State-Branded Programs and Consumer Preference for Locally Grown Produce

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Revitalization of state brands is deemed important to several constituencies. Stated preference with choice experiment methods were used to elicit consumer preferences for two locally grown products: spinach, which has had a well-publicized food safety incidence, and carrots, which have had no such incidence in recent history. A full factorial design was used to implement the choice experiment, with each commodity having four identical attributes varying at different levels. Findings reveal that consumers are willing to pay a premium for locally grown spinach marked with the *Arizona Grown* label over locally grown spinach that was not labeled. This premium was higher than the premium that would be paid for state-branded carrots. This difference highlights consumers' perceptions of "locally grown" as an indicator of safety in their food supply. Findings have important implications with respect to providing consumer value and point to differentiated positioning strategies for state-branded produce.

Key Words: state-branded produce, certification, food safety, traceability, discrete choice models

Local food markets have grown significantly since the Farmer-to-Consumer Direct Marketing Act of 1976. In the 1980s, under the Reagan administration, many federal programs were shifted to the states and supported through block grants. This influx of funding prompted more states to establish branding programs intended to promote and identify all agricultural products produced within their respective state (Halloran and Martin 1989). *Something Special from Wisconsin* and *Jersey Fresh*, introduced in 1983 and 1984, respectively, are two state programs that quickly followed. By the end of the decade, an additional 15 states had similar promotion programs, focused on the production and commercialization of locally grown produce and commodities. More recently, however, funding for many state-branding programs has dwindled. As Patterson (2006) points out, many state-branding programs were reliant on the infusion of support provided by the state block grants and have not since found a steady source of funding.

Revitalization of state-branding campaigns and brands is deemed to be important to several constituencies: namely, the state's growers, processors, retailers, and consumers. State brands help consumers to delineate what is meant by the term "local"—a term currently left largely to retailer interpretation—and to gain assurance as to the credence attributes commonly ascribed to locally grown produce (e.g., freshness, reduced environmental impact, support of local economy). For members of the produce supply chain, the state brand may offer a way in which to meaningfully differentiate otherwise undifferentiated commodities. Such distinctive value should enable growers and producers to command higher margins and gain a more predictable volume of sales.

Research has indicated that consumers prefer to purchase locally grown foods and are willing to pay a premium for local food in their desire to gain fresh food products, support and grow the local economy, and reduce the environmental impact of industrial production and large transport

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distances between producers and consumers (Howard and Allen 2006, Velasquez, Eastman, and Masiunas 2005, Patterson et al. 1999, Adelaja, Brumfield, and Lininger 1990). However, with respect to assuaging food safety concerns, relatively little is known about consumers' willingness to pay (WTP) for state-branded food safety attributes. Given increasing concerns over food safety due to recent, widespread pathogen outbreaks and fear of deliberate food tampering, an investigation into consumer preferences and attributions of produce is needed.

This research examines produce attributes for which consumers are willing to pay a premium and which states should promote in their marketing campaigns. In particular, we focus on food safety and traceability attributes to determine if these attributes play a role in the choice of locally grown and state-branded products. It is believed that credence attributes such as "food safety," "traceability," "certification," and "brand" should positively impact consumers' perceived utility and consumers' willingness to pay a premium. To ascertain whether these product attributes provide food safety benefits to consumers, an experiment containing two different types of produce—one that has had a food safety outbreak in recent years and one that has not—is employed. The first product, spinach, has had a recent, well-publicized food safety incidence. In 2006, a widely known *E. coli* outbreak in the United States that sickened over 200 people in 26 states was linked to fresh spinach (Centers for Disease Control and Prevention 2006). The second product, carrots, has had no such incidence in recent history. These vegetables were also selected because they are currently produced within Arizona's state borders, the state where the data was collected. We hypothesize that consumers will exhibit a higher WTP for state-brand certification for produce that has had a recent food safety outbreak. Conjoint choice experiments and random utility discrete models are used to estimate consumer preferences and WTP for attributes associated with state brand and locally grown, with specific emphasis on perceived food safety and traceability benefits.

This research is organized as follows: next, a brief review of conjoint analysis and its linkage with preferences for state-branded products is presented; the experimental design and data are then described; the estimation procedure and results from the random utility discrete choice models are reported; and lastly, we conclude with a discussion of the results for the marketing of state brands and locally produced foods.

Conjoint Analysis and Preference for State-Branded Products

Conjoint analysis is a multivariate technique used traditionally to elicit preferences and, more specifically, to understand how respondents develop preferences for products. The process involves several steps: first, the product attributes of interest are identified; next, different levels (or values) of the product attribute are determined and used to formulate numerous profiles of the product; lastly, respondents are asked to choose from a set of hypothetical products with differing attribute levels (Louviere, Hensher, and Swait 2000). Respondents are not directly queried on the importance of each product attribute; rather, the importance of each product attribute is determined from respondents' stated preferences. By considering product attributes jointly, the researcher is able to observe trade-offs made between product attributes. Because consumers are asked to make a discrete choice and select one product among a set of alternative state-branded products, conjoint analysis mimics a typical consumer-purchasing scenario, whereby consumers seek to maximize their utility. Thus, conjoint analysis is consistent with Lancaster utility maximization and consumer demand theory. The discrete choice and utility maximization frameworks are discussed next.

Utility Maximization and Discrete Choice Random Utility Models

The link between conjoint analysis and preferences for state-branded programs can be explained further with the Lancaster utility maximization framework and the discrete choice random utility model. Lancaster (1966) refined the idea of utility maximization by defining the choice process in terms of product characteristics, as opposed to the product itself. Therefore, the source of an individual's utility is derived from the attributes of a product, which are representations of the objective characteristics of a good. For example, in fresh produce the measurable characteristics of size, brand, and certification correspond to the attributes of nutrition, convenience, and safety, which are unique to each consumer in terms of measurement. Lancastrian theory holds that utility should be a function of quantifiable characteristics—as opposed to attributes, which are subjective in measurement. Based on Lancastrian theory, model specifications are built to measure the part-worth values of the produce characteristics. A preference function that uses independent dummy variables to relate each attribute level to the utility function is known as a part-worth utility model. Such a model imposes no structure of continuity on the relationship of attribute levels to utility (Gustafsson, Herrmann, and Huber 2001). The part-worth utility model is employed to appropriately handle the attributes of location, certification/safety, and traceability, none of which is conducive to a metric scale. Only with the variable of price do we assume a continuous negative relationship, so that

$$V_{ij} = x_j\beta + p_j\pi + \varepsilon_{ij}\,, \tag{1}$$

where V_{ij} denotes the individual's indirect utility from choosing product j, x_j is a vector of product attribute level j's, p_j is price for product j, β is a conformable vector of coefficients, π is a conformable coefficient to be estimated, and ε_{ij} is an error term.

The main effects are estimated by an additive linear function. The effects will indicate how utility is affected by the level of the attribute when it is isolated from all other attributes. Higher-order effects will indicate whether utility is also affected when two attributes are presented in tandem (Louviere, Hensher, and Swait 2000). To incorporate the combination effects of attributes by interacting product attribute levels, the equation is modified, so that

$$V_{ij} = x_j\beta + p_j\pi + c_{ij}\chi + \varepsilon_{ij}\,, \tag{2}$$

where c_{ij} is a vector of combination effects from product attribute level i's interacted with product attribute level j's, and χ is a conformable vector of coefficients to be estimated.

A final dimension is added to the model which reflects the preference variation among the population. In order to differentiate among preferences of various sub-populations, socioeconomic characteristics are incorporated by adding interaction terms with the different attribute level variables, so that

$$V_{ij} = s_{ij}\alpha + x_j\beta + p_j\pi + c_{ij}\chi + \varepsilon_{ij}\,, \tag{3}$$

where s_{ij} is a vector of socioeconomic variables i's interacted with product attribute level j's, and α is a conformable vector of coefficients to be estimated.

We assume that the difference of the error $\varepsilon^i_{AB} = (e^i_A - e^i_B)$ is a logistically distributed error term (Domencich and McFadden 1975, Darby et al. 2008). However, since respondents are required to make choices from four alternative product categories (grown in Arizona, grown in other regions in the U.S., grown outside the U.S., or elect to purchase none of the carrots or spinach products), their discrete logistic choice of zero or one reduces to a multinomial logit model.[1] The final model specification is presented in equation (4):

$$\begin{aligned} Y_j = {} & \beta_1 + / - \beta_2 PRICE - \beta_3 TRACE + / - \beta_4 AZG \\ & + / - \beta_5 USDA + / - \beta_9 AZGAGE \\ & + / - \beta_{10} AZGINC + / - \beta_{11} AZGEDU + \varepsilon. \end{aligned} \tag{4}$$

As indicated earlier, three characteristics are interacted with the *Arizona Grown* attribute to estimate the quadratic interaction effects of these variables. The signs on parameters indicate hypothesized signs based on previous literature or focus group indication.

It is assumed that the decision to choose "none or indifferent" is the base category and is made outside of the modeling framework. Therefore, the probability of choosing the "none" category is indeterminate in our conjoint experiment. Nevertheless, in normalizing the coefficient of "none" to zero, the problem disappears (Amemiya and

[1] Also note that the formulation in equation (3) has two major foundations that permit us to link choice behavior stated in a conjoint choice survey and the respondent's preference for the attributes. The first is the Lancastrian utility theory, which states that consumers derive utility from attributes of a good or service, rather than from the good directly. The second is the random utility theory, which postulates that individual utility is unknown but can be decomposed into a systematic or deterministic component and the stochastic error component. Thus, attributes of a good are perfectly correlated with the *service* perceived by the consumer. This theoretical distinction is useful when analysts want to examine which signals most effectively communicate the service that provides the desired utility (Darby et al. 2008).

Nold 1975). Under the distributional assumption for the random error term, the probability P_i of the ith individual preference for product j can now be expressed as

$$(5) \qquad P(Y=j)=\frac{e^{\beta_j' x_i}}{1+\sum_{k=1}^{j} e^{\beta_k' x_i}} \quad \text{for } j=1,2,\ldots j,$$

$$P(Y=0)=\frac{1}{1+\sum_{k=1}^{j} e^{\beta_k' x_i}}$$

(Louviere, Hensher, and Swait 2000).

The estimated β-coefficients of equation (4) do not directly represent the marginal effects of the independent variables on the probability P_i. Since the explanatory variable is qualitative or discrete in nature, $\partial P_i/\partial x_{ij}$ does not exist. In such a case, the marginal effect is obtained by evaluating P_i at alternative values of x_{ij}. For example, in the case of a binary explanatory variable x_{ij} that takes values of 1 and 0, the marginal effect is determined as

$$(6) \qquad \partial P_i \big/ \partial x_{ij} = P(x_{ij}=1) - P(x_{ij}=0)$$

(Train 2002). For multinomial models, the marginal effects could be estimated with equation (7):

$$(7) \qquad \frac{\partial P_j}{\partial X_i} = P_j(\beta_j - \sum_{i=1}^{m} P_i \beta_i),\ j=1,2,\ldots,m$$

(Greene 2003, p. 916). The experimental design and survey data collected are presented next.

Experimental Design and Data

To identify appropriate test attributes, focus groups and key person interviews were conducted with producers, retailers, consumers, and other stakeholders in Arizona's agriculture. Four major attributes were subsequently identified as determinant attributes in assessing food safety in produce: production location, product certification, traceability, and price (as shown in Table 1). Production location (origin) was tagged to the choices since the focus of the study is on state brands and locally grown. Therefore, choice A was always "grown in Arizona," B was "grown in other regions of the U.S.," C was "grown outside the U.S.," and D was "opt out or indifferent" between A, B, and C.

The specified attributes for each vegetable product would allow for 3 × 2 × 3 × 5 = 90 attribute levels. However, this reduces to 30 attribute levels when choices were tagged to production location. Still, a full factorial design with all permutations will yield $3^2 \times 3^3 \times 3^5 = 59{,}049$ product profiles. No single person could evaluate all product profiles. With the assumption of a common utility function for all respondents, we generated 30 product profiles for each product and eliminated all inefficient profile sets using dominance criteria. The full factorial design was reduced via PROC OPTEX, a component of SAS 8.0 that produces a D-optimal main effects design (Huber and Zwerina 1996, SAS Institute 2006). Each respondent was presented with ten sets of each product profile for a total of 20 profiles for carrots and spinach. However, respondents were given the option to complete twenty additional pairs for three intercept locations (premium grocer, farmers market, and restaurants), and tests were conducted to evaluate consistency of responses. Each profile was then randomly assigned to a choice set which contained three product profiles and one option for "no preference or indifferent." This opt-out option is important for modeling real purchase situations since it allows choices to be collectively exhaustive (Boyle et al. 2001).

Incorporating price as a variable was completed by taking the average price per pound found in three major market locations during the spring of 2009. The average price was then set as a baseline and four additional premium price points were projected for each produce item based on suggestions from the retail focus group. All specified attributes and attribute levels are presented in Table 2.

The data for the conjoint experiment was collected using self-administered written surveys. Consumers were intercepted at a variety of food retailing outlets: a traditional supermarket, a premium grocer which carries higher-end fare, an open-air farmers market, and a locally owned restaurant that serves moderately priced cuisine. Data was collected from the four locations from May through June of 2009—during the midst of the recent recession. Intercept locations were cho-

Table 1. Sample Choice Design

	❒ Choice A	❒ Choice B	❒ Choice C	❒ Choice D
Product origin	Grown in Arizona	Grown in U.S.	Grown outside the U.S.	I prefer none of these alternatives.
Traceability	Traceable	Traceable	Non-Traceable	
Certification	USDA	--	USDA	
Price	$0.95/lb.	$0.65/lb.	$1.25/lb.	

Table 2. Attributes and Levels for Conjoint Analysis

Carrots		Spinach	
Product Attribute	Levels	Product Attribute	Levels
Production origin	Grown outside of U.S.	Production origin	Grown outside of U.S.
	Grown in U.S.		Grown in U.S.
	Grown in Arizona		Grown in Arizona
Traceability	Traceable	Traceability	Traceable
	Non-traceable		Non-traceable
Certification	USDA	Certification	USDA
	Arizona Grown		*Arizona Grown*
	(blank)		(blank)
Price per pound [a]	$0.65	Price per pound	$1.85
	$0.80		$2.10
	$0.95		$2.35
	$1.10		$2.60
	$1.25		$2.85

[a] The mean price for carrots equaled $0.831, with a standard deviation of $0.201. The mean price for spinach was $2.171, with a standard deviation of $0.328.

sen for their proximity to urban, suburban, and rural populations, as well as for the diverse demographic populations that each serves. Each location was visited on both weekdays and weekends between the hours of 10:00 a.m. and 6:00 p.m.

Upon entrance to the retail locations, customers were approached and informed about the research project being conducted. They were queried about whether they purchase fresh spinach and fresh carrots and then offered the opportunity to complete a 15- to 20-minute survey regarding their preference for fresh produce. Each willing participant was confirmed to be over 18 years of age and offered $10 compensation. After reading and agreeing to the university's consent form, each respondent was given a seat at the interviewers' stand and administered a paper copy of the survey instrument.

Section I of the survey asked each respondent to complete questions designed to assess consumers' revealed preferences and perception about local produce from the state of Arizona. Section II elicited stated preference information for the conjoint analysis. Nondescript pictures of both carrot and spinach bunches were included as a visual reference to emphasize the uniformity of paired product characteristics and to add realism. Attribute definitions were provided and the choice scenario was then presented. The following is an example:

> Imagine that you are purchasing carrots/spinach and there is a variety of fresh carrots/spinach to choose from. The carrots/spinach are (is) all offered in a 1-lb. bunch. The carrots/spinach differ(s) only on the four attributes defined below (certification/safety, product origin, traceability, and price). On all other attributes, the carrots/spinach are (is) identical. Any purchase that you decide to make will have the effect of reducing the money available to you and your family for other purchases.
>
> *Certification/safety*. Indicates the product has met or exceeded certain safety and production requirements.
>
> *Product origin*. Specifies where the carrots/spinach are grown: in Arizona, in the United States, or outside of the United States.
>
> *Traceability*. Indicates that the carrots/spinach can be traced to the farm where they were grown.
>
> *Price*. Indicates the price per pound.

Actual, continuous price data were used. The mean and standard deviation of these prices are reported in Table 2.

For the purposes of the survey, produce certified "USDA" was presumed to have met the USDA quality and condition standards for vegetables. Section III asked demographic questions. After completion, each survey was visually checked for completeness and the respondent signed a form indicating receipt of the compensation.

Sample Overview and Descriptive Statistics of Data

The entire sample includes 315 total respondents: 108 from a traditional supermarket, 82 from a premium grocer, 75 from a farmers market, and 50 from a local restaurant (see Table 3). Respondents are the number of people intercepted at each location who agreed to participate in this study. The number of observations refers to the total number of conjoint experiments completed and is for both vegetable products.

Table 3. Number of Respondents and Observations by Intercept Location

Store Type	Respondents	Observations
Basic grocer	108	2,160 (108 × 20)
Premium grocer	82	4,920 (82 × 60)
Farmers market	75	4,500 (75 × 60)
Restaurant	50	3,000 (50 × 60)
Total	315	14,580

Note: In the "Observations" column, "20" indicates one pair of 10 choices for carrots and one pair of 10 choices for spinach, while "60" indicates 3 pairs of 10 choices for carrots and 3 pairs of 10 choices for spinach.

Population Representation

Five demographic categories—income, age, education, gender, and race—of the sample were compared to those of the state as a whole. Using the 2000 Census data for Arizona as a basis for comparison, the sample's distribution of gender and race is similar (see Table 4). Income is skewed toward the upper levels, which may be the impact of self-reporting bias. The age of the sample population represents a younger demographic than that of the state. A noticeable difference exists in the education levels, with the sample group reporting much higher levels of overall education than those of the state.

Sub-Sample Demographics

The sample was also analyzed by data collection location (see Table 5). A comparison of the demographics of sub-sample respondents shows that the age and income were found to be lower at the basic grocer than other locations. The highest mean age was just over 49 years, reported at the premium grocer. This location also had the fewest respondents with post–high-school education. The location with the highest percentage of post–high-school education was the farmers market. The highest mean household income was reported at over $82,000 per year at the restaurant location. Over 80 percent of respondents reported being the primary grocery shopper at each location, with over 90 percent being represented at the restaurant location. All locations had at least 70 percent of respondents reporting their race as white. The location with the lowest percentage of whites was the basic grocer, which reported 73.15 percent; the highest percentage was at the premium grocer, at 85.37 percent.

To help shed light on consumer preference for state produce, respondents answered questions pertaining to their attitudes, perceptions, and purchasing behavior. The mean was derived for each item and statistical tests were conducted to identify the differences among sub-groups of the sample.

Table 4. Demographic Comparison

Demographic		Sample %	Arizona %[a]
Age	18–25	22.76	10.04
	26–35	21.47	20.56
	36–45	19.23	21.28
	46–55	14.74	17.38
	56–65	14.42	12.23
	65+	7.37	18.49
Annual household income	< $10K	8.36	8.60
	$10K–25K	12.86	20.30
	$25K–50K	22.51	31.50
	$50K–75K	22.83	19.20
	$75K–100K	16.72	9.70
	$100k–150K	10.61	6.90
	$150K+	6.11	3.90
Race	White	79.17	77.90
	Hispanic	11.54	13.20
	African American	3.21	3.60
	Asian	4.49	2.30
	Native American	1.60	0.30
Education	Some high school	2.88	11.20
	High school grad	13.10	24.30
	Some college	39.94	26.40
	College grad	27.16	21.90
	Graduate school	16.93	8.40
Gender	Male	45.69	49.90
	Female	54.31	50.10

[a] Source: U.S. Census data (for 2000).

Table 5. Sample Demographics by Data Collection Location

Variable	Full Sample	Basic Grocer	Premium Grocer	Farmers Market	Restaurant
Mean household income	$70,739	$60,175	$75,000	$73,972	$82,291
Mean age of respondent	44.87	40.19	49.63	47.13	43.72
Gender – % female	54.31%	51%	46.34%	56.00%	72.92%
Primary shopper – %	84.66%	80.56%	85.37%	85.33%	91.67%
Race – % white	79.17%	73.15%	85.37%	84.00%	74.47%
Education – % post high school	84.03%	85.19%	76.83%	88.00%	87.50%

Purchasing Behavior

It is believed that brand awareness drives both purchase intent and behavior. Respondents were presented with a picture of the *Arizona Grown* brand label and asked to reveal if they were aware of such a brand; response choices included "yes," "no," and "unsure." Respondents were also asked to indicate their purchase frequency of locally grown produce on a scale of 1=daily, 2=weekly, 3=bimonthly, 4=monthly, or 5=never. These responses were then grouped into positive and negative/unsure categories and cross-tabulated (see Table 6). The results indicate that the group that was aware of the *Arizona Grown* brand purchased locally grown vegetables more frequently (2.49) than the group that was unaware/unsure (3.24).

Consumer Attitudes

Respondents were asked about the importance of a number of produce-related attributes. Mean scores were generated for the population and for each data collection site subgroup. The results were analyzed by applying the Tukey-Kramer test for mean difference among groups at a 0.05 significance level. Many of the subgroups were found to be significantly different. All subgroups had significantly different mean responses for the factors *organic*, *product origin*, *environmentally friendly production practices*, and *production method*. The results are presented in Table 7. However, the top five rated choices for the total population are (in order) taste (1.21), freshness (1.22), appearance (1.48), USDA food safety guidelines (1.66), and past purchase experience (1.68). These were consistent across subgroups, indicating that differences in consumers' attitudes were scalar in nature.

Consumer Perception

A series of statements about the importance of the *Arizona Grown* brand were listed and respondents were asked to indicate how strongly they agreed or disagreed with each. Each response was given a score in the range of 5 (strongly agree) to 1 (strongly disagree), with 3 being neutral. The goal was to elicit perceptions about food safety, nutrition, and production standards associated with the brand.

After mean responses were generated, a Tukey-Kramer procedure was used to identify the response differences between the population and subgroups at a 0.05 significance level. The subgroup with the most significant differences from the population was the farmers market patrons. Table 8 displays the results of this analysis. The three statements (in order) that best represent produce bearing the *Arizona Grown* label are: (i) more supportive of local farmers, (ii) more desirable, and (iii) healthier than conventionally grown produce. Again, test statistics indicated that the differences between subgroups were scalar in nature: ordering for "less desirable," "less healthy," and "worst for the environment" did not vary significantly among the locations (Table 8).

Estimation Procedure and Results

To begin the estimation procedure for the discrete choice models, the regularity of preferences is tested within the consumers of carrots and spinach, as well as within the respondents from different locations. Inevitably, price sensitivity will vary for each surveyed household; this variance will be captured by the random error term. The model relies on a distribution of random components that are independent and identically distributed (IID). Thus, it is necessary to extract any systematic variance within the sample or determine whether the data should be aggregated. In order to identify if that variance exists, the overall goodness of fit is compared between sub-samples. The model was first estimated based on sub-samples of the two different vegetable products. When comparing the measure of fit, a test statistic is generated that indicates the probability that the subsamples have significantly different preference structures (Louviere, Hensher, and Swait 2000).

If we assume L (>1) different consumer characteristics to test for systematic variance between subsamples, then the utility function for a consumer with characteristic 1 is

$$U_l = \beta_0 + \beta_l X_l + \varepsilon_l, l, ..., L \,, \tag{8}$$

where ε_l is a random error term. The null hypothesis states that consumer characteristics do not affect the parameters $\beta_l, l, ..., L$, or $H_0 : \beta_1 = \beta_2 = ... \beta_x = \beta$.

Table 6. Purchase Frequency of Locally Grown by Brand Awareness[a]

Brand Awareness	Sample Size	Mean	Standard Deviation	P-value
Aware	140	2.49	0.88	0.00
Unaware/unsure	173	3.24	0.01	0.00

[a] Purchase scale is 1 = daily, 2 = weekly, 3 = bimonthly, 4 = monthly, and 5 = never.

Table 7. Important Characteristics When Buying Fresh Produce[a]

Characteristic	Mean	Basic Grocer	Premium Grocer	Farmers Market	Restaurant
Product origin	2.04	2.25*	1.93*	1.54*	2.5*
Production method	2.07	2.43*	1.9*	1.5*	2.42*
Price	1.75	1.56*	1.74	1.97*	1.88
Fair labor practices	2.09	2.06	2.43*	1.73*	2.16
USDA safety standards	1.66	1.56	1.57	1.87	1.74
Taste	1.21	1.16*	1.2	1.1*	1.48*
Organic	2.29	2.56*	2.41*	1.76*	2.26*
Traceable	2.34	2.59*	2.23	1.89*	2.68*
Environmentally friendly	1.9	2.08*	2.03*	1.44*	2.18*
Brand name	3.0	2.7*	2.9*	3.5	3.04
Freshness	1.22	1.22	1.24	1.18	1.26
Appearance	1.48	1.4	1.43	1.67	1.42
Past purchase experience	1.68	1.7	1.68	1.78	1.5

[a] 1 = very important, 3 = neutral, and 5 = not important.

Note: * indicates significant at the 0.05 level.

Table 8. Consumer Perception about *Arizona Grown* Brand[a]

Descriptive Statement	Mean	Basic Grocer	Premium Grocer	Farmers Market	Restaurant
Fresher	3.75	3.61	3.81	4.08*	3.43
Superior taste	3.34	3.22	3.4	3.62*	3.07*
Less healthy	2.14	2.52*	2.05	1.6*	2.26
Worse for environment	2.27	2.38	2.0	2.5	2.27
Exceeds USDA guidelines	3.33	3.39	3.4	3.34	3.02
More susceptible to contaminants	2.32	2.48	2.23	2.09	2.46
More supportive of local economy	3.84	4.07	4.55*	3.84	4.08
More supportive of local farmers	4.09	3.86	4.18	4.51*	3.84*
Less responsible production	2.4	2.57	2.37	2.09	2.56
Less desirable	2.09	2.43*	1.88	1.68*	2.32*

[a] 1 = strongly disagree … 5 = strongly agree.

Note: * indicates significant at the 0.05 level.

Once the model is estimated for each of the (L) characteristics, using the subsample data as a source, the log likelihood value at convergence LL_l is obtained. The log likelihood value, LL_j, is obtained from the model estimated from pooled subsample data sets. The test statistic is then calculated from the formula $-2(LL_J - \Sigma LL_l)$, which has a chi-squared distribution with $K(L-1)$ degrees of freedom, where $K = \beta$. If the calculated chi-squared statistic is greater than the critical chi-squared value, then the null hypothesis is rejected. This study uses $L = 8$ characteristics, which produces a critical value of 25.121 at the 0.005 significance level. Jointly, the pooled data has $LL_J = -8937$, and the summation of the individual log-likelihood functions equals –8915. The outcome of the above calculation yields a test statistic of 42, which is greater than the proposed critical value. The null hypothesis ($H_0 : \beta_1 = \beta_2 = ... = \beta_x = \beta$) is rejected, indicating that a separate model would be required for carrots and spinach. Similar tests were performed for data collected from all four locations (traditional supermarket, premium grocer, farmers market, and local restaurant), and the test statistics were lower than the critical values, indicating that the data from these locations could be aggregated. This was consistent with the results in Tables 7 and 8, indicating consistent rankings for the top three to six characteristics.

Using a full information maximum likelihood procedure for a multinomial-logit (MNL) model in the statistical software package NLOGIT 4.0, findings reveal that the models for both carrots and spinach fit the data well. The goodness-of-fit statistics for both models, the two subgroups, are presented in Table 9. The chi-squared statistics have corresponding p-values of 0.000 for both

Table 9. Overall Fit for Conjoint Model for Each Vegetable Group

	Carrot	Spinach
Likelihood function value	-4,567.63	-4,355.11
Pseudo R-squared	0.433	0.473
Chi-squared statistic	6,993.73 (0.000)	7,837.31 (0.000)
Percentage of correct predictions	66%	66%

models. In addition, the pseudo R-squared (ρ^2) value, or likelihood ratio index, is both positive and above 0.4, which indicates that we should reject the null hypothesis that the probability (P_i) of an individual choosing alternative i is independent of the parameters in the MNL model. The ρ^2 statistic is calculated as

$$\rho^2 = 1 - [L^*(\hat{\beta}) / L^*(0)], \tag{9}$$

where $L^*(\hat{\beta})$ is the maximized value of the log-likelihood function and $L(0)$ is the value of the log-likelihood function evaluated at the aggregate share probability. A ρ^2 value of 0.2–0.4 is considered to be indicative of an extremely good model fit. In a linear model, these test statistics equate to R-squared values of 0.7–0.9 (Louviere, Hensher, and Swait 2000).

Estimated results for carrots and spinach are presented in Tables 10 and 11. Recall that only the coefficients for choice A, B, and C (grown in Arizona, grown within the U.S., and grown outside the U.S.) are provided in a multinomial logit estimation. The coefficients for "none or indifferent" serve as the base choice and are normalized to one.

The results indicate that the quadratic interaction terms of the demographic variables of age, income, and education have a significant impact on choice of the *Arizona Grown* brand. The signs of all the quadratic interaction terms were as predicted, except for age with the carrot model. The model estimates show that both commodities have the expected sign for the price coefficient. The traceability was positive but not significant. This is an indication of a protest bid and will be explored further in the WTP subsection. With respect to certification, the parameters had mixed results. The correct sign was estimated for USDA and *Arizona Grown* certification for carrots and spinach. These certification standards would apply to produce grown outside the United States, indicating a possible explanation for the negative coefficients for this choice. Overall, consumers perceive certified produce to be safer. Further interpretation of the results is better with the marginal effects and WTP estimates because the coefficients of discrete choice models are different from those of linear econometric models (Greene 2003). The marginal effects and WTP results and discussion are presented in the following sections.

Table 10. Parameter Estimates and Marginal Effects for Carrots

Product-Specific Attribute	Y = 1	Marginal Effects	Y = 2	Marginal Effects	Y = 3	Marginal Effects
Constant	-16.22*	-0.45*	-14.34*	0.44*	-13.62*	0.008*
Price	-26.65*	0.31*	-25.33*	-0.31*	-26.8*	0.003*
Traceability	3.86	-0.1	4.29	0.1	3.6	-0.002*
Certified *Arizona Grown*	2.67*	0.29*	1.43*	-0.29*	-2.23*	-0.002
Certified USDA	3.1*	-0.02*	3.34*	0.08*	-9.12	-0.057
Arizona Grown × age	-0.49*	0.013*	-0.55*	-0.01	-0.71*	-0.008*
Arizona Grown × income	0.157*	0.003	0.142*	0.003	0.08*	-0.002
Arizona Grown × education	0.033*	0.07*	0.002*	0.007*	-0.079*	-0.004*

Note: * indicates significance at the 0.05 level. Y = 1 is grown in Arizona, Y = 2 is grown in the United States, and Y = 3 is grown outside the United States.

Table 11. Parameter Estimates and Marginal Effects for Spinach

Product-Specific Attribute	Y = 1	Marginal Effects	Y = 2	Marginal Effects	Y = 3	Marginal Effects
Constant	-11.19*	-0.396*	-9.59*	0.379*	-8.49*	0.013*
Price	-8.56*	0.126*	-8.03*	-0.127*	-8.86*	0.003*
Traceability	2.46	-0.163	3.15	0.168	2.06	-0.004*
Certified *Arizona Grown*	1.13*	0.064*	1.02*	0.002*	-8.71*	-0.065*
Certified USDA	1.58*	0.294*	0.36*	-0.294*	1.17	0.0006
Arizona Grown × age	-0.2*	0.005*	-0.22	-0.004*	-0.3	-0.0006*
Arizona Grown × income	0.59*	0.007	-0.62	-0.006	-0.83	-0.001
Arizona Grown × education	0.62*	0.006	0.65*	-0.005	-0.76	-0.0009*

Note: * indicates significance at the 0.05 level. Y = 1 is grown in Arizona, Y = 2 is grown in the United States, and Y = 3 is grown outside the United States.

Marginal Effects, WTP Analysis, and Implications

Variables related to *Certification* had a significant impact on consumers' perceived utility. An increase in the level of certification, at both the state and national level, has a positive impact on the utility derived by consuming locally grown spinach. However, the same is not true for carrots. Consumers may be more concerned with the recent *E. coli* recall for spinach. Carrots reflect an increase in utility only for an increase in the national certification standard.

Marginal willingness to pay can be calculated from the marginal rate of substitution between a coefficient, θ_k, and the coefficient for the price parameter, θ_{price}, so marginal willingness to pay (MWTP) for an increase in an attribute is calculated as

$$\text{MWTP}_k = -\frac{\theta_k}{\theta_{price}},$$

with the absolute value of θ_{price} representing the marginal utility of income. By factoring out a consumer's marginal utility of income, the coefficients in Table 10 and Table 11 can be translated into willingness to pay in currency units. Since each variable has a part-worth utility associated with it, each attribute can be priced accordingly.

The estimates of WTP illustrate the importance of labeling in the marketing of locally grown produce (see Table 12). The marginal utility of income is over 50 percent larger for spinach than it is for carrots.

Table 12. Willingness-to-Pay Estimates for *Arizona Grown*

	Carrot [a]	Spinach [a]
Marginal utility of income	$26.65	$8.56
Traceability	$0.00	$0.00
Certified *Arizona Grown*	$0.10	$0.18
Certified USDA	$0.11	$0.13

[a] In dollars per pound.

A review of Table 12 shows a much higher WTP for spinach than carrots with regard to the *Arizona Grown* certification. Recall that this estimate is based on the referent alternative of "no label." Initial analysis indicates a higher sensitivity toward the perceived safety of a commodity with a recent food safety outbreak. Also, traceability was not significant, indicating zero WTP estimates for both commodities. WTP estimates for branded, locally grown food are comparable to existing research, which has estimated premiums between 17 and 23 percent. The results of this study indicate percentage increases ranging from 18 to 27.7 percent.

Consumers were willing to pay a premium of $0.18 per pound for locally grown spinach marked with the *Arizona Grown* label over locally grown spinach that was not labeled. This premium was higher than the $0.10 premium that would be paid for locally branded carrots. This difference highlights consumers' perception of "locally grown" as an indicator, or "cue," of safety in their food supply. Additionally, local produce bearing the *Arizona Grown* label had a higher WTP than local produce labeled USDA-certified. The gap between labels was lessened, but still significant when associated with spinach. This result suggests the brand association consumers have between local food and safe food.

Interestingly, the premium garnered by traceability was not significantly different from zero. This can be interpreted as a protest bid. Since traceability is a public good, we can conclude that a consumer may not fully understand the benefits of *ex post* food safety systems. *Ex post* traceability systems can perform an important economic function in limiting costs from a food safety outbreak, or maintaining consumer confidence in an industry after such an incidence. However, tracing backwards does little to reduce consumer information asymmetry and improve food safety. In other words, the good is assumed by consumers to have a positive impact on social welfare but not on individual utility. In one instance, a respondent commented: "Why would I be willing to pay for my neighbors' safety? If I get sick, I get sick." The difference in consumers' preference for food safety versus their preference for traceability should be highlighted. Admittedly, the consumer is expecting the industry and federal agencies to incur the direct cost of traceability. Alternatively, the industry has to market food safety jointly with traceability.

Conclusion

The part-worth utility of each commodity attribute was estimated. Consumers' willingness to pay was then calculated and compared across commodities. Findings reveal that consumers are willing to pay a premium of $0.18 per pound for locally grown spinach marked with the *Arizona Grown* label over locally grown spinach that was not labeled. This premium was higher than the $0.10 premium that would be paid for state-branded carrots. This difference highlights consumers' perceptions of locally grown as an indicator, or "cue," of safety in their food supply. Additionally, consumers have a higher WTP for local produce bearing the *Arizona Grown* label than for local produce labeled USDA-certified. The gap between labels was lessened, but still significant when associated with spinach. This result corroborates the association consumers have between local food and safe food. Interestingly, traceability carried a not significant to zero WTP in both commodities; this may be explained by it being an *ex post* attribute that may be regarded as a public good. That is, consumers perceive traceability as having minimal direct contribution in reducing food risks. This finding is consistent with a protest bid notion. Respondents who were aware of the *Arizona Grown* brand nearly doubled their purchase frequency of locally grown produce. Other WTP expectations were consistent with previously tested attributes and studies. These findings have important implications with respect to providing consumer value and point to differentiated positioning strategies for state-branded produce.

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