Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for A Local (Colorado-Grown), Organic, and GMO-free product

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Abstract

Demand for value-added products is highly segmented among different types of consumers. In this paper, we assess consumer preferences for local, organic, and GMO-free potatoes in order to discover their potential niche markets. We identify socio-demographic characteristics that affect consumer preferences and compare the effects of different attributes on consumers' willingness to pay. Results suggest that the attribute "Colorado Grown" carries a higher premium than organic and GMO-free attributes.

Keywords: *GMO-free, local product, organics, payment card, willingness to pay.*

Introduction

The recent farming crisis nationwide associated with declining commodity prices and weather-related yield problems have forced farmers to find new markets for their commodities through value-added marketing. To discover the right niche market is a complicated task, since demand is highly segmented among consumers who may be concerned with different attributes (such as local, organic, eco-labeling, and other specialty types). Baker (1999) deals with the case of market segmentation for apples showing that there are different types of apple consumers, from those who are strongly concerned about food safety to those who are extremely price sensitive. There is a large body of literature from marketing science and finance that sets the foundations of how to analyze the problem of market segmentation. (See Kwoka (1991) and Elliehausen and Wolken (1990)). In the present study, we won't identify different market segments, but rather different socio-demographic characteristics that affect consumer response toward different attributes.

We will focus our attention on the potato sector, addressing the question of what message should producers convey to consumers in order to get the highest premium for their product. Potatoes are the most economically significant crop in the U.S. produce industry, earning farmers nearly $2.7 billion in 1999 (ERS-USDA, 2001). The bulk of Colorado potatoes are currently produced in the San Luis Valley (SLV) in the southwestern part of the state. The growers in the SLV have been suffering from market prices that are lower than break-even points, a situation that has decreased grower profitability and sustainability over the past few years. As a result, these producers are trying to find a way in which to create a niche for the potato that would turn a basic

"commodity" into a value-added "differentiated" product, increasing both sales and small operating margins.

Colorado potatoes are grown with all of the components necessary to create a high-quality differentiated product that could be differentiated from other potatoes on the market. These components include the use of environmentally friendly conservation techniques in the SLV, and cool weather, which contributes to the smoothness of the potato skin and helps to disable many pests. All things considered, this Colorado grown product is a high quality product and gives consumers the opportunity to support the agricultural producers of their state. Unfortunately, however, the Colorado potato producer has not communicated these attributes to the consumer in an effective manner; thus, potato buyers are unable to distinguish the Colorado potato from that of one grown in Idaho or other places. Coupled with this is the manner in which potatoes are packaged and displayed relative to other crops such as vegetables and fruits. (Bananas, apples, tomatoes, prepackaged salads, and grapes have overtaken the potato as the star revenue generator in grocery stores nationwide.) (ERS-USDA, 2001). Consumers simply do not find the potato appealing both in appearance, freshness, or quality.

Within the limits of the case study described above, the objective of this paper is to elicit consumer's willingness to pay (WTP) for a labeled value-added potato that could be marketed as an organic, GMO-free, or Colorado-Grown, and compare the corresponding consumers' WTP for these different attributes as well as the different socio-demographic factors that affect consumer response. A multiple bounded probit model is used in this assessment to quantify factors affecting consumer preferences

among organic, GMO-free and Colorado-Grown potatoes. In contrast to previous studies, consumers are asked to value a range of different attributes.

The following section of this paper provides a literature review of niche marketing and product differentiation. Section three contains the methodology describing our WTP estimation of truncated data, which was collected using a payment card format. The data collection process and the corresponding descriptive statistics are reported in the fourth section. The fifth section of the paper contains results of the parametric willingness to pay estimate and the last section provides a conclusion and suggestions for further study.

Literature Review

Recently niche marketing has become the focus of many studies that deal with consumer acceptance of value-added or differentiated products. Drawing from the consumer economics literature, there is a large body of studies dealing with consumer awareness and willingness to pay for local, organic, or environmentally friendly products. Many researchers have studied consumer demand for organic or other products with low or no pesticide usage.[2] Roosen *et al.* (1998) studied the consumer's valuation of insecticide use restrictions in the case of apple. Using an experimental action, they found out that the average WTP for apples not treated with a particular group of pesticides was between \$0.22/lb in the first trial and \$0.34/lb in the last trial. Misra, Huang, and Ott (1991) found that 46% of Georgia consumers were willing to pay more for certified residue-free product. Thompson and Kidwell (1998) analyzed the choice between

[2]See Thompson (1998) for a comprehensive review of studies on organic food demand.

organic and conventional produce using a two-equation probit model, showing that families with children were more likely to buy organic. Huang (1996) studied the demand for organically grown products, concluding that consumers who are nutritionally conscious, concerned about the use of pesticides, and wanting produce tested for freedom from residues would have a higher propensity to prefer organically grown products. These findings are comparable to the ones obtained in this paper, where consumers concerned about nutritional value and freshness are more willing to pay a premium for organic products.

Using a similar background and problem setting, there are many studies that evaluate the value of labeling in eco-label programs. Especially interesting for our study is the research conducted by Wessels *et al.* (1999). They emphasized that eco-label certification may work better for some fish species than others, stating higher subjective willingness to pay values for certified salmon than cod. In the same way, we presume that labeling programs associated with products of lower perceived consumer value may not be efficient tools in stimulating demand. There are very few studies that analyze how consumers perceive different attributes associated with different labeling programs.[3] In one of the few studies we are aware of, Nimon and Beghin (2000) identified a premium for organic cotton fibers, although the authors could not find evidence of a premium associated with environmentally friendly dyes.[4] In another study, Govindasamy and Italia (1997) compared consumers' response toward traditional and an integrated pest management product. Their findings conclude that consumers with higher annual

[3] Loureiro, McCluskey and Mittlelhammer (2000) presented differences in terms of consumer's response toward organic, eco-labeled, and regular apples. However, they do not present estimates of willingness to pay associated with these different products.
[4] Note that these choices do not need to be mutually exclusive.

incomes were more likely to express an interest in purchasing integrated management product and less likely to strictly purchase conventional product.

Locality and origin of product seem to be important attributes needed to differentiate and create new niche markets, particularly for those products with a well-known reputation. Suryanata (1999) shows how Hawaii's foodstuff (pineapples and macadamia nuts) was able to capture a premium value of place-association due to the social construction of Hawaii as a "paradise" place. As a result, Hawaii has been very successful diversifying its agricultural base and marketing its produce as "exotic." Bastian *et al*. (1999) studied consumer interest in the diversity of products available from local craft brewers. Mass production by megabreweries provides craft brewers with the opportunity for niche marketing of differentiated beers in the Rocky Mountain region. Patterson *et al*. (1999) studied the "Arizona Grown" program, showing that consumers were largely unaware of this local promotional program, however, most indicated that they would prefer Arizona products if they were to know about them. Jekanowski *et al*. (2000) conducted a study in Indiana, showing that quality perceptions pay an important role on consumers' acceptance toward local products.

Niche markets for regional products are also a popular trend in Europe. Ilbery and Knefsey (1999) examine the niche markets for European specialty food products. They develop a framework that shows how a unique configuration of networks at local and regional levels will contribute to the success or failure of these local products creating endogenous rural development. In the case of research looking at how consumers value locally grown products in Europe, Loureiro and McCluskey (2000) studied consumer response toward Protected Geographical Identification labels, which

identify local meat grown in Northern Spain (Galicia), showing that consumers are willing to pay a premium for local meat, but this premium depends on quality.

An interesting aspect of the current study is that it compares willingness to pay estimates and consumer response toward different product attributes such as organic, GMO-free and local, in order to find out their respective niche markets. The information gathered from this study should be helpful to producers in order to design the right marketing strategy to increase recognition of Colorado potatoes.

The Classical Maximum Likelihood Approach

The survey elicited willingness to pay using a payment card format. Alberini (1995) showed that interval data has desirable properties and in general provides more robust WTP estimates than those from a dichotomous choice model with follow up. The crucial valuation question was: *Assuming fresh potatoes were priced at $1.00 per pound at your grocery store, how much of premium per pound (in cents), if any, would you be willing to pay for fresh potatoes containing the following characteristics: GMO-Free, Organically Grown and Colorado Grown?* Consumers were presented with the following bid intervals[5]: $0, less than five cents/lb, between 5-10 cents/lb, between 11-15 cents, 16-20 cents and more than 20 cents. Frequency distribution of responses is presented in Table 2. With this survey data, a classical parametric willingness to pay estimate for organic, Colorado grown, and GMO-free potatoes will be compared.

[5] Data were collected in a supermarket setting, where consumers were instructed at the beginning of the survey that they could ask any question about attributes they would be valuing. Additional information was provided in a systematic way with the interviewer reading a paragraph to each consumer who needed additional information about organic, GMO-free, and Colorado-Grown products.

Cameron and Huppert (1989) developed a maximum likelihood framework that suits data gathered using a payment card. This model relies on many distributional assumptions about the unobservable willingness to pay estimate. We suppose that the respondent's true valuation or willingness to pay *(WTP)* lies within the interval defined by lower and upper thresholds t_{li} and t_u of the payment card. It's generally presumed that the expected willingness to pay, $E(WTP_i \mid x_i)$, is some function of the explanatory variables and associated parameters, $g(x_i, \beta)$, for which a linear-in-parameters form is computationally convenient. In the simplest case[6], we will have:

$$(1) \qquad WTP_i = x'_i \beta + \varepsilon_i ,$$

where ε_i is distributed normally with mean 0 and standard deviation σ. Further, let's suppose that x'_i is a vector of explanatory variables that potentially affect consumers' willingness to pay for different potato attributes, including socio-demographic characteristics of the respondent, such as age, income, education, and importance of general quality (represented here by freshness and nutritional value) of the product.

We can standardize each pair of interval thresholds for (WTP_i), expressing the probability that the true valuation lies between both thresholds as:

$$(2) \qquad \Pr(WTP_i \subseteq (t_{li}, t_{ui})) = \Pr((t_{li} - x_i'\beta)/\sigma < z_i < (t_{ui} - x'\beta)/\sigma)),$$

[6] Notice that we cannot use the log form used in previous studies since we are including the 0 interval in the limited dependent variable range.

where z_i is the standard normal random variable. Therefore, after this transformation the probability expressed in (2) can be rewritten as the difference between two standard normal cumulative distributions functions (CDFs), and expressed as:

$$\Pr(WTP_i \subseteq (t_{li}, t_{ui})) = \Phi(z_{ui}) - \Phi(z_{li}). \quad (3)$$

Thus, the likelihood function is given as:

$$LogL = \sum_{i=1}^{n} \log[\Phi(z_{ui}) - \Phi(z_{li})]. \quad (4)$$

The estimation of this likelihood function will make it possible to draw conclusions about how consumers value perceived quality of potatoes (in terms of freshness and nutritional value) and how these different attributes affect their willingness to pay. Estimation of this likelihood function is conducted using the software package LIMDEP. First and second order derivatives are not presented here because of space limitations.

Data

Data were gathered from a survey conducted during the fall of 2000 in different locations of the state of Colorado. Students from the National Agribusiness Marketing Association (NAMA) at Colorado State University conducted the surveys in supermarkets such as King Soopers, Albertson's, Super Wal-Mart, and Safeway along the Colorado Front Range, including stores in Fort Collins, Greeley, Parker, and Denver. Consumers were solicited in the produce section and asked for their voluntary participation in the survey. In total, 437 usable questionnaires were collected.

The survey was divided into four sections. Section I focused on general consumption patterns and potato attributes that consumers found important including the premium that these consumers were willing to pay for various attributes. Section II dealt with nutrition issues and what would prompt consumers to purchase more potatoes. Section III asked questions about biotechnology, and the last section provided demographic information with which to develop a target audience.

As summarized in Table 1, 60% of the respondents are female, and the mean age of the sample is 44 years. The mean education level indicates that respondents have "some" years of college, with almost half of the respondents earning a bachelors degree or higher. Thirty-one percent of the respondents had at least one child in their household, with over one half of the respondents having none. Finally, among the respondents of the income question, the mean income earned in the year 2000 was $50,000 or more. These figures are comparable in terms of family composition, income, and education to the Colorado and U.S. 2000 Census projections, respectively. However, the percentage of female respondents is slightly higher than the Census figures for Colorado and the U.S., with 50.4 % and 51.1%, respectively.

As in all surveys, a representative sample is always of concern to the researcher. There could also be some degree of sample selection bias, in which the people who were more interested in Organic, Colorado-Grown or GMO products elected to participate in the survey. In the current study, participation was estimated to be about 40% of the total solicited population. Research conducted by Edwards and Anderson (1987) found significant differences between the characteristics of survey respondents and non-respondents. Finally, Messonnier *et al*. (2000) examined sample nonresponse and

selection biases, finding out that unit nonresponses seriously affected welfare measures. Given the preceding observations, we understand that our findings are limited in their ability to be applied to a fully generalized broader population.

Model Specification and Variable Definition

The WTP equation depicted in (1) has been estimated independently for each attribute (organic, GMO-free and Colorado Grown) and using a common set of exogenous variables. This was done to facilitate a comparison among the different socio-demographic factors that characterize the niche markets for the organic, GMO-free, and Colorado Grown potatoes. The final specification of the WTP equation is as follows:

(5)

$$WTP_i = \beta_1 Age + \beta_2 Upper - Class + \beta_3 Female + \beta_4 Children + \beta_5 Fresh + \beta_6 Nutrition + \varepsilon_i,$$

where *Age* is a continuous variable representing consumer's age, *Upper-Class* is a dummy variable that captures the cross product of those consumers with a high level of education and high levels of income, *Female* is a dummy variable that represents that the respondent is a female, *Children* is a dummy variable that represents the presence of children in the household, and *Fresh* and *Nutrition* represent the subjective importance of both attributes when shopping for produce. Summary statistics of the relevant variables included in this equation are presented in Table 1.

Results

WTP estimates

As we can see in Graph 1, the frequencies or percentages associated with the WTP ranges for the different attributes of potatoes have a negative slope. As demand theory would predict, the higher the bid amount (or in this case the amount contained in the interval of the payment card), the lower the percentage of affirmative responses to the WTP question. At first glance, it's noticeable how large are the percentages of the distribution located in the lower-end levels of the WTP curve. This will reflect on our results since the elicited mean WTP estimates for the different potato attributes are very close to zero. It's interesting to note that the attribute "Colorado Grown" seemed to carry a higher premium than the organic and GMO-free attributes.

Mean WTP for the different attributes were estimated using the model results presented in Table 3, evaluating the coefficients at the corresponding means of the independent variables. Confidence intervals have been estimated using the formula presented by Cameron (1991). The different premiums carried by the different attributes and their corresponding 95% confidence intervals are presented in Table 4. According to our results, locally grown potatoes carry a potential premium about 5.522 cents/lb over the initial price of $1/lb-or a 5% premium. This may be due to the fact that Coloradoans appreciate a locally grown product even though it may currently lag far behind other fruits and vegetables with respect to good marketing of value-added characteristics. Colorado agricultural promotion campaigns, such as "Colorado Proud," may have an impact on consumer purchasing patterns. In light of these results, it seems reasonable to think that the largest niche market for Colorado potatoes is actually related to its locally

grown nature. This finding can be used by the local potato sector to better market Colorado grown potatoes. Currently, as previously stated, there is little or no labeling recognition associated with the local crop, while the Idaho Russet Burbank comes to be a recognizable brand.

The fact that the WTP estimates for the organic and GMO-free attributes are 3.137 cents/lb and 0.164 cents/lb, respectively shows the difficulty of creating differentiated markets for potatoes based on these attributes. Value-added attributes such as organic or GMO-free labeling seem to be very effective marketing mechanisms for the vegetable and dairy markets, but this strategy may not be generalized to the potato sector. In the eco-label industry, Wessells et al. (1999) pointed out that eco-labeled certification may work better for some fish species than for others, and this also seems to be the case with organic and GMO-free labeling programs of fruits and vegetables.

Regressions reflecting socio-demographic factors and quality characteristics affecting WTP are presented in Table 3. With respect to the organic WTP equation, consumers concerned about freshness are willing to pay more for organic potatoes. This makes intuitive sense as the potato's image has deteriorated significantly relative to the store appearance of other fruits and vegetables. In addition, the age of the consumer *(Age)* seems to have a negative effect on the willingness to pay for organic potatoes. Specifically, as people age one year, they are willing to pay .16 cents less for each pound of organic potatoes. This makes intuitive sense, since as people age they become generally less concerned about the impacts of pesticides in the environment or food**;** instead, they consider their food supply to be safe**.** The variable *Upper-Class* is positive and statistical significant, implying that if consumers are wealthy and well educated, they

are willing to pay on average 3.65 cents more per pound to obtain organic potatoes. This finding makes intuitive sense and is in concordance with Huang's article.

It's surprising that the presence of children in the household has a negative effect on the WTP for all potato attributes considered in this study. This could be due to the fact that consumers are more concerned about the use of pesticide in the case of other fruits and vegetables, which are more often, eaten raw. Potatoes, however, are usually cooked before serving, a process that reduces the risk of pesticides. Also, this negative effect on WTP could be explained because overall, families with children are more concerned about the nutritional value of their food, and potatoes are perceived as a poor source of vitamins and minerals to satisfy the children's daily dietary needs. Thus there is not a WTP for a product that the consumers would not want to feed to their children—pointing to the need for better campaigns describing the quality associated with potatoes. The variable female was not significant in any of the three WTP regressions. However, we left it in the model since at it has a positive sign.

The niche market for GMO-free potatoes seems to be affected by similar factors as found in the organic niche market. The variable *Age* has a negative and statistically significant relationship with WTP for GMO-free potatoes, while variables such as *Upper-Class* and *Freshness* have both a positive and statistically significant effect. The variable Children is still negative but insignificant.

We found some interesting results with respect to locally grown potatoes (Colorado-Grown). Consumers were willing to pay the highest premium for Colorado-Grown but the statistical results indicate that consumer concerns about nutrition is the only variable that seems to positively and statistically significant affect willingness to pay

for Colorado-Grown products. This would indicate that although consumers are willing to pay for home grown, it must be linked to quality in order to garner the higher premium of 5 cents/lb. The need for a stronger Colorado identification is further demonstrated by the results of the variable *Upper-Class*, that in spite of being positive, is not significant. This result has strong implication for the Colorado potato sector. Although wealthier and more educated consumers are willing to pay a premium for organic and GMO-free potatoes, they are not willing to pay a premium for Colorado potatoes, unless accompanied by higher levels of quality.

Conclusions

In this paper, we assess consumer response toward organic, GMO-free and "Colorado grown" potatoes in order to identify the best niche market for the Colorado potato. At the present time, Colorado producers are trying to find a way in which to create a niche market for Colorado potatoes. A sample of 409 consumers was interviewed in Colorado and data were analyzed using a probit model that fits payment card data. Willingness to pay estimates show a higher premium for the "Colorado Grown" attribute. We concluded that while the "Colorado Grown" attribute affords the potato producer with the highest consumer acceptance and premium (relative to organic and GMO-free). In order to secure a higher premium, Colorado Grown potatoes must also be of high quality. This finding can be useful for the Colorado potato producers who are looking for new ways of improving both, their product image while increasing consumer awareness of Colorado potatoes. For further studies, it may be convenient to compare whether these findings hold for other products and other geographical areas around the country.

Table 1: Socio-Demographic Characteristics of the Sample

Variable	Description	Mean	Standard Deviation
Gender	Dummy variable, 0=Male, 1=Female	0.603	0.537
Children	Dummy variable, 0=No children under 18 years old living in the household 1= Otherwise	1.516	5.016
Income	Household's income level: 1=<$25,000 2=$25-50,000 3=$50-75,000 4=$75-100,000 5=>$100,000	2.941	1.266
Age	Age of Consumer	44.38	15.180
Education Level	Highest Level of Education completed: 1=Non-Graduate 2=High School 3=Some College 4=Associates Degree 5=Bachelors Degree 6=Masters Degree 7=Doctorate	3.147	1.454
Fresh	Importance of Freshness in Produce Choice: Lickert scale from 1-5.	2.872	1.177
Nutrition	Importance of Nutrition : Lickert scale from1-5.	3.724	1.159
Upper-Class	Dummy variable that captures when consumer has a graduate education and income over $75,000.	0.112	0.3157

Table 2: Percentage and Distribution of the Different WTP

Intervals	WTP for Organic: Percentage of Responses by Interval	WTP for Colorado Grown: Percentage of Responses by Interval	WTP for GMO-Free Percentage of Responses by Interval
WTP=0 cents/lb.	41.73%	27.83%	53.02%
WTP $\subset$ 0-5 cents/lb.	14.84%	19.45%	15.56%
WTP $\subset$ 6-10 cents/lb.	21.01%	29.72%	17.29%
WTP $\subset$ 11-15 cents/lb.	11.20%	10.54%	7.20%
WTP $\subset$ 15-20 cents/lb.	4.76%	6.48%	2.59%
WTP>20 cents/lb.	6.44%	5.94%	4.32%

Table 3: Willingness to Pay Regressions for Different Potato Attributes

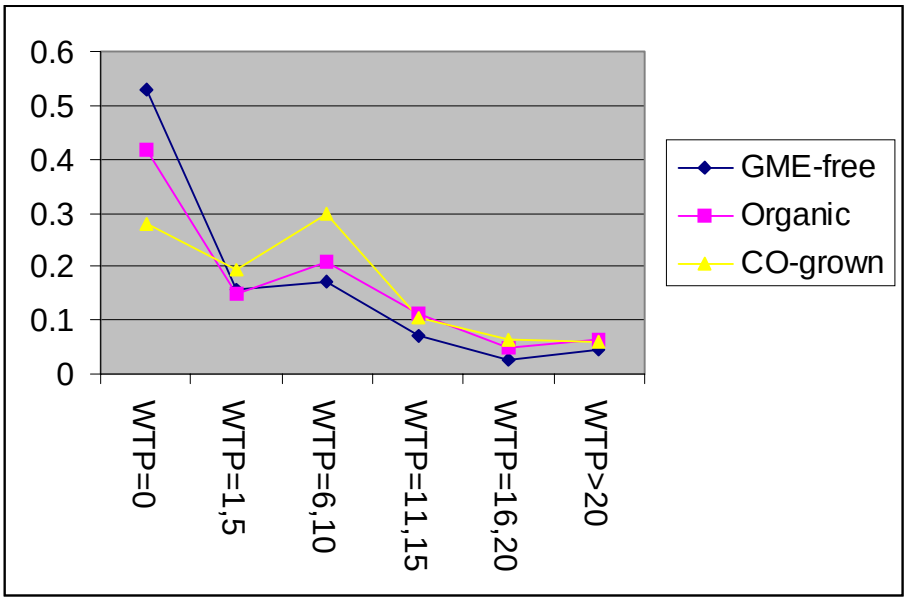
	Organic		GMO-Free		Colorado-Grown	
Coeff.	Coefficients	P-value	Coefficients	P-values	Coefficients	P-values
AGE	-0.1202***	0.00426	-0.1751***	0.0005	-0.0439	0.1943
UPPER-CLASS	3.6920*	0.08033	5.5457**	0.0150	0.6685	0.71474
GENDER	0.5027	0.72016	1.6859	0.2882	1.2631	0.29448
FRESH	1.4495***	0.01406	1.3556**	0.0488	0.4262	0.39932
CHILDREN	-0.4901	0.71264	0.2303	0.8776	-1.3715	0.22977
NUTRIT	1.0263*	0.07002	0.6168	0.3433	1.6440***	0.00078
Sigma	9.5977***	0.00000	10.0478***	0.0000	8.6913***	0.00000

Table 4: WTP estimates and corresponding 95% Confidence Intervals.

WTP	Mean WTP Estimate (Cents/lb)	C.I[7].
WTP for Organic Potatoes/lb	3.1375	(4.4538, 1.8206)
WTP for GMO-free Potatoes/lb	0.1648	(1.9302, -1.6005)
WTP for Colorado Grown Potatoes/lb	5.5228	(6.61435, 4.5809)

[7] As Cameron (1991) points out, confidence intervals for the predicted mean WTP estimate can be obtained as: $C.I._{.95}[E(\overline{WTP}) = \overline{X}'\beta \pm t_{.025} * \sqrt{\overline{X}\sigma^2(X'X)^{-1}\overline{X}}$.

Graph 1: Graph of frequencies of WTP for different attributes



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