium apple. Respondents also preferred a sweet apple to a tart apple. A crisp apple was strongly preferred to a mealy apple. Origin matters, with a "PA Grown" apple preferred to a "Grown in the USA" apple. A "Grown Outside USA" apple showed the lowest utility for origin. As expected, price utility was inversely related to price, decreasing as price increased. Finally, respondents showed no preference between conventional versus organic production methods.

The apple attribute utility values can be used in two ways to identify the optimal levels of each attribute in structuring new apple products. The overall buyer utility for an apple product is the sum of the utility values for each selected product attribute. The first-choice apple product is based on the notion that a buyer will select the apple product with the highest overall utility for him. The first-choice apple, consisting of the highest-utility attribute levels, would be a blemish-free, large, sweet, crisp apple, Pennsylvania-grown, and sold at the lowest possible price, $0.99 per pound.

In the event that the first-choice product is not feasible in the marketplace, an alternative approach is for apple growers and marketers to compare buyer utilities for different, feasible apple product configurations, designed through knowledge of apple production and marketing. For example, all other attributes being equal, a medium apple selling for $1.99 per pound has higher utility (9.67) than a large apple selling for $2.99 per pound (8.99).

Relative Importance of Apple Attributes

An important question which can be raised is: *If* one were to create an apple with a more desirable attributes profile, how much more "preference" could I expect to get from consumers? In other words, where should I put my efforts to improve Pennsylvania apple sales (or at least preference)?

Figure 1 illustrates the relative importance of each attribute and measures the extent to which each attribute contributes to the ideal level of preference. Consistent with other studies, quality—represented by number of blemishes—is the most important apple attribute. Consumers expect blemish-free apples. One can expect about 50 percent of the increase in preference to come from quality and texture. The biggest expected

Table 5. Utility of Apple Product Feature Levels for Survey Respondents

Attribute	Utility
QUALITY	
Blemish-free	5.37
Very few blemishes	4.61
Few blemishes	4.03
SIZE	
Small	4.30
Medium	4.82
Large	4.90
FLAVOR	
Sweet	4.78
Tart	4.56
TEXTURE	
Crisp	5.31
Mealy	4.03
PRICE/LB	
$0.99	5.06
$1.99	4.86
$2.99	4.09
ORIGIN	
PA-grown	5.04
Grown in USA	4.72
Grown outside USA	4.25
PRODUCTION	
Conventional	4.66
Organic	4.68

gain in preference would come from making the apple crisp and with fewer blemishes. Lowering the price of apples from the highest price to the lowest price would change the desired preference level by only about 18 percent. Origin (Pennsylvania-grown) contributes almost as much as price, with an expected gain in preference of 15 percent when you move from an apple grown outside the country to a Pennsylvania-grown one. Production method (organic vs. conventional) would contribute almost nothing to the ideal apple.

The low relative importance of the two credence attributes—origin and production method—compared to the search and experience product attributes is inconsistent with the results of a recent, similar study by Wirth, Love, and Palma (2007) on consumer preferences for shrimp products. In that study, country-of-origin was the most important of seven attributes (five search/experience and two credence), followed by price, then production method (the second credence attribute). One possible explanation is consumers' high familiarity with apples compared to shrimp. Rao and Monroe (1988) found that highly familiar consumers use extrinsic cues, such as credence attributes, less than low-familiar consumers.

The relationship between consumers' product familiarity and their use of credence attributes is an emerging area of research. James, Rickard, and Rossman (2009) found that increased knowledge of agriculture decreased willingness to pay for two credence attributes, organic and locally grown, on applesauce labels. Dentoni et al. (2009, p. 394) demonstrated that "consumers' familiarity with apples acts as a negative moderator of the impact of their beliefs in the presence of credence attributes as cues of other attributes" such as freshness and environmental friendliness. The results of this apple conjoint analysis seem to support the Dentoni et al. (2009) conclusion that familiarity with apples appears to reduce the effects of credence attributes on consumers' attitudes toward apple products. Future research on this topic should focus on clarifying the relationship between product familiarity and credence attribute importance across a spectrum of food products ranging from low familiarity to high familiarity.

Conclusions

Several studies have examined the effects of individual categories of search, experience, or credence attributes on consumer preferences for apples. This study employed conjoint analysis within a SEC attribute framework to quantify the utility and relative importance of, and trade-offs between, apple physical search and experience attributes (sweetness, blemishes and imperfections, size, crispness), credence attributes (conventional vs. organic production method, local origin vs. product of USA vs. imported), and purchase price on purchase intention when buying fresh apples. The two credence attributes were relatively unimportant compared to apple physical search and experience attributes. Quality, texture, and purchase price were more important than origin ("PA Grown," "Grown in USA," "Grown Outside USA"), and production method (organic vs. conventional) was not statistically significant.

The non-significance of production method suggests that there is almost no value to produc-

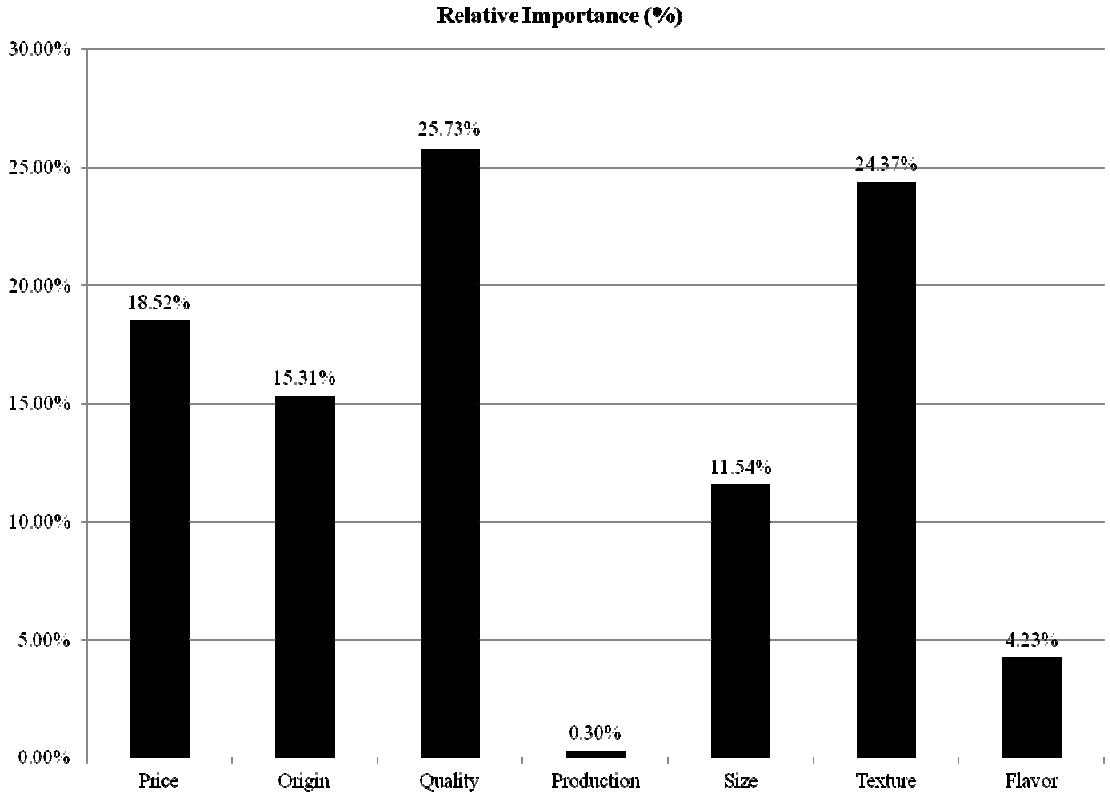

Figure 1. Relative Importance of Seven Apple Product Attributes in Conjoint Preference Ratings

ing an organic apple for the "mass market." In terms of apple production, the authors believe that an allocation of scarce resources into organic apple production may not be economically justifiable. Promoting locally grown apples through the "PA Grown" program will be a far more efficient approach for apple growers than "going organic."

Limitations and Direction for Future Research

As with any research study, there are limitations that future research may wish to address or readers may wish to consider when evaluating the results. Potential limitations relate to the fact that the study data are for a single U.S. state (Pennsylvania), a single product (apples), and a single time.

One limitation was the use of Pennsylvania residents only. The state has a good mixture of urban, suburban, and rural consumers, and while there is no evidence to suggest that a broader sample would yield significantly different results, a wider sampling frame would be desirable. The study must be replicated in other states and other countries to establish generalizability of the results.

Another possible consideration is that respondents in this study did not actually taste the apples, and therefore the concept of quality may have been confounded with other variables such as blemishes and color. Future researchers may wish to include an actual taste test, and, related to the aforementioned sampling frame limitation, future researchers may wish to extend the product universe beyond apples to other fruits and vegetables.

The aggregate conjoint analysis employed in this study provides valuable market intelligence for apple industry decision making, but aggregate results are often less useful for developing actionable, firm-level marketing strategies. Modern target-marketing strategy follows a formal, disciplined, four-step process: market segmentation, target customer selection, market positioning, and customized marketing execution, or STPM (Stanton and Lang 2009). The first step, segmentation, divides the consumer population into distinct con-

sumer segments—coherent subgroups of consumers who have similar characteristics, needs, attitudes, and behaviors—so that the same marketing methods can be used for all the members of a group. A market can be segmented based upon an endless list of variables, with five categories of segmentation variables commonly used in food marketing: socio-cultural, psychographics, demographics, user behaviors, and geographic (Schaffner, Schroder, and Earle 2003).

Two different approaches are generally used in segmentation analysis: *a priori* and *post hoc*. Both approaches provide useful information, but the *post hoc* approach provides deeper insights. With the *a priori* approach, consumer characteristics or behaviors of interest are pre-selected, and consumers are assigned to groups based on them (Stanton and Lang 2009). Within a research framework, the significance of the pre-selected characteristics can be evaluated by the inclusion of interaction terms between key demographic/psychographic variables and product attributes in an empirical model. Given the endless list of potential segmentation variables, this technique requires previous identification of the key segmentation variables to avoid a shotgun approach of adding large numbers of variables to an econometric model.

For both organic foods and locally grown foods—the focus of this study—key segmentation variables have not yet been clearly identified. Li, Zepeda, and Gould (2007) reviewed the major studies on the determinants of consumers' organic food purchase behavior and noted conflicting results in studies on the impacts of demographics (age, education, household size, gender, and race). Consumer attitudes and concerns seemed to be important factors, with those concerned about nutrition, health, and food safety more likely to be organic food shoppers. Research to characterize locally grown food shoppers and to identify their key segmentation variables is just beginning to appear in the academic literature. Two studies (Dentoni et al. 2009, Zepeda and Li 2006) described earlier in this paper seem to suggest that attitudes are important determinants of demand for locally grown food products. *Post hoc* analysis to characterize locally grown food purchasers and to identify the most relevant and effective segmentation variables is an important direction for future food marketing research. Factor analysis can determine the best segmentation variables, and cluster analysis is a tool of choice for segmentation (Stanton and Lang 2009).

Finally, as with any study of this type, consumers' perceptions and trade-offs were measured at a discrete point in time. This survey was administered during the most severe economic downturn since the Great Depression. Numerous industry publications reported significant changes in consumer price sensitivity and purchasing behavior during the study period. The authors recognize that temporary economic factors may have affected the responding consumers' stated preferences and attribute trade-offs, generating study results that are different from long-term preferences. As economic conditions improve at some future time, there may be shifts in consumers' preferences and the relative importance of the various search, experience, and credence attributes. Future research duplicating this study during a period of economic prosperity may provide important information on the effects of economic conditions on consumer preferences and the trade-offs between search, experience, and credence attributes.

References

Anderson, J.G., and J.L. Anderson. 1991. "Seafood Quality: Issues for Consumer Research." *Journal of Consumer Affairs* 25(1):144–163.

Bachmann, D., J. Elfrink, and G. Vazzana. 1996. "Tracking the Progress of Email vs. Snail-mail." *Marketing Research* 8(2): 31–35.

Baker, G.A. 1999. "Consumer Preferences for Food Safety Attributes in Fresh Apples: Market Segments, Consumer Characteristics, and Marketing Opportunities." *Journal of Agricultural and Resource Economics* 24(10): 80–97.

Berrens, R.P., A.K. Bohara, H. Jenkins-Smith, C. Silva, and D.L. Weimer. 2003. "The Advent of Internet Surveys for Political Research: A Comparison of Telephone and Internet Samples." *Political Analysis* 11(1): 1–22.

Champ, P.A., K.J. Boyle, and T.C. Brown (eds.). 2003. *A Primer on Nonmarket Valuation.* Dordrecht, the Netherlands: Kluwer Academic Publishers.

Couper, M.P. 2000. "Web Surveys: A Review of Issues and Approaches." *Public Opinion Quarterly* 64(4): 464–494.

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): 476–486.

Darby, M.R., and E. Karni. 1973. "Free Competition and the Optimal Amount of Fraud." *Journal of Law and Economics* 16(1): 67–88.

Dentoni, D., G.T. Tonsor, R.J. Calantone, and H.C. Peterson. 2009. "The Direct and Indirect Effects of 'Locally Grown' on Consumers' Attitudes towards Agri-Food Products." *Agricultural and Resource Economics Review* 38(3): 384–396.

Food Institute. 2009. "USDA Reports on the State of the Organics Industry." *The Food Institute Report* 82(24) (June 15).

Ford, G.T., D.B. Smith, and J.L. Swasy. 1988. "An Empirical Test of the Search, Experience and Credence Attributes Framework." *Advances in Consumer Research* 15: 239–244.

Froehlich, E.J., J.G. Carlberg, and C.E. Ward. 2009. "Willingness-to-Pay for Fresh Brand Name Beef." *Canadian Journal of Agricultural Economics* 57(1): 119–137.

Gao, Z., T.C. Schroeder, and X. Yu. 2010. "Consumer Willingness to Pay for Cue Attribute: The Value Beyond Its Own." *Journal of International Food & Agribusiness Marketing* 22(1): 108–124.

Green, P.E. 1974. "On the Design of Choice Experiments Involving Multifactor Alternatives." *Journal of Consumer Research* 1(2): 61–68.

Green, P.E., and V. Rao. 1971. "Conjoint Measures for Quantifying Judgmental Data." *Journal of Marketing Research* 8(3): 355–363.

Green, P.E., and V. Srinivasan. 1978. "Conjoint Analysis in Consumer Research: Issues and Outlook." *Journal of Consumer Research* 5(2): 103–123.

Green, P.E., and Y. Wind. 1975. "New Ways to Measure Consumers' Judgments." *Harvard Business Review* (July/August): 89–108.

Hair, Jr., J.F., W.C. Black, B.J. Babin, R.E. Anderson, and R.L. Tatham. 2006. *Multivariate Data Analysis* (6th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Harrison, R.W., A. Ozayan, and S.P. Meyers. 1998. "A Conjoint Analysis of New Food Products Processed from Underutilized Small Crawfish." *Journal of Agricultural and Applied Economics* 30(2): 257–263.

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

____. 2008b. "The Many Faces of Organic 2008." Hartman Group, Bellevue, WA.

James, J.S., B.J. Rickard, and W.J. Rossman. 2009. "Product Differentiation and Market Segmentation in Applesauce: Using a Choice Experiment to Assess the Value of Organic, Local, and Nutrition Attributes." *Agricultural and Resource Economics Review* 38(3): 357–370.

Knapton, K., and S. Myers. 2005. "Demographics and Online Survey Response Rates." *Quirk's Marketing Research Review*. Available at http://www.quirks.com (accessed June 29, 2009).

Li, J., L. Zepeda, and B.W. Gould. 2007. "The Demand for Organic Food in the U.S.: An Empirical Assessment." *Journal of Food Distribution Research* 38(3): 54–69.

Mabiso, A., J. Sterns, L. House, and A. Wysocki. 2005. "Estimating Consumers' Willingness-to-Pay for Country-of-Origin Labels in Fresh Apples and Tomatoes: A Double-Hurdle Probit Analysis of American Data Using Factor Scores." Available at http://agecon.lib.umn.edu/cgi-bin/detailview.pl?paperid=16215 (accessed August 30, 2009).

Manalo, A.B. 1990. "Assessing the Importance of Apple Attributes: An Agricultural Application of Conjoint Analysis." *Northeastern Journal of Agricultural and Resource Economics* 19(2): 118–124.

Nelson, P. 1970. "Information and Consumer Behavior." *Journal of Political Economy* 78(2): 311–329.

____. 1974. "Advertising as Information." *Journal of Political Economy* 82(4): 729–754.

Raab, C., and D. Grobe. 2005. "Consumer Knowledge and Perceptions about Organic Food." *Journal of Extension* 43(4). Available at http://www.joe.org/joe/2005august/index.shtml (accessed July 7, 2009).

Rao, A.R., and K.B. Monroe. 1988. "The Moderating Effect of Prior Knowledge on Cue Utilization in Product Evaluations." *Journal of Consumer Research* 15(2): 253–264.

Schaffner, D.J., W.R. Schroder, and M.D. Earle. 2003. *Food Marketing: An International Perspective* (2nd ed.). New York: McGraw-Hill Custom Publishing.

Schmitt, J. 2008. "'Locally Grown' Sounds Great, but What Does It Mean?" *USA Today* (October 28, p. 4B).

Stanton, J.L., and M.F. Lang. 2009. *Precision Target Marketing.* Atlantic City, NJ: Raphel Publishing.

Sterns, J., and D. Ricks. 1999. "Focus Groups as a Useful Approach to Agribusiness Research." Staff Paper No. 99-32, Department of Agricultural Economics, Michigan State University, East Lansing, MI.

Stigler, G.J. 1961. "The Economics of Information." *Journal of Political Economy* 69(3): 213–225.

U.S. Department of Agriculture. 2008. "Number of Farmers Markets Continues to Rise in U.S." AMS Report No. 173-08, Agricultural Marketing Service, U.S. Department of Agriculture, Washington, D.C.

Wang, Q., and J. Sun. 2003. "Consumer Preference and Demand for Organic Food: Evidence from a Vermont Survey." Paper presented at the American Agricultural Economics Association's annual meetings, Montreal (July 27–30).

Wirth, F.F., and K.J. Davis. 2003. "Seafood Dealers' Shrimp Purchasing Behavior and Preferences." *Journal of Shellfish Research* 22(2): 581–588.

Wirth, F.F., L.A. Love, and M.A. Palma. 2007. "Purchasing Shrimp for At-Home Consumption: The Relative Importance of Credence versus Physical Product Features." *Aquaculture Economics and Management* 11(1): 17–37.

Yue, C., H.H. Jensen, D.S. Mueller, G.R. Nonnecke, and M.L. Gleason. 2005. "Assessing Consumers' Valuation of Cosmetically Damaged Apples Using a Mixed Probit Model." Working Paper No. 05-WP 419, Center for Agricultural and Rural Development, Iowa State University, Ames, IA.

Zepeda, L., and C. Leviten-Reid. 2004. "Consumers' Views on Local Food." *Journal of Food Distribution Research* 35(3): 1–6.

Zepeda, L., and J. Li. 2006. "Who Buys Local Food?" *Journal of Food Distribution Research* 37(3): 1–11.