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Assessing Consumer Willingness to Pay for Value-Added Blueberry Products Using a Payment Card Survey

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This study offers insights on consumer acceptance and willingness to pay for three value-added blueberry products. A modified payment card approach was used. The analytical framework adopted allows the researcher to attach straightforward economic interpretation to the estimated impacts of willingness to pay factors. Results show consumer socio-economic characteristics are important determinants but play different roles depending on the products. Information on health benefits may also be important. However, it is found that outside information or consumer self-stated awareness of blueberries' health benefits have different impacts. These impacts may function as substitutes rather than complements to each other.

Key Words: blueberry, payment card contingent valuation, value-added, willingness to pay

JEL Classifications: D12, Q13

The U.S. value-added agriculture was estimated to be worth $80 billion in 2002 (Erickson et al., 2004) and this sector was anticipated to continue growing at the rate of about 7% a year (Arno, 2005). All 50 states in the United States have established various forms of programs specifically designed to facilitate the development of value-added agriculture (Roe, 2005). These programs may include quality and safety guarantees (Carriquiry and Babcock, 2007; Hu, Woods, and Bastin, 2009; Lapan and Moschini, 2007), functional food traits creation (Giannakas and Yiannaka, 2008; Singletary and Morganosky, 2004), and product traceability and identity preservation (Hobbs, Bessell, and Kerr, 2006; Huygen, Veeman, and Lerohl, 2004). Producers also pursue direct marketing strategies (Baer and Brown, 2006; Ellerman, McFeeters, and Fox, 2001) and forward integration through producer organizations or cooperatives (McKee, 2006; Puaha and Tilley, 2003).

Currently most of the value-added strategies allow producers to capture a greater share of consumer expenditures. The effectiveness of those strategies relies on the understanding of consumers' perception of visible product traits

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(e.g., packaging, color) and awareness and knowledge of intangible benefits, such as health or nutritional values (Ehmke et al., 2008; Lusk and Parker, 2009). Information plays a vital role. However, there is paucity in research to understand and differentiate the impacts from consumers' prior knowledge and information given exogenously. Are these two different sources of information both important in consumer purchasing decisions? If so, do these sources have equal impact on consumption? Would their impact be complimentary to each other? The first contribution of this research is to explicitly address the development of effective value-added strategies through examining influential factors in consumer's purchasing decisions including impacts of health information exposure and consumer prior health knowledge.

Using survey data collected in Kentucky, we focus on three new value-added blueberry products: blueberry herbal tea, blueberry basil vinegar, and blueberry syrup. Most past studies on horticultural products focused on fresh items (e.g., Smith, Huang, and Lin, 2009). Thus the second contribution of this research is to offer a view on the less examined processed, multi-ingredient products. While the efficiency of agriculture production has greatly improved over the past several decades, farmers only receive less than 10% of consumer's overall expenditures on food and this percentage is expected to continue shrinking (Ellerman, McFeeters, and Fox, 2001). Commodity prices typically change very little, while variations in the value of processing can be large (Cowan, 2002). In addition to reducing waste fresh products, for farmers developing and processing the end products themselves, values created in this process will return as farmers' profit. This could be particularly important for small-sized producers.

We examine whether the three new products considered will receive enough consumer support to warrant profitable production in Kentucky. Consumer preference and willingness to pay (WTP) for these three products are elicited through a modified payment card contingent valuation method proposed by Hu (2006). Unlike conventional payment card questions, the modified approach allows respondents to state a true zero as their WTP. We then adopt an analytical framework that offers a more direct interpretation of the estimated parameters than what has often been applied in the literature, thus, making it our third contribution. Following the new product development literature, we also match consumer WTP with various consumer characteristics to determine the proper segmentation of consumers in order to inform effective marketing strategies (Sumberg and Reece, 2004).

Implications of results from this research are not limited to blueberry products or within Kentucky only. The insights gained from our results are useful for illustrating the importance of marketing research in (new) value-added product production planning, testing, promotion, merchandizing, and pricing strategies development. The same method and analysis adopted in this study can be readily extended to other products in other states or countries.

The Survey and Data

In the United States, blueberries are conventionally produced primarily in New England (wild lowbush varieties), New Jersey, the Northwest states, and Upper Midwest areas (highbush varieties). Kentucky producers have only recently realized the potentials of blueberries. Blueberries, while still produced on small acreages, and primarily for local fresh markets, are the third most popular berry crop in Kentucky following strawberries and blackberries (Ernst and Woods, 2004). While fresh market blueberries bring decent returns, it is not practical to target the entire yield exclusively at the fresh market. Quality, harvest timing, and market seasonality considerations make the development of value-added blueberry products particularly interesting to growers.

To elicit consumer WTP for the three blueberry products, we conducted an in-store survey in the state of Kentucky, between May and September 2007. The survey was funded by the University of Kentucky New Crop Opportunity Center. The survey period coincided with in-season blueberries on the market. This allows consumers to have a better conceptual connection with these new products since many of them have consumed fresh or processed blueberry

products, or seen these products on display in stores during this time.

In each grocery store, a table or booth was set up where shoppers were intercepted and invited to participate in the survey. After the survey, respondents were debriefed about how the data collected might be used and each received a $5 gift card from the store. Major advantages of conducting an on-site survey include fast sample collection process and a relatively high response rate. In this context, response rate is defined as the percentage of individuals who agreed to participate in the survey over all individuals approached (Lessler and Kalsbeek, 1992). Although a precise measure is difficult to record, based on our estimate, the overall response rate in our surveys was well above 50%.

Potential drawbacks associated with an in-store survey may typically be linked to moderator bias and sample selection bias. To reduce possible moderator bias, faculty and students from University of Kentucky conducting the survey met regularly to ensure everybody gave the same interpretation of the survey instruments and used the same approach when intercepting shoppers. Typical protocols for on-site surveys were followed, such as allowing only one individual among a group to fill out the questionnaire. Each survey site team included at least one faculty member. To mitigate sample selection bias, the sampling plan stretched over multiple locations and time frames. Stores carrying mostly groceries in four locations in Central and Northern Kentucky were visited. These locations were mostly in urban/suburban areas with one rural location. In choosing survey days and times, an effort was made to ensure each visit to a store covered both morning and afternoon, and survey visits were spread across weekends and weekdays.

Table 1 presents demographic and other characteristics of consumers in our sample. The overall sample size is 604. Sample representativeness can be established by comparing statistics of key variables with the state of Kentucky's general population. The sample is quite representative except for the household income category: the annual household income sample average is higher than the state average ($51,760 vs. $40,299). Female shoppers were also overrepresented in the sample, but females are in general more likely to be involved with grocery shopping.

To limit the response burden and to ensure each survey question received sufficient attention from respondents, WTP questions were presented to each respondent to elicit his/her WTP for only two of the three blueberry products. The two products were randomly selected and the associated WTP questions were then presented to respondents. As a result the active sample sizes used to estimate WTP for the three products were different: 372 for tea, 412 for vinegar, and 395 for the syrup. Descriptive statistics of these sub-samples are also presented in Table 1 and are very close to the overall sample suggesting the randomization was executed appropriately.

The survey questionnaire was initially developed as a result of focus group discussions and was pre-tested prior to implementation. It contained three sections, designed to be completed within 4 to 8 minutes by each respondent. The first section collected information about the respondent's household food expenditure, past blueberry purchasing experience, and future consumption intentions. The last section asked for consumer demographic information and the general health status of his/her family members. The second section presented respondents with the WTP questions. In this section, an adapted payment card approach was used. Appendix 1 presents the elicitation questions used for blueberry herbal tea and blueberry basil vinegar. Questions for blueberry syrup shared the identical format to blueberry basil vinegar except that respondents were asked to compare blueberry syrup to the common alternative, maple syrup. Following suggestions of the cheap talk literature (Cummings and Taylor, 1999), respondents were reminded to make decisions as close to their otherwise actual preference as possible.

The payment card WTP elicitation approach was initially developed by Mitchell and Carson (1989) to address survey bias in evaluating WTP toward public environmental and resource projects. Most previous studies have used the payment card method to measure respondent WTP for public goods (e.g., Brox, Kumar, and Stollery, 2003), but Hu et al. (2006) and Hu (2006) adopted this approach in the context of food

Table 1. Sample Statistical Characteristics

	Full Sample		Tea		Vinegar		Syrup		
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Description
MALE	0.321	0.467	0.341	0.474	0.333	0.471	0.290	0.454	Dummy variable; 1 for male
AGE	43.707	16.666	43.634	15.864	44.283	16.907	43.177	17.118	Continuous variable; year of age
INCOME	51.763	37.326	53.638	37.776	50.207	35.975	51.640	38.198	Continuous variable; annual household income before tax ($ thousand)
EDU	14.589	2.694	14.815	2.749	14.423	2.696	14.553	2.624	Continuous variable; year of education
FULL	0.518	0.500	0.574	0.495	0.501	0.500	0.484	0.500	Dummy variable; 1 for full time employment
HSIZE	2.621	1.378	2.690	1.428	2.589	1.341	2.590	1.365	Continuous variable; size of household
CHILD	0.320	0.466	0.339	0.473	0.319	0.466	0.302	0.459	Dummy variable; 1 for presence of children
MARRY	0.566	0.496	0.593	0.491	0.563	0.496	0.545	0.498	Dummy variable; 1 for married
DIAB	0.272	0.445	0.259	0.438	0.281	0.450	0.273	0.445	Dummy variable; 1 for presence of diabetes patient in household
HEART	0.225	0.418	0.214	0.410	0.239	0.426	0.221	0.415	Dummy variable; 1 for presence of heart disease patient in household
INDUSTRY	0.162	0.369	0.188	0.391	0.158	0.365	0.143	0.350	Dummy variable; 1 for working in food industry
AWARE	0.765	0.424	0.754	0.431	0.752	0.432	0.789	0.408	Dummy variable; 1 for being aware of health benefit of blueberries
INFO	0.551	0.498	0.579	0.494	0.546	0.498	0.531	0.499	Dummy variable; 1 for being given health information in survey
N	604		372		412		395		

products. The payment card approach, unlike the referendum type of questions, allows respondents to choose the amount that best reflects the maximum price they would like to pay for a product. Since the number of values offered in a payment card survey is limited, this approach does not face the boundary issue challenging open-ended WTP questions.

Care was taken in the design of the payment cards used in this study so that the conventional payment card approach was modified to better suit this study: Values of possible price intervals were listed directly under the WTP question rather than on separate cards. Additionally, a reference price interval was given to respondents, showing the prevalent market price ranges of some similar products to each of the three products respectively.[1] Furthermore, since the products examined in the study were food items, no prior expectation about consumer preferences between the new product and the alternatives in the market exists. Therefore, the offered payment card value ranges covered a wider scale: from far below market average price to much higher than the market average. Finally, unlike the conventional payment card method, the survey offered respondents an option to indicate that they do not wish to pay any positive amount for a product. This design allows researchers to capture true stated zero prices instead of inferring zero prices from the data.

Since prices are directly related to package size, actual products or prototypes were presented to respondents. These products were manufactured by the University of Kentucky food science lab and were professionally packaged into the standard package size. Respondents were encouraged to visually examine the actual products but no tasting was permitted. During the survey, most consumers checked the packaging and ingredients labeling of the actual products while filling out the questionnaire.

[1] Giving the reference price range may possibly generate reference price effects or the start point bias (Hu et al. 2006). However, since the price range given was merely a reflection of existing market prices, these biases are expected to occur in an actual market regardless. Further research may investigate the reference price effect in a payment card context.

Nutrition research documents that blueberry is a rich source of antioxidants and have considerable health benefits (U.S. Highbush Blueberry Council, 2002). To examine the role of the health benefits knowledge in the WTP determination, respondents were asked "are you aware of any health benefits of blueberries in addition to the general merits associated with being a fruit?" Statistics in Table 1 indicate that more than 70% of the respondents said yes, meaning they were aware of some health benefits at the time of the survey. Before respondents enter the WTP questions, the survey split the sample into two groups: the treatment group was offered additional information stating the health benefits of blueberries; the control group was not offered the information. This allows one to test whether and how nutrition information and nutrition perception may affect a respondent's WTP individually or jointly. The health benefit statement given during the survey was as follows: "Blueberries are among the fruits with the highest antioxidant activity. There is growing evidence that blueberries are an important part of a healthful diet. Antioxidants may protect the body against the damaging effects of free radicals and the chronic diseases associated with aging. Blueberries naturally contain antioxidants such as Vitamins C and E, anthocyanins, and phenolics."

Willingness to Pay Elicitation

Suggested by economic theory, a straightforward analysis is to simply regress the stated card values on various explanatory factors. This approach treats the stated card values as the true WTP. Cameron (1987) showed that this hedonic type of analysis is generally not efficient and misses the important notion that the chosen card values only reflect the lower bound of a respondent's WTP. An alternative approach is to model WTP through a random utility framework. Since the WTP for each of the three products can be analyzed by the same approach, to reduce notation complexity, the following discussion suppresses product categories. Suppose the indirect utility associated with individual i making a choice of a blueberry product can be written as:

$$(1) \quad V_i = B_i\mathbf{X}\boldsymbol{\alpha} + (M_i - B_i{*}WTP_i)\alpha_M + \mathbf{Z}\boldsymbol{\alpha}_\mathbf{Z} + e_i$$

In the above expression, B_i is an indicator variable; $B_i=1$ if the product is chosen by individual i and $B_i=0$ if it is not chosen. $\mathbf{X}$ represents individual characteristics (i.e., demographics and socioeconomic variables) and $\boldsymbol{\alpha}$ is a vector of unknown parameters associated with factors in $\mathbf{X}$.

The first term on the right side suggests that consumption of blueberry products affect individual utility through personal characteristics. This is consistent with the demand theory: variables in $\mathbf{X}$ may only matter in individual (ordinal) utility when they are jointly considered with specific consumption behavior. M_i is individual i's income and WTP_i is the individual's true willingness to pay for the product. α_M is an unknown parameter associated with these monetary variables. Note that in this case, WTP_i is a variable that is known to the respondent but not to the researcher. This assumption is the key difference between the random utility approach and the hedonic analysis. The interaction term $B_i{*}WTP_i$ is subtracted from income suggesting that when the individual decides to purchase a blueberry product, the price paid for the product decreases the utility. Vector $\mathbf{Z}$ represents all other composite goods that may affect utility and $\boldsymbol{\alpha}_\mathbf{Z}$ is the associated unknown parameter vector. Finally, e_i is an independent and identically distributed random (iid) noise term indicating that the researcher cannot measure V_i precisely.

Consider the utility function in Equation (1); individual i will choose to purchase a blueberry product, only if the marginal utility gained from consumption is the same as the utility reduced due to the price paid. In other words, the individual will make the purchase if $V_i(B_i = 0) = V_i(B_i = 1)$. After substituting $B_i = 0$ and $B_i = 1$ into Equation (1) respectively and equating the two states, individual i's WTP can be written as[2]:

$$(2) \qquad WTP_i = \frac{\mathbf{X}\boldsymbol{\alpha} + e_i}{\alpha_\mathbf{M}}$$

[2] Strictly speaking, the error term in Equation (2) is the difference between two error terms. To simplify presentation, we did not change the notation.

In a payment card question, if individual i chose a card value C_k as the highest acceptable price, the true WTP lies between card value C_k and the next card value $C_{k+1}(C_{k+1} > C_k)$. In a probabilistic term, this relationship can be expressed as:

$$(3) \qquad P(C_k \leq WTP_i < C_{k+1})$$

Substitute Equation (2) into Equation (3) and Equation (3) can be re-written as:

$$(4) \qquad P((\alpha_M C_k - \mathbf{X}\boldsymbol{\alpha}) \leq e_i < (\alpha_M C_{k+1} - \mathbf{X}\boldsymbol{\alpha}))$$

If one knows the distribution of e_i, the above probability can be evaluated. Assuming e_i follows a standard logistic distribution[3], the WTP probability can be written as:

$$(5) \qquad \begin{aligned} P(C_k \leq WTP_i < C_{k+1}) &= L(\alpha_M C_{k+1} - \mathbf{X}\boldsymbol{\alpha}) \\ &- L(\alpha_M C_k - \mathbf{X}\boldsymbol{\alpha}) \end{aligned}$$

where L is the standard logistic distribution function.

Following the same principle, if the respondent would be willing to pay zero or require to be compensated for choosing a blueberry product, the probability of the WTP is:

$$(6) \quad P(WTP_i \leq C_l = 0) = L(\alpha_M C_l - \mathbf{X}\boldsymbol{\alpha}) = L(-\mathbf{X}\boldsymbol{\alpha})$$

where C_l is the lowest value reflected by a payment card question, which in our case is zero. Following the same logic, if the respondent selects the highest card value as the acceptable price, the underlying probability that the true WTP is at least as high as this card value is:

$$(7) \qquad P(C_h \leq WTP_i) = 1 - L(\alpha_M C_h - \mathbf{X}\boldsymbol{\alpha})$$

where C_h is the highest card value offered in a payment card question. Joining Equation (5) to Equation (7), the final log likelihood function for the WTP, LL, is consistent with previous studies (e.g., Cameron, 1987) and can be expressed as:

[3] Other distributions may also be used, such as a normal distribution. Hu (2006) showed little difference between using either a logistic or a normal distribution. The logistic distribution has been chosen because it has slightly better tolerance to extreme values.

$$(8) \qquad LL = \sum_{i=1}^{N} \left(\begin{array}{l} w_l \ln(L(-\mathbf{X}\boldsymbol{\alpha})) + \sum_{k=1}^{h-2} w_k \ln(L(\alpha_M C_{k+1} - \mathbf{X}\boldsymbol{\alpha}) - L(\alpha_M C_k - \mathbf{X}\boldsymbol{\alpha})) \\ + w_h \ln(1 - L(\alpha_M C_h - \mathbf{X}\boldsymbol{\alpha})) \end{array} \right)$$

where w_l, w_k, and w_h are indicator variables which equals one when the lowest, the k-th, and the highest card value is chosen by individual i, otherwise zero.

Results

Although treating self-stated payment card values as a respondent's actual WTP may not reveal the true underlying WTP spectrum, the distribution of card values chosen by respondents for each product offers a view of the general spread of WTP. Table 2 presents the frequency of the chosen card values. For each product, the actual count and percentage of each value chosen are reported. The value that received the largest count across all three products is zero. This is typically expected in studies about food or environmental products (e.g., Cameron and Huppert, 1991). The zero bid value captures those who would not be consumers of these three blueberry products. The highest card frequency for blueberry herbal tea appeared at $4.10 (11.6%) with $3.10 following closely (11.3%). For blueberry basil vinegar, the most frequently chosen nonzero card value is also $4.10 with 10.2% of the respondents. The spike of card value frequency for blueberry syrup occurred at $3.85, representing 12.7% of the sample.

Determinants of Willingness to Pay

Table 3 reports the estimation results of the WTP function for each product. All three models are strongly significant. Variable PAYCARD corresponds to parameter α_M in Equation (1). It is significant and has the expected positive sign under all products. This suggests that respondents in this study were sensitive to the price they pay for blueberry products. Notice in Equation (1) that since what the price respondents would pay for a product is subtracted from their income, each additional dollar increase in price will decrease the utility by α_M. This is consistent with the notion that price has a negative impact on utility. Cameron and Huppert (1991) adopted a similar payment card survey approach, but their empirical model specification is quite different. They directly parameterize the WTP function and the α_M parameter was specified as the standard deviation of the WTP. As a result, in their work, α_M is a nuance parameter to be estimated and has no direct economic interpretation. Although the model used in this study is mathematically equivalent to Cameron and Huppert (1991), the benefit of establishing individual random utility functions allows researchers to attach economic interpretation on α_M.

The rest of the parameters given in Table 3 correspond to elements in vector $\boldsymbol{\alpha}$. Variable INFO (respondent received health information statement) is not significant in blueberry herbal tea and blueberry syrup models but is positively significant in blueberry basil vinegar model. This suggests that when holding other factors in the model constant, additional information exposure on unique health benefits of blueberries is only effective in boosting the purchase of blueberry vinegar. Variable AWARE is positive for both blueberry vinegar and syrup. This indicates that holding other factors in the model constant, when consumers were aware of the health benefits of blueberries, they were more likely to pay for these blueberry products.[4] The positive impact of such awareness to the utility and WTP is greater than the exogenously given information (variable INFO, which is insignificant under blueberry syrup) for both products. This suggests that compared with consumer self-evaluated knowledge of such benefits, information given has much less impact on consumer utility and their WTP.

[4] It may be possible that consumers who have bought these products were more likely to be aware of the health benefits. While this causality is interesting, it is beyond the scope of the current study with the current dataset. In addition, since all three blueberry products examined are not commonly seen on the market yet, we expect the possibility of such a reverse relationship to be small.

Table 2. Frequency of Chosen Payment Card Values

	Blueberry Herbal Tea		Blueberry Basil Vinegar		Blueberry Syrup	
Card Value	Count	Percentage (%)	Count	Percentage (%)	Count	Percentage (%)
0	61	16.4	69	16.7	67	17.0
1.1	—	—	14	3.4	9	2.3
1.35	—	—	13	3.2	2	0.5
1.6	17	4.6	10	2.4	2	0.5
1.85	12	3.2	29	7.0	13	3.3
2.1	10	2.7	24	5.8	19	4.8
2.35	13	3.5	19	4.6	16	4.1
2.6	23	6.2	29	7.0	14	3.5
2.85	30	8.1	27	6.6	24	6.1
3.1	42	11.3	40	9.7	31	7.8
3.35	15	4.0	22	5.3	17	4.3
3.6	28	7.5	12	2.9	39	9.9
3.85	28	7.5	15	3.6	50	12.7
4.1	43	11.6	42	10.2	26	6.6
4.35	9	2.4	7	1.7	13	3.3
4.6	18	4.8	12	2.9	20	5.1
4.85	8	2.2	6	1.5	12	3.0
5.1	6	1.6	3	0.7	7	1.8
5.35	6	1.6	19	4.6	14	3.5
5.6	0	0.0	—	—	—	—
5.85	3	0.8	—	—	—	—
Total	372	100	412	100	395	100

Examining how perceived knowledge and information exposure jointly affect consumer WTP can shed additional lights in customizing marketing strategies. The interaction term, AWR-INFO, captures this potential effect. It is only significant in blueberry basil vinegar model. The sign is negative, which means for consumers who already believed they knew about the health benefits of blueberries, giving additional information on the same topic would generate noise and therefore discount the positive impact from these variables. More strikingly, the magnitude of the coefficient of the interacted term is even greater than that for variable INFO. This suggests that consumer utility and WTP is maximized when they are aware of the health benefit, but if these consumers are given more information on the health benefits, the increase to their utility/WTP will not be as high.

Literature on information, conflict, and consumer perceptions may help to understand this result. For example, Huffman et al. (2007) and Rousu et al. (2007) found that when information was given from different sources, their impacts do not necessarily add upon one another and impact cancellation often occurs. The relationship will be more transparent when the dollar implications of this finding are discussed. Knowing this result, producers and marketers of the blueberry basil vinegar product should be cautious in implementing information campaigns. If there is a way to differentiate consumers based on their awareness of blueberry health benefits, a more effective strategy can be taken to target only those who are not aware of such benefits. It is also noticeable that not all blueberry product sales (i.e., the other two products in this study) may be affected by either the information exposure or consumer awareness.

Consumer demographic and socioeconomic characteristics are also found to have important impact on their utility and WTP associated with the products. To capture the possible nonlinear impact of the explanatory variables to consumer WTP, the square terms of continuous variables were also included in the analysis. Respondents' age (variable AGE) had a negatively significant impact on WTP for blueberry syrup but was

Table 3. WTP Equation Parameter Estimation Result

	Blueberry Herbal Tea		Blueberry Basil Vinegar		Blueberry Syrup	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
CONSTANT	−4.584**	2.299	−4.068*	2.137	2.178	1.369
PAYCARD	1.034***	0.046	1.036***	0.044	0.993***	0.044
INFO	−0.005	0.329	1.244***	0.452	−0.598	0.410
AWARE	0.404	0.356	1.844***	0.385	0.700**	0.341
AWR-INFO	−0.163	0.388	−1.623***	0.499	0.696	0.449
MALE	−0.119	0.192	0.097	0.186	0.194	0.180
AGE	3.285	3.142	−2.517	3.260	−5.302**	2.690
AGE2	−5.591	3.450	2.313	3.355	4.105	2.864
INCOME	−0.005	0.087	0.236**	0.100	0.234***	0.090
INCOME2	0.002	0.006	−0.011	0.007	−0.013**	0.006
EDU	8.184***	3.070	6.097**	2.742	−0.728	1.679
EDU2	−2.544**	0.989	−1.697*	0.878	0.559	0.547
FULL	0.205	0.184	0.031	0.244	0.272	0.186
HSIZE	0.672***	0.244	0.069	0.126	0.581***	0.224
HSIZE2	−0.076**	0.030	−0.004	0.017	−0.079***	0.030
CHILD	−0.701***	0.263	−0.504**	0.241	−0.143	0.211
MARRY	−0.273	0.204	−0.121	0.192	−0.141	0.181
DIAB	0.187	0.211	0.314	0.206	0.022	0.210
HEART	0.140	0.230	−0.086	0.192	0.169	0.217
INDUSTRY	−0.065	0.217	−0.094	0.221	−0.553**	0.262
LL	−1110.995		−1216.930		−1181.009	
N	372		412		395	

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

insignificant on other two products. The square term of variable AGE is insignificant in all three product models. This implies that holding other factors constant, older consumers were significantly less likely to pay for blueberry syrup. Household income level (variable INCOME) had positive impact on their utility/WTP under blueberry basil vinegar and syrup. Variable INCOME2 represents the quadratic term of income and it is significantly negative for blueberry syrup. This suggests that although in general, families with higher income were most likely to pay for blueberry vinegar and syrup, there is evidence for diminishing marginal effects of income.

Respondent education level had a positive impact on the WTP for blueberry herbal tea and basil vinegar. The square term of education, EDU2 on the other hand, is negative under both products. Similar to the impact of income on blueberry basil vinegar, more educated individuals were likely to pay more for blueberry herbal tea and basil vinegar, but as education level increased, the rate of increase in WTP decreased. This similar type of impact carries on to another continuous variable representing household size (HSIZE) under blueberry herbal tea and syrup: larger families were more likely to pay for these products, but with a decreasing rate as household size increased. Families with children were less likely to pay for blueberry herbal tea and basil vinegar but such a factor was not significant for syrup. Households with individuals working in the food industry were likely to pay less for blueberry syrup. Finally, there were several demographic variables not significant in explaining consumer WTP. Respondent gender (MALE), full-time employment status (FULL), and marital status (MARRY) were all insignificant.

Numerous past studies have shown the relationship between diet and health. It is possible that individuals with certain diseases may have different preferences of blueberry products. Indicators of two types of disease, diabetes (DIAB) and heart disease (HEART), were also insignificant. In addition, the same result holds regardless of sub-groups of respondents (treatment

or control group). A possible explanation may be that individuals who have already contracted those diseases may already know the health benefit of blueberries. For these three products, the perceived taste or other ingredients in the products might not be particularly attractive to these respondents. Furthermore, Mancino and Kinsey (2004) found that those diagnosed with diet-related diseases might not necessarily respond to healthful eating styles or health information even after diagnosis.

Willingness to Pay Estimates

So far the discussion focused on various factors that may contribute to the differences observed in WTP. Table 4 gives the estimated WTP in dollar values. First, an average WTP is presented for each product. This average value is calculated by substituting the estimated α_M and $\boldsymbol{\alpha}$ to Equation (2) and taking the sample "average" of variables in vector **X** and zero (which is the mean) for the error term. If a variable in **X** is continuous, the simple mean is used and if a variable is binary the median is used. The sample average WTP for blueberry herbal tea, basil vinegar, and syrup was \$3.65, \$2.87, and \$3.30 respectively. Numbers in parentheses show the asymptotic 95% confidence intervals of the mean estimates obtained after a simulation of 10,000 replications using the approach described by Krinsky and Robb (1986). It can be seen that the standard errors are relatively small compared with the mean WTP estimate.

Since these WTP measures were calculated based on a representative consumer (at sample mean/median), they reflect the "average" market WTP. A typical box of fruit tea bags other than the blueberry flavor was priced between \$3.50 to \$4.50 in the market at the time of this study; the WTP for blueberry tea bags found in this analysis is close to the lower end. Similarly for blueberry basil vinegar, the common market

Table 4. Estimated WTP

Blueberry Herbal Tea				
Average WTP:	3.65			
	(3.22, 4.08)			
	Child = 0	Child = 1		
	3.65	2.97		
	(3.22, 4.08)	(2.46, 3.47)		
Blueberry Basil Vinegar				
Average WTP:	2.87			
	(2.34, 3.39)			
	Child = 0	Child = 1		
	2.87	2.38		
	(2.34, 3.39)	(1.84, 2.92)		
	Information, Aware, Aware-Information			
	111	010	100	000
	2.87	3.24	2.66	1.46
	(2.34, 3.39)	(2.69, 3.78)	(1.90, 3.40)	(0.56, 2.35)
Blueberry Syrup				
Average WTP:	3.30			
	(2.80, 3.80)			
	Industry = 0	Industry = 1		
	3.30	2.74		
	(2.80, 3.80)	(2.10, 3.39)		
	Aware = 0	Aware = 1		
	1.89	3.30		
	(1.18, 2.60)	(2.80, 3.80)		

* 95% confidence intervals are in parentheses.

price of a comparable product (apple/cider vinegar) was between $2.50 and $4.00; the $2.87 WTP was also close to the lower bound. For blueberry syrup, the suggested $3.30 WTP was relatively higher, staying in the middle of the market price range for a comparable maple syrup product (priced between $2.50 and $4.00).

If stakeholders would like to develop blueberry value-added product strategies, these average WTP measures offer important information. These results show that consumer WTP for these products were not significantly higher than other comparable products currently in the market. A cost-benefit analysis should carefully evaluate this to make sure that the production is profitable.

In addition, results in Table 3 indicate that various consumer characteristics play important roles in predicting WTP. These results can guide effective consumer segmentation analysis and in turn help develop merchandising and market positioning strategies for Kentucky market. Table 4 gives the impact from binary variables while Figure 1 presents the estimated WTP measures by different continuous characteristics. Although Table 4 suggests that some of the confidence intervals of the WTP measures overlap, there are still several significant differences across consumer profiles.

For blueberry herbal tea, Table 4 indicates that holding other factors at the sample average, families without children would pay $3.65, compared with $2.97 for families with children. Respondent education and size of household had a non-linear impact on WTP. Suggested by panel A in Figure 1, when a respondent had 16 years of education, the respondent would pay close to $3.70 for blueberry herbal tea, higher than individuals with either more or less education. Similarly, in Panel B, when a household had four members, WTP reached maximum at $3.90 and when the household got larger, WTP dropped significantly. For blueberry basil vinegar, WTP for households without children was $2.87, and $2.38 for those with children.

Table 4 displays WTP measures based on other significant variables in Table 3, including the information variables INFO (given information in survey) and AWARE (aware health benefits before survey). Holding other factors at the sample average, if health information was given in the survey and consumers were also aware of these benefits before the survey (i.e., all three dummy variables INFO, AWARE, and AWR-INFO equal one as represented by "111" in Table 4), they would be willing to pay an average of $2.87 for blueberry basil vinegar. If on the other hand, consumers were aware of the benefits but were not given the information in the survey (represented by "010"), they would be willing to pay as high as $3.24. This result verifies previous observation that although more positive information does increase consumer WTP in general, the maximum WTP may not be achieved simultaneously at the maximum amount of information. A more efficient marketing strategy should be focused on market differentiation.

Nevertheless, Table 4 also shows that if consumers were not aware of blueberry health benefits, providing relevant information may be useful as consumers would be willing to pay $2.66 when such information was given ("100") compared with $1.46 when it was not given ("000"). In addition to these information variables, Panel C in Figure 1 suggests that holding other factors at the sample average, the highest WTP occurred when the respondent had 18 years of education. As suggested by Table 3, household income had a linear impact on WTP. When a family's income was higher than $100,000 a year, WTP would be above $4.00 (Panel D in Figure 1).

For blueberry syrup, Table 4 shows that if a household did not have any member working in the food industry, the household would be willing to pay $3.30 compared with $2.74, when some members did work in the food industry. When the respondents were aware of the health benefits of blueberries, WTP was $3.30 compared with $1.89 for those who were not aware of such benefits. Given by Panel E in Figure 1, when household income was around $90,000 a year, the household would be willing to pay the highest amount for blueberry syrup at around $3.50. Panel F suggests again that when a household had four members, WTP was the highest, reaching $3.38. Finally Panel G indicates a linear impact of respondent age on WTP for blueberry syrup with greater than $4.50 for consumers under 20 and less than $2.00 for consumers over 70.

Based on significant factors reported in Table 3, Table 5 describes a consumer profile

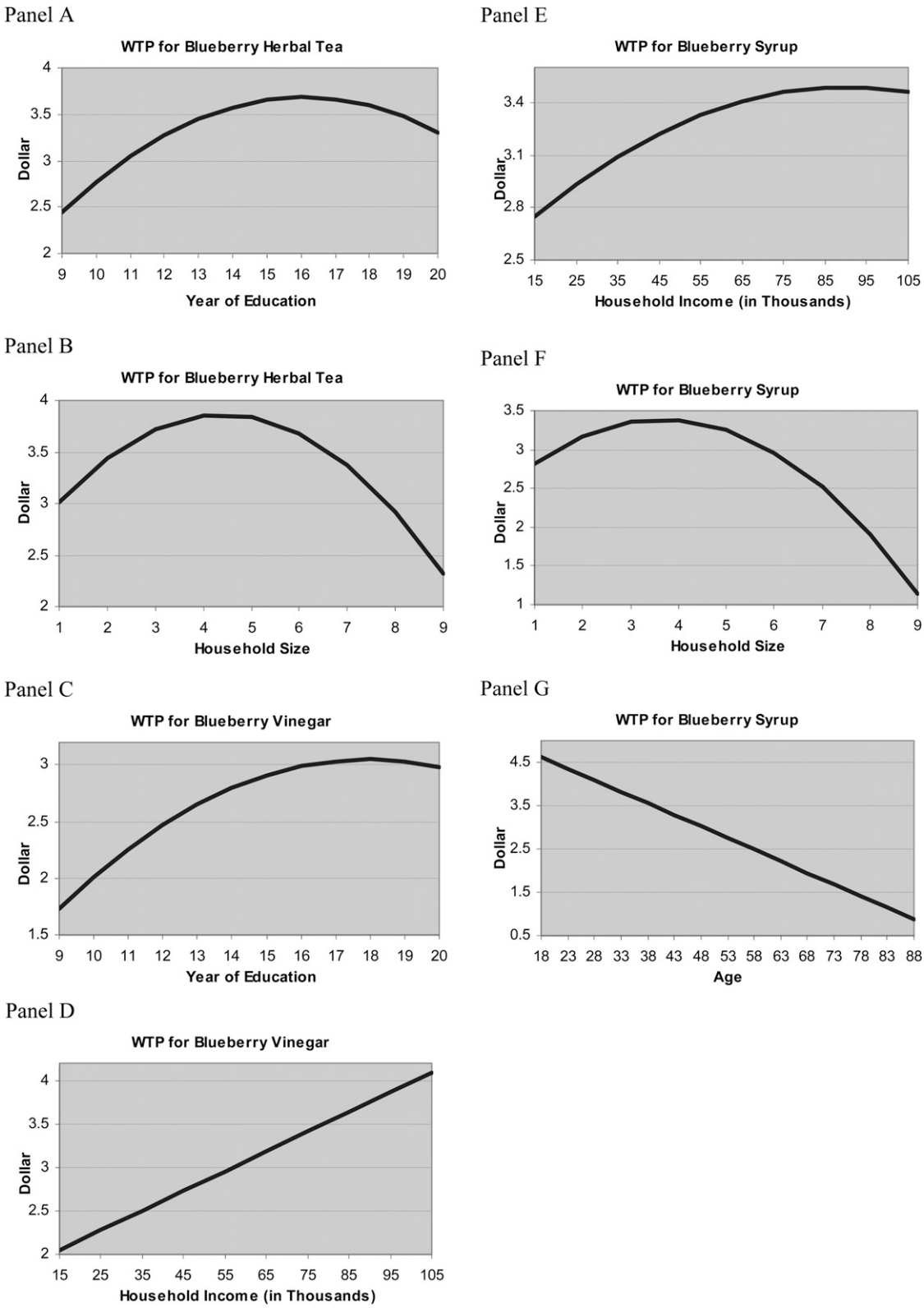

Figure 1. Graphic Presentation of Estimated WTP

Table 5. Consumer Profile with Maximum WTP for Each Product

Product	Consumer Profile	WTP
Blueberry Herbal Tea	16 years of education; 4 people in household; no children in household	3.90 (3.34, 4.46)
Blueberry Basil Vinegar	aware of health benefits but not subject to further information labels; $100K annual household income; 18 years of education; no children in household	4.52 (3.45, 5.60)
Blueberry Syrup	aware of health benefits; 25 years of age; $85K annual income; 4 people in household; not working in food industry	4.52 (3.58, 5.46)

* 95% confidence intervals are in parentheses.

under each product of who would be willing to pay the highest amount compared with other types of consumers for that product. The type of consumer who would be willing to pay the highest possible, $3.90, for blueberry herbal tea were those who had 16 years of education with four individuals in the household but had no children. The consumers who were aware of the health benefits of blueberries but were not given additional information by the producer, who earned high household income with high education, and had no children in the household would likely be willing to pay the highest among all consumers for blueberry basil vinegar at $4.52. For blueberry syrup, the type of consumers who would be willing to pay the highest would be those who were aware of the health benefits; were young with mid to high level of income; had four members in the households; and were not working in the food industry. Once again, this information gives producers a direction to identify the most lucrative market for their products.

Conclusions

This research contributes to the understanding of market implications of multi-ingredient and value-added horticultural products by investigating potential consumer support. Kentucky consumer preferences and willingness to pay for three new blueberry products is examined through a modified payment card survey. This study adopts an analytical framework that enables the researcher to attach straightforward economic interpretation to the estimated impacts of willingness to pay factors.

It is found that, on average, Kentucky consumers would be willing to pay positive amounts for these three products. The analysis clearly shows that consumer demographic characteristics play important roles in determining their WTP for the three value-added products. Some factors, such as consumer education and income, may have nonlinear impact on their WTP but some factors, such as consumer age, exhibit only linear effects. Meanwhile, consumer family health status indicators, represented by existence of diabetes and heart diseases, do not show significant impact on WTP.

Another contribution of this study is to examine the importance of consumer's product knowledge and exogenous information in purchasing decisions. It is found that consumers' self-awareness of the health benefits of blueberries and health benefits information given in the survey each may have a positive impact on WTP. However, not all three products' WTP are affected by information exposure. Furthermore, when both sources of information are available to consumers, in other words, when health benefits information is given while consumers already knew some of the benefits, their impact does not simply add up and the joint impact (although still positive) may be smaller. Producers and marketers should be sensitive to the different impact these two sources of information have on consumer WTP. For example, if producers believe that majority of consumers already know the health benefits of their products, they should not repeat the same information to avoid the cancellation effect.

Understanding the demand aspect of these value-added products may help producers and

retailers in their new product development strategy and provide grounds for a more comprehensive analysis of value-added strategies. For example, although it is found that, on average, Kentucky consumers would like to pay for these three products, their WTP may not be significantly higher than other comparable products in each of the corresponding product categories. A careful cost-benefit analysis is required to assure that the value-added strategy underlying these products can be profitable. Given the relatively low WTP, one possible solution is to lower the cost of production. For example, rather than pure blueberries, a part of the ingredients may be substituted by other cheaper fruits. Certainly, this changes the product but a similar study like what has been presented in this article can be used to examine the WTP. Another approach suggested by this study is to target specifically customers with certain characteristics who are most likely to pay a higher price for these products. For example, based on our results, marketers can target younger consumers to promote blueberry syrup and higher education level groups to promote blueberry tea and vinegar products. Information needed to segment consumer groups for certain regions may not be readily available but can be collected through marketing research.

The conceptual approach and research methods used in this study are not limited to blueberries or other horticultural products. The purpose of this analysis is to provide a general research approach to understand consumers of value-added products. Minor adjustments to the survey and estimation method may enable it to be applied to other value-added agricultural products. Finally, this study offers an exploratory view of the first step in new product development. Once the market has established information on quantity consumed, it may be collected to allow further marketing research such as estimating price and income elasticities of these products.

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References

Arno, K. *Taking Value-Added Foods to Market.* Blethen Maine Newspapers Inc., April 13, 2005. Internet site: http://business.mainetoday.com/selfemployment/savvy/050413foodmakers.shtml (Accessed April 10, 2007).

Baer, A.G., and C. Brown. "Adoption of E-Marketing by Direct Market Farms in the Northeastern U.S." Selected Paper, American Agricultural Economics Association Annual Meeting, Long Beach, CA, July 23–26, 2006.

Brox, J.A., R.C. Kumar, and K.R. Stollery. "Estimating Willingness to Pay for Improved Water Quality in the Presence of Item Nonresponse Bias." *American Journal of Agricultural Economics* 85(2003):414–28.

Cameron, T.A. "The Impact of Grouping Coarseness in Alternative Grouped-Data Regression Models." *Journal of Econometrics* 35(1987):37–57.

Cameron, T.A., and D.D. Huppert. "Referendum Contingent Valuation Estimates: Sensitivity to the Assignment of Offered Values." *Journal of the American Statistical Association* 86(1991): 910–18.

Carriquiry, M., and B.A. Babcock. "Reputations, Market Structure, and the Choice of Quality Assurance Systems in the Food Industry." *American Journal of Agricultural Economics* 89(2007):12–23.

Cowan, T. *Value-Added Agricultural Enterprises in Rural Development Strategies.* Report for Congress, Congressional Research Service RL 31598. 2002. Internet site: http://bennelson.senate.gov/documents/CRS/Agriculture/CRS_AddedValueEnterprises.pdf (Accessed November 1, 2007).

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

Ehmke, M.D., T. Warziniack, C. Schroeter, and K. Morgan. "Applying Experimental Economics to Obesity in the Family Household." *Journal of Agricultural and Applied Economics* 40(2008): 539–49.

Ellerman, J., D. McFeeters, and J. Fox. "Direct Marketing as a Value-Added Opportunity for Agriculture" Fact Sheet AE-8-01. Ohio State University, 2001.

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

Ernst, M. and T. Woods "Marketing Highbush Blueberries in Kentucky" University of Kentucky

Cooperative Extension Service publication AEC-EXT 2004-01. University of Kentucky, 2004.

Giannakas, K., and A. Yiannaka. "Market and Welfare Effects of Second-Generation, Consumer-Oriented GM Products." *American Journal of Agricultural Economics* 90(2008):152–71.

Hobbs, J.E., K.M. Bessell, and W.A. Kerr. "Food Safety and Private International Law: Liability, Traceability and Transboundary Marketing." *Journal of International Food & Agribusiness Marketing* 18(2006):7–13.

Hu, W. "Use of Spike Models in Measuring Consumers' Willingness to Pay for Non-GM Oil." *Journal of Agricultural and Applied Economics* 38(2006):525–38.

Hu, W., W.L. Adamowicz, and M.M. Veeman. "Labeling Context and Reference Point Effects in Models of Food Attribute Demand." *American Journal of Agricultural Economics* 88(2006): 1034–49.

Hu, W., T.A. Woods, and S. Bastin. "Consumers' Acceptance and Willingness to Pay for Blueberry Products with Non-conventional Attributes." *Journal of Agricultural and Applied Economics* 41(2009):1–14.

Hu, W., F. Zhong, and Y. Ding. "Actual Media Reports on GM and Chinese Consumers' Willingness to Pay for GM Soybean Oil." *Journal of Agricultural and Resource Economics* 31(2006): 376–90.

Huffman, W., M. Rousu, J.F. Shogren, and A. Tegene. "The Effects of Prior Beliefs and Learning on Consumers' Acceptance of Genetically Modified Foods." *Journal of Economic Behavior & Organization* 63(2007):193–206.

Huygen, I., M. Veeman, and M. Lerohl. "Cost Implications of Alternative GM Tolerance Levels: Non-Genetically Modified Wheat in Western Canada." *AgBioForum* 6(2004):169–77.

Krinsky, I., and A. Robb. "On Approximating the Statistical Properties of Elasticities." *The Review of Economics and Statistics* 68(1986):715–19.

Lapan, H., and G. Moschini. "Grading, Minimum Quality Standards, and the Labeling of Genetically Modified Products." *American Journal of Agricultural Economics* 89(2007):769–83.

Lessler, J., and W.D. Kalsbeek. *Nonsampling Error in Surveys*. New York: John Wiley & Sons, 1992.

Lusk, J.L., and N. Parker. "Consumer Preferences for Amount and Type of Fat in Ground Beef." *Journal of Agricultural and Applied Economics* 41(2009):75–90.

Mancino, L., and J. Kinsey. "Diet Quality and Calories Consumed: The Impact of Being Hungrier, Busier and Eating Out." Working Paper 04-22, The Food Industry Center, University of Minnesota, 2004.

McKee, G.J. "The Development, Operation, and Dissolution of a Value-Added Cooperative: United Sprint Wheat Processors" Agribusiness and Applied Economics Report No. 594, North Dakota State University, 2006.

Mitchell, R.C., and R.T. Carson. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Washington, D.C.: Resources for the Future, 1989.

Puaha, H., and D.S. Tilley. "Investment Decisions in New Generation Cooperatives: A Case Study of Value Added Products (VAP) Cooperative in Alva, Oklahoma." Selected Paper, Southern Agricultural Economics Association Annual Meeting, Mobile AL, February 1–5, 2003.

Roe, J.D. "Value Added What??...Horizontal versus Vertical Expansion in Iowa Production Agriculture." Selected Paper, American Agricultural Economics Association Annual Meeting, Providence RI, July 24–27, 2005.

Rousu, M., W. Huffman, J.F. Shogren, and A. Tegene. "Effects and Value of Verifiable Information in a Controversial Market: Evidence from Lab Auctions of Genetically Modified Food." *Economic Inquiry* 45(2007):409–432.

Singletary, K.W., and M.A. Morganosky. "Functional Foods: Consumer Issues and Future Challenges." *Journal of Food Distribution Research* 35(2004):1–5.

Smith, T.A., C.L. Huang, and B.-H. Lin. "Does Price or Income Affect Organic Choice? Analysis of U.S. Fresh Produce Users." *Journal of Agricultural and Applied Economics* 41(2009):731–44.

Sumberg, J., and D. Reece. "Agricultural Research through a 'New Product Development' Lens." *Experimental Agriculture* 40(2004):295–314.

US Highbush Blueberry Council. *Nutrition*. 2002. Internet site: http://www.blueberry.org/health.htm (Accessed November 16, 2007).

Appendix 1. Payment Card Willingness to Pay Questions for Blueberry Herbal Tea and Blueberry Basil Vinegar

Blueberry Herbal Tea
What is the **maximum** price you would be willing to pay for the following blueberry product:
Blueberry Herbal Tea (24 bags)
For comparison purpose, a box of generic fruit tea bags (**24 bags**) is typically sold for between **$3.50** and **$4.50** in a grocery store. Please indicate your choice (and price willing to pay) below:
☐ I do not wish to buy this product.
☐ I would like to buy and the **maximum** price I would pay for it is (please circle):

$1.60	$1.85	$2.10	$2.35	$2.60	$2.85	$3.10	$3.35	$3.60
$3.85	$4.10	$4.35	$4.60	$4.85	$5.10	$5.35	$5.60	$5.85 and above

Blueberry Basil Vinegar
What is the **maximum** price you would be willing to pay for the following blueberry product:
Blueberry Basil Vinegar (8 oz)
For comparison purpose, a bottle of apple/cider vinegar (**8 oz**) is typically sold for between **$2.50** and **$4.00** in a grocery store. Please indicate your choice (and price willing to pay) below:
☐ I do not wish to buy this product.
☐ I would like to buy and the **maximum** price I would pay for it is (please circle):

$1.10	$1.35	$1.60	$1.85	$2.10	$2.35	$2.60	$2.85	$3.10
$3.35	$3.60	$3.85	$4.10	$4.35	$4.60	$4.85	$5.10	$5.35 and above