Consumer Preference for Alternative Milk Packaging

Clinton L. Neill
Graduate Research Assistant
Oklahoma State University Agricultural Economics Department
clinton.neill@okstate.edu

Ryan B. Williams
Assistant Professor
Texas Tech University Agricultural and Applied Economics Department
ryan.b.williams@ttu.edu

Selected paper prepared for presentation at the Southern Agricultural Economics Association's (SAEA) Annual Meeting, Atlanta, Georgia, January 31- February 3, 2015

Introduction

Within the agricultural industry, many consumers have been willing to purchase products that are labeled as locally grown or produced (Loureiro and Hine 2001). Consumers have begun to perceive some of them as products with environmental attributes even though they are not labeled as such. In many studies, locally produced agricultural products have been grouped with organic, grass-fed, non-GMO, and free range products (Loureiro and Hine 2001; Loureiro et al. 2001; Kreman 2004).

Some consumers are purchasing products that have an inferred environmental attribute. In some cases, consumers are purchasing products that are not eco-labeled, but perceive them to have less of an environmental impact than conventionally produced products. In other words, the consumer perceives a product to be environmentally friendly, but there are no observable identifiers for consumers to know if it truly is environmentally friendly. Alternatively, products that are labeled as organic have been clearly defined as reducing negative environmental impacts associated with the production process.

Previous studies (Toro-Gonzalez 2013; Bajari and Benkard 2001) have discussed the idea of an unobservable or inferred product attribute. This type of attribute normally occurs because it is not possible to observe or measure differences in quality. Also, it is difficult to place a label suggesting the differentiation in quality due to quality varying among consumers. However, while the previous literature discusses matters of quality, which is identifiable by the consumer, the current study proposes a differentiating product attribute that is not based upon personal quality measurements, but rather consumer inclinations toward environmental impacts.

One prime example of a product that usually has an inferred environmental attribute is the glass milk bottle. Dairies and creameries used to ship glass bottles of milk to consumers

within a 100 mile radius. As technology advanced, especially in the production of alternative materials for packaging and transportation methods, the plastic milk bottle was adopted. According to Zaleski (1963), the plastic bottle is a viable alternative to glass bottled milk because it is cheaper on a per unit basis and does not have to be returned.

A nationwide poll conducted by Organic Gardening (1989) concluded that only 28.3 percent of consumers actually sought out organic or limited pesticide-use produce, even though over seventy percent responded that organic produce provides better long-term health effects than conventionally grown produce.

Byrne et al. (1991) analyzed consumer attitudes toward organic produce and purchase likelihood, which is essentially consumer willingness to pay. The study attempted to determine the following: which consumers are currently buying organic produce; consumer comparisons of organic and conventional produce; and consumer purchase likelihood of higher-priced organic produce (Byrne et al. 1991). They discovered that, in general, advancing age, higher education, and males demonstrated negative effects on the organic alternative. At the same time however, higher income households have a higher ability to pay for the higher priced organic good which results in a positive purchase likelihood result. It is apparent that organics, along with many other eco-labeled products, have a growing consumer demand, but these same products are usually coupled with price premiums (Byrne 1991).

It is recognized that eco-labeling is not the only form of differentiated product labeling, but that other forms of labeling also affect consumer preference. For example, locally grown foods, whether organic or not, have also seen support in purchase likelihood among consumers. Similarly, research (Loureiro and Hine 2001; Baker 1999) has demonstrated that consumers have a higher WTP for GMO-free (Genetically Modified Organism) products as compared to

conventional. The significance of discussing these different types of labels lies in price premium association and consumer WTP.

For example, Baker's (1999) study reveals a case of market segmentation for apples showing that there are different types of apple consumers. Some consumers are strongly concerned about food safety while others are price sensitive (Baker 1999). Informed by the results of Baker (1999), Loureiro and Hine (2001) conducted a study comparing consumer willingness to pay for a local, organic, and GMO-free products in order to discover their potential niche markets within Colorado.

The study attempted to identify the existence of market segmentation in the potato market along with corresponding price premiums (Loureiro and Hine 2001). The results of the study showed that consumers were willing to pay a higher price premium for the "Colorado Grown" potatoes over the ones labeled organic and GMO-free. A major issue that the authors discovered was that consumers were unaware of the distinguishing quality characteristics of the Colorado potato. Additionally, the lack of a method to physically differentiate the potato (i.e. a label) from those grown elsewhere hindered the ability for producers to successfully take advantage of a segmented market.

This study allowed for the idea that certain types of labels have a stronger inhibition on consumer preferences than others. Loureiro and Hine (2001) have paved a path in this type of research by pointing out that product differentiation is dependent upon labels or consumer knowledge of the product. While there have been several studies prior to their work (Baker 1999; Huang 1996; Ibery and Kneafsey 1999; Misra et al 1991; Nimon and Beghin 1999; Thompson and Kidwell 1998), Loureiro and Hine (2001) have synergized the concept of differentiating a product through specific eco-labels and determining WTP. They conclude with the suggestion of

further study by stating that it would be best to compare their findings with other products in other geographical areas around the country (Loureiro and Hine 2001).

Loureiro et al. (2001) also conducted a study that assessed consumer preferences for organic, eco-labeled and regular apples and identified socio-demographic characteristics affecting the choice among those three alternatives. The researchers conducted a consumer intercept survey in which they received direct answers from consumers at a grocery store. This method of survey taking is imperative to obtaining data from a household's decision maker in regards to grocery shopping. Also, this method of survey allows for visual aids to be utilized and assists the consumer in making a more accurate decision in accordance with their desired preferences.

Loureiro et al. (2001) found in this analysis that consumers prefer apples that are labeled as organic to those that are simply eco-labeled. The results of this study reveal that, to consumers concerned about food safety and the environment, eco-labeled apples are an intermediate choice with organic apples being the most preferred. This suggests that consumers respond to labels, but that certain labels hold higher levels of preference for specific consumers. They conclude that the distinction of the eco-label is more vague, and the personal benefits are more difficult to measure compared with labeled organic products (Loureiro et al. 2001).

It is known that the producer of a product is also a consumer of intermediate products that are vital to the production process; thus, they also have preferences on the characteristics of the product that they purchase. Gallardo and Wang (2013) address this issue in their study about willingness to pay for pesticides' environmental features and social desirability bias. The central concern with the study was to determine if producers are willing to pay for pesticides that

decrease the probability of pesticide toxicity to natural enemies along with determining if there was social pressure on pesticide choice.

In order to determine WTP, Gallardo and Wang (2013) conducted a discrete-choice experiment using direct and indirect valuation to determine the value apple and pear growers place on environmental features when choosing pesticides to control for first-generation codling moth. They evaluate the likelihood that growers consider environmental amenities when purchasing a pesticide. This study hinges on the concept of unobservable product attributes due to the fact that the potential environmental attributes are not guaranteed and therefore only perceived on the part of the consumer – or in this case, the producer purchasing the pesticide.

Apple growers' willingness-to-pay (WTP) to decrease the probability of pesticide toxicity to natural enemies was $26.03/acre under direct valuation and $26.60/acre under indirect valuation. Pear growers' WTP was $40.06/acre under direct valuation and $33.37/acre under indirect valuation. They found no evidence of social desirability bias, since differences across WTP obtained through either valuation were not statistically significant. Their results underscore the importance of understanding context when investigating social desirability bias (Gallardo and Wang 2013).

Several other studies have investigated social desirability bias and contingent valuation (CV). Johannson-Stenman and Martinsson (2006) proposed a model in which utility, besides being a function of the good's characteristics, was a function of the individual's perceived concern relative to the average perceived concern of others (Gallardo and Wang 2013). Both Lusk and Norwood (2009a,b) and Norwood and Lusk (2011) found that indirect valuation had the potential to provide better predictions of field behavior if social concerns were the primary

contributor to bias, and could therefore provide potentially improved predictions of WTP and market shares (Gallardo and Wang 2013).

The survey will be done by consumer intercept at a local grocery store. The design of the survey is constituted from the double bounded contingent valuation method (CVM). CVM is a nonmarket-valuation method that is used to value specific changes from the status quo; it is a stated-preference technique, as in the individual "states" their preference. Specifically, in the CVM individuals are asked about the status quo versus some alternative state of the world, or in this case unconventional packaging of milk, and WTP is elicited for the alternative.

This research evaluates consumers' willingness to pay and general preference for products that are perceived as having "environmentally friendly" attributes. With the current trend of local dairies producing glass bottled milk all across the nation, the study focuses on glass bottled milk. The particular interest of this study is evaluating the consumer's perceived attitude toward glass bottled milk and how they respond to varying price points associated with the product.

Conceptual Framework

Within the framework of discrete choice and random utility models (RUMs) there are a set of specific statistical models used to estimate consumers' representative utility. The one most applicable to the proposed research is the logit model. Its popularity is due to the fact that the formula for the choice probabilities takes a closed form and is readily interpretable. Originally, the logit formula was derived by Luce (1959) from assumptions about the characteristics of choice probabilities, namely the *independence from irrelevant alternatives* (IIA) (Train 2009). The purpose of this model is to specify the shape of the distribution function F with the logistic density

$$f(t) = \lambda(t) = \frac{e^t}{(1+e^t)^2}.$$

An advantage of the logit model is that the cumulative distribution function F=Λ can be computed explicitly, as

$$\Lambda(t) = \int_{-\infty}^{t} \lambda(s)ds = \frac{e^t}{1+e^t} = \frac{1}{1+e^{-t}}.$$

Logit models are non-linear in nature and the parameters can be estimated by maximum likelihood (ML). If the observation within a data set are mutually independent, then the likelihood function is given by $L(p) = \prod_{i=1}^{n} p^{yi}(1-p)^{1-y}$ and the log-likelihood by

$$\log\big(L(p)\big) = \sum_{(i;y_i=1)} \log(p) + \sum_{(i;y_i=1)} \log(p-1)$$

$$= \sum_{i=1}^{n} y_i \log(p) + \sum_{i=1}^{n}(1-y_i)\log(1-p).$$

Maximizing this with respect to p we get the ML estimator $\hat{p} = \sum_{i=1}^{n} y_i/n$.

The logit model has the property that the average predicted probabilities of success and failure are equal to the observed fractions of successes and failures in the sample. The ML first order conditions have a unique solution, because the Hessian matrix is negative definite. This simplifies the numerical optimization, and in general the Newton-Raphson iterations will converge rather rapidly to the global maximum (Heij et al. 2004).

The general logit model allows for marginal effects that are somewhat larger around the mean and in the tails but somewhat smaller in the two regions in between. The logit model is used when the tails of the distribution of data are of importance. This is the case when the choices are very unbalanced, in the sense that the fraction of individuals with $y_i = 1$ differs considerably from 50% of the population (Heij et al. 2004).

The method known as the double-bounded or interval data model allows the efficient use of the data to estimate willingness to pay (under the assumption that there is a single valuation

function behind both answers). The following econometric estimation is taken from Lopez-Feldman (2012). Let's define y_i^1 and y_i^2 as the dichotomous variables that capture the response to the first and second closed questions, then the probability that an individual answers yes to the first question and no to the second can be expressed as $\Pr(y_i^1 =, y_i^2 = 0|z_i) = \Pr(s,n)$ (where to simplify notation the right hand side of the expression omits the facts that the probability is conditional on the values of the explanatory variables). Given this and under the assumption that $WTP_i(z_i, u_i) = z_i'\beta + u_i$ and $u_i \sim N(0, \sigma^2)$, we have that the probability of each one of the three cases is given by:

1. $y_i^1 = 1$ and $y_i^2 = 0$

$$\begin{aligned}\Pr(s,n) &= \Pr(t^1 \leq WTP < t^2) \\ &= \Pr(t^1 \leq z_i'\beta + u_i < t^2) \\ &= \Pr\left(\frac{t^1 - z_i'\beta}{\sigma} \leq \frac{u_i}{\sigma} < \frac{t^2 - z_i'\beta}{\sigma}\right) \\ &= \Phi\left(\frac{t^2 - z_i'\beta}{\sigma}\right) - \Phi\left(\frac{t^1 - z_i'\beta}{\sigma}\right)\end{aligned}$$

Where the last expression follows from $\Pr(a \leq X < b) = F(b) - F(a)$ and t^i represents the alternative. Therefore, using symmetry of the normal distribution we have that:

$$\Pr(s,n) = \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)$$

2. $y_i^1 = 1$ and $y_i^2 = 1$

$$\begin{aligned}\Pr(s,s) &= \Pr(WTP > t^1, WTP \geq t^2) \\ &= \Pr(z_i'\beta + u_i > t^1, z_i'\beta + u_i \geq t^2)\end{aligned}$$

Using Bayes rule, which says that $\Pr(A,B) = Pr(A|B) * \Pr(B)$, we have:

$$\Pr(s,s) = \Pr(z_i'\beta + u_i > t^1 | z_i'\beta + u_i \geq t^2) * \Pr(z_i'\beta + u_i \geq t^2)$$

Here by definition $t^2 > t^1$ and then $\Pr(z_i'\beta + u_i > t^1 | z_i'\beta + u_i \geq t^2) = 1$ which implies:

$$\Pr(s,s) = \Pr(u_i \geq t^2 - z_i'\beta)$$

$$= 1 - \Phi\left(\frac{t^2 - z_i'\beta}{\sigma}\right)$$

so by symmetry we have:

$$\Pr(\mathrm{s},\mathrm{s}) = \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)$$

3. $y_i^1 = 0$ and $y_i^2 = 0$

$$\Pr(n,n) = \Pr(WTP < t^1, WTP < t^2)$$

$$= \Pr(z_i'\beta + u_i < t^1, z_i'\beta + u_i < t^2)$$

$$= \Pr(z_i'\beta + u_i < t^2)$$

$$= \Phi\left(\frac{t^2 - z_i'\beta}{\sigma}\right)$$

$$\Pr(\mathrm{n},\mathrm{n}) = 1 - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)$$

One way to proceed with the estimation is to construct a likelihood function to directly obtain estimates for β and σ using maximum likelihood estimation. The function that needs to be maximized in order to find the parameters of the model is:

$$\sum_{i=1}^{N}\left[d_i^{sn} ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) + d_i^{ss} ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right)\right.$$

$$\left. + d_i^{nn} ln\left(1 - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right)\right]$$

where $d_i^{sn}, d_i^{ss}, d_i^{nn}$ are indicator variables that take the value of one or zero depending on the relevant case for each individual, that is to say, a given individual contributes to the logarithm of the likelihood function in only one of its four parts.

There are different ways in which we can estimate WTP depending on the values that we give to the vector z. Some options are to estimate the WTP for every individual, the WTP for individuals with certain characteristics and the WTP using the average of the explanatory variables. In general what we have is:

$$E(WTP|\tilde{z},\beta) = \tilde{z}'\left[-\frac{\hat{\alpha}}{\hat{\delta}}\right]$$

where $\tilde{z}'$ is a vector with the values of interest for the explanatory variables (i.e., the value for each individual, the value for a certain group or the average).

Data

In order to extract consumer willingness to pay for a returnable glass milk bottle a survey was conducted in Lubbock, Texas at the Market Street Grocery Store #553 (4425 19th Street). This survey was approved by the Texas Tech University Human Research Protection Program Institutional Review Board and Market Street before it was administered to the participants. Surveys were collected on two separate occasions: April 27th and May 19th, 2014. In total, 245 surveys were collected and 229 were used in the analysis after removing incomplete surveys.

Table 5.5 shows the summary of statistics for the demographic characteristics and perception variables collected from the consumers. The average age of the consumer surveyed was between the ages of 30 to 45 with 2 to 3 people living in their household. The average household income level of the consumers surveyed was about $56,650. It is important to note that all of these average characteristics are similar to those reported in the latest US Census for Lubbock, Texas. It is important that the sample that was collected closely resembles the general population in

order to have an accurate representation of consumer willingness to pay. Also, this survey was approved by the Texas Tech University Human Research Protection Program Institutional Review Board before it was administered to the participants. The hypothesis for this study is that consumers are willing to pay a higher premium if they have the perception that a returnable glass bottle is more environmentally friendly than a plastic one.

Table 5.5: Summary of Statistics for Survey Respondents

Variable	Description	Percentage of Occurrence	Mean	Standard Deviation
Age	Age of the consumer:		1.9039	1.0171
	1=18-30	47.60%		
	2=30-45	23.58%		
	3=45-60	19.65%		
	4=Older than 60	9.17%		
Gender	Dummy Variable,		0.6245	0.4853
	0=Male	37.55%		
	1=Female	62.45%		
Household size	Number of people currently living in household		2.5721	1.2911
	1=1	24.02%		
	2=2	30.57%		
	3=3	20.52%		
	4=4	13.97%		
	5= More than 4	10.92%		
Education	Highest level of		2.6245	0.9265
	education completed:	0.44%		
	0=Some school	9.61%		
	1=High school diploma	37.12%		
	2=Some college	32.75%		
	3=Bachelor's degree	20.09%		
	4=Advanced degree			

Variable	Description	Percentage of Occurrence	Mean	Standard Deviation
Household Income	Household's income		$56,650	$36,870
	level:	24.45%		
	Less than $20,000	8.735		
	$20,000-$35,000	13.54%		
	$35,001-$50,000	18.34%		
	$50,001-$70,000	13.545		
	$70,001-$100,000	21.40%		
	More than $100,000			
Environmental Score	Combination variable		5.4716	2.1430
	with *Bags* and *Purchase*			
	of Eco-labeled Products	10.92%		
	added together. (Scale 2-	9.61%		
	10)	13.97%		
	2	13.54%		
	3	20.52%		
	4	14.85%		
	5	7.42%		
	6	5.24%		
	7	3.93%		
	8			
	9			
	10			
Purchase of eco-labeled products	How often the consumer		2.7293	1.2794
	purchases eco-labeled			
	products (Likert scale 1-	21.40%		
	5).	22.27%		
	1	30.57%		
	2	13.54%		
	3	12.23%		
	4			
	5			

Results

The willingness to pay analysis was bounded at a maximum of $4.00 or a $1.25 premium level. The LIFEREG procedure in SAS is used in order to truncate the dependent variable at a

zero premium level in order to eliminate negative willingness to pay estimates. The assumption in doing this truncation is that if a consumer has a negative willingness to pay for the glass bottle, they will substitute by purchasing one of the alternatives.

Once the interval and log-likelihood models have been estimated, the results can be interpreted. The estimated coefficients from the WTP specification will show how the premium amount changes across individuals, which will help identify the types of consumers that are willing to pay the highest and lowest premiums for the glass bottled milk. The log-likelihood estimates will reveal the optimal premium range for returnable glass bottled milk. This will allow for the detection of the average premium that could be effectively added to the price.

The LIFEREG procedure uses the maximum likelihood estimation method, in which the researcher is able to define the distribution. In order for ease of interpretation, the logistic distribution was used in the estimation. Again, this procedure allows the researcher to truncate the dependent variable. This is especially useful when attempting to estimate the effects of a double-bounded contingent valuation question.

Other variables not in the summary of statistics were included in the analysis: *Perception*- whether or not the consumer perceives the glass bottle to be more environmentally friendly as compared to plastic; *More than* 2- a binary variable which identifies households with more than 2 people; *Stated*- the consumer's stated preference among the various types of milk packaging if all were the same price; *Local*- certain versions of the survey stated that the milk in the glass bottle was produced locally. The results of the willingness to pay model are presented in Table 5.6. Mean WTP estimated using the result of the regression is a 59.78 cent premium, or about $3.35 for the returnable glass bottle as compared to $2.75. The lower and upper bounds of

the willingness to pay are 33.03 cents and 86.53 cents, respectively, or about $3.08 and $3.62, respectively.

The intercept is significant at the 99% level and represents a base premium price that consumers within the sample are willing to pay. When comparing the intercept value to the mean willingness to pay with a Wald test, it was found that they are not statistically different. This means that the mean willingness to pay could be the base premium price level.

Table 5.6: Willingness to Pay for Returnable Glass Bottled Milk Regression

Parameter	Estimate	Std Error	Pr > ChiSq
Intercept	3.3838***	0.2089	<.0001
Age	0.098	0.1621	0.5457
Age Squared	-0.014	0.0339	0.6801
Gender	-0.0744	0.0548	0.1748
Household Size	-0.0757***	0.0229	0.001
Education	0.6226	0.4843	0.1986
Household Income	0.0494	0.0348	0.1555
Household Income Squared	-0.0001	0.0001	0.2352
Income/Education Interaction	-0.7106	0.4849	0.1428
Personal Responsibility	-0.0675	0.0568	0.2348
Perception	0.2678***	0.0582	<.0001
Local	0.0315	0.0541	0.5604
Bags	0.0381*	0.021	0.0696
Purchase of eco-labeled Products	0.0668***	0.0223	0.0028
Scale	0.3402	0.0178	
Log Likelihood	-202.555		

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The other statistically significant variables at the 99% level are *perception* and *purchase of eco-labeled products*. If a consumer perceives the returnable glass bottle to be more environmentally friendly than plastic, they are willing to pay an additional 26.78 cents. The more often a consumer purchases eco-labeled products they increase their likelihood of paying an additional 8 cents for each increase on the Likert scale.

At the 90% level, the variable *bags* is statistically significant. This shows that the more often a consumer uses canvas or reusable bags at the grocery store they increase their willingness

to pay by about 3.8 cents. It is also found that as household size increase a consumer's willingness to pay decreases by 7.5 cents. It was originally hypothesized that some of the demographic variables (age, income, education, etc.) would be statistically significant such that it would divulge which demographics would be willing to pay more for the glass alternative. Instead, none of those variables are statistically significant, revealing that the demographic characteristics are not important economically.

Table 5.7 illustrates how the varying levels of willingness to pay were distributed after all of the consumers completed the survey. This assists in understanding how the consumers reacted to the varying premium levels.

Table 5.7: Willingness to Pay Premium Distribution

Premium Level Combination	% Yes, Yes	% Yes, No	% No, Yes	% No, No
$2.80; $2.85	19.72%	3.45%	0.00%	9.30%
$2.85; $2.95	14.49%	6.90%	0.00%	11.63%
$2.95; $3.15	28.73%	55.17%	21.43%	34.88%
$3.10; $3.45	13.38%	13.79%	50.00%	18.60%
$3.25; $3.75	22.54%	20.69%	28.57%	25.58%
% of Total Sample	**62.01%**	**12.66%**	**6.11%**	**18.78%**

It is apparent at all premium levels that consumers are willing to pay some level of premium for the returnable glass bottle. Only 18.78% of the consumers surveyed were not willing to pay any premium amount, while 62.01% were willing to pay both premium amounts that were presented to them. It was found that 12.66% were willing to pay the first premium presented to them, but were not willing to pay twice that premium. At the same time, 6.11% of the consumers found the

first premium to be too large, but were still willing to pay some unknown premium less than the one they were presented. The results in Table 5.7 support the results in Table 5.6 in the fact that a majority of consumers, approximately 81%, are willing to pay some premium for the returnable glass bottle.

Table 5.8: Stated Preference Regression for Returnable Glass Bottled Milk

Parameter	Estimate	Odds Ratio	Std Error	Pr > ChiSq
Intercept	0.9052	----------	1.4532	0.5333
Age	-1.053	0.349	1.1253	0.3495
Age Squared	0.1957	1.216	0.2379	0.4107
Gender	-0.155	0.857	0.3883	0.6908
Household Size	-0.147	0.864	0.1592	0.3574
Education	5.0192	151.29	3.5559	0.1581
Household Income	0.3174	1.374	0.2556	0.2144
Household Income Squared	-7E-04	0.999	0.0007	0.3244
Income/Education Interaction	-4.933	0.007	3.5541	0.1652
Personal Responsibility	-0.087	0.917	0.3969	0.8268
Perception	1.3957***	4.038	0.223	<.0001
Local	-0.415	0.66	0.3843	0.28
Bags	0.4065***	1.502	0.1516	0.0073
Purchase of eco-labeled Products	0.3421**	1.408	0.1583	0.0307
Log Likelihood	-141.8			

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

In order to analyze which consumers have a preference for the glass bottled milk, a traditional logit model was estimated. The model components are similar to the WTP model with the change of the dependent variable to *Stated*. The purpose of using *Stated* as the dependent variable is to determine what the preferred milk packaging of the consumers is in regards to alternative milk packaging. Specifically, the regression is focused on the consumers' stated preference towards a returnable glass bottle. The results of this regression are shown in Table 5.8.

This type of regression will provide a stated preference analysis of the consumers in this geographic area in regards to a perceived environmental attribute. This is critical for comparison

to the WTP regression because if a consumer prefers glass, *ceterus paribus*, then they are more likely to accept a price premium to purchase glass.

The results of the logit model indicate that five variables are statistically significant. The variable with the largest impact on a consumer's stated preference for returnable glass bottled milk is *Perception*. The results show that a person is 4.038 times more likely to have a stated preference for the returnable glass bottle if they perceive it to be more environmentally friendly than plastic. It was hypothesized that someone who perceived the returnable glass bottle to be more environmentally friendly than plastic would have an increased likelihood to prefer the glass alternative; however, the opposite was hypothesized for the binary variable of *More than 2*.

Furthermore, the more often a consumer shops with canvas or reusable bags, they are 1.502 times more likely to have stated that they have a preference for the returnable glass bottle. Similarly, the more often a consumer purchases eco-labeled products (i.e. for each increase on the Likert scale), they are 1.408 times more likely to have stated that they have a preference for the returnable glass alternative. Also, even though the education variable is not statistically significant, it is economically significant in that for each increase in education, a consumer is 151.29 times more likely to prefer the returnable glass bottle.

Given that the primary goal of this research is to determine whether or not consumers are willing to pay for a perceived environmental attribute, in reference to the milk packaging options, it is important to determine which variables impact a consumer's perception of the returnable glass bottle. Table 5.9 shows the results of a traditional logit model with the dependent variable as *Perception*. In this case, the variables on the right-hand side of the model are the same as before, except that the *Perception* variable is removed and used as the dependent variable. Given that the dependent variable in this case was used as an independent variable in

the previous analyses, there is potential for some variables to be endogenous. However, any variables that result in being significant demonstrate a pathway as to explaining the willingness to pay results.

Table 5.9: Consumer Environmental Perception for Returnable Glass Bottled Milk

Parameter	Estimate	Odds Ratio	Std Error	Pr > ChiSq
Intercept	-0.1384	----------	0.0122	0.9120
Age	-0.3420	0.710	0.1179	0.7314
Age Squared	0.1046	1.110	0.2399	0.6243
Gender	-0.00018	1.000	0.0000	0.9996
Household Size	-0.1795	0.836	1.7356	0.1877
Education	-3.1469	0.043	1.1832	0.2767
Household Income	-0.2355	0.790	1.2923	0.2556
Household Income Squared	0.000586	1.001	1.2188	0.2696
Income/Education Interaction	3.1952	24.415	1.2148	0.2704
Personal Responsibility	-0.1748	0.840	0.2615	0.6091
Local	-0.1478	0.863	0.2018	0.6532
Bags	0.4613***	1.586	11.8502	0.0006
Purchase of eco-labeled Products	0.0142	1.014	0.0113	0.9155
Log Likelihood	-134.715			

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

After running the traditional logit, it was found that only one variable was statistically significant, which was at the 99% level, in determining whether or not a consumer perceives the returnable glass bottle to be more environmentally friendly than plastic – *Bags*. This means economically that the more often a consumer uses canvas or reusable bags they are 1.586 times more likely to perceive the returnable glass bottle to be more environmentally friendly than plastic.

Discussion

The parameter estimates from the LIFEREG procedure can be economically interpreted as the marginal willingness to pay estimates. Marginal willingness to pay refers to the difference in willingness to pay as an explanatory variable changes by one unit. This fact is due to the

dependent variable being a bounded range of willingness to pay estimates. A logistic distribution was assumed in order to ensure a closed form solution among the maximum likelihood estimates. Unlike a traditional logit model, the exponential of the estimates do not need to be taken due to the nature of the model.

While it is intuitive to think that those consumers that use canvas or reusable bags and those that purchase eco-labeled products are willing to pay more for the glass alternative, it is still important that this connection was made. There is now a clearer understanding of which types of consumers are willing to pay more the glass alternative and appropriate marketing efforts can be introduced.

The most interesting revelation is that people who perceive the returnable glass bottle to be more environmentally friendly than plastic are willing to pay an extra 26.78 cents. This is significant in the fact that approximately 81% of those surveyed were willing to pay some premium for the returnable glass bottle. At the same time, approximately 72.5% of the survey respondents perceive the glass bottle to be environmentally friendly. It is apparent that some of those who do not perceive or are unsure if the glass alternative is more environmentally friendly are still willing to pay a premium. This may be the result of nostalgia or reveal potential hypothetical bias within the survey sample.

What this portion of the study reveals that even though there is no clear identifier (i.e.-label), consumers are willing to pay a premium for the perceived environmental attribute of a glass bottle. This is significant in the fact that consumers have the perception of the glass bottle being more environmentally friendly than the plastic alternative.

There is a negative relationship between *Household size* and willingness to pay that could be a response to the inherent risk with purchasing the glass alternative. Additional people that are

potentially handling the glass bottle increases the risk of breakage. This is a concern for many parents that have small children in their home. Also, it is a concern for people over the age of 60 that have a reduced level of strength when handling heavier objects.

From the results of the social cost portion of the study, it was found that a consumer needs to be willing to pay an extra 4 to 19 cents over the price of the plastic bottle in order for the returnable glass bottle to be the socially optimal choice among the alternatives. The WTP regression revealed that the mean willingness to pay for the glass alternative was about 60 cents which is higher than the predicted range.

It can be seen that the most statistically significant variable within the stated preference regression is whether or not the consumer perceives the returnable glass bottle to be more environmentally friendly than plastic. If the consumer does perceive the glass bottle to be more environmentally friendly, then they are 4.038 times more likely to have stated that they have a preference for the glass bottle.

The more often a consumer uses, or prefers to use, canvas or reusable bags when they shop for groceries, they are 1.508 times more likely at each level on the Likert scale to have stated that they have a preference for the returnable glass bottle. Moreover, the more often the consumer purchases food products that are considered to be eco-labeled they are 1.408 times more likely to have stated that they have a preference for the returnable glass bottle. The education variable is economically significant even though it does not meet the statistically significant cutoff. In fact, as a consumer's education increases they are about 151 times more likely to prefer the returnable glass bottle.

Once again, if a consumer perceives the glass alternative to be more environmentally friendly than the plastic they are much more likely to have stated that they have a preference for

the glass. This is significant in the fact that it corresponds with the WTP regression. Consumers that have a positive environmental inclination toward the returnable glass bottle. This is occurring even though there is not a labeling scheme informing them that the returnable glass bottle has a lower environmental impact as compared to the plastic.

Conclusions

Overall, it was found that consumers, on average, are willing to pay a premium for returnable glass bottled milk. This is significant in the fact that there is no identifying label suggesting that the bottle is environmentally friendly. The idea that consumers do perceive returnable glass packaging to be more environmentally friendly than plastic shows that there is precedence for more research into these types of products. If there are other products similar to the returnable glass bottle, whether or not they truly have a lower environmental impact, then consumers could be indirectly creating a market for these products.

The multiple regressions used within this study reveal a pathway that contributes to the understanding of the information. In the perception regression, it was found that the more often a consumer uses canvas or reusable bags, the more likely they are to perceive the glass bottle to be more environmentally friendly. From this regression it was seen that a consumer's stated preference for the returnable glass alternative was based not only upon the *Bags* and *Perception* variables, but was also influenced by *Household size* and how often they purchase eco-labeled products. Finally, both the perception of environmental friendliness and willingness to pay for glass packaging are explained by the same pattern of statistically significant explanatory variables.

For the Lubbock area, there is potential demand for the glass bottled milk. It is hoped that the local dairies in this area will be able to use this information in order to appropriately introduce this type of product into the grocery stores so that they may take advantage of

accessing this portion of the market through product differentiation. From the results of the analysis, the types of consumers that have a stated preference for returnable glass bottled milk are people that prefer to buy eco-labeled food products and/or use canvas/reusable bags when they shop for groceries. It is also important to note that consumers that perceive the glass bottle to be environmentally friendly are those that willing to pay the highest premium.

Another important note is that there are more consumers that are unsure if they perceive the returnable glass bottle is more environmentally friendly than plastic than there are those that do not perceive it to be. It was found through this study, that under certain situations the returnable glass is the socially optimal choice. It is also important to educate potential consumers of these aspects. This could be accomplished through appropriate advertising, labeling, and other mechanisms.

Future research should focus on determining potential consumer return rates of the glass bottle to the store in order to determine if the calculated WTP return rate is in line with the likelihood of actual consumer return rates. If these two variables do not line up, then the returnable glass bottle would not be the optimal social choice. Other research should focus on expanding the idea of the perceived environmental attribute to other types of products and geographical locations to determine if the results of this study hold true on a broader scale.

Overall, the double bounded dichotomous choice design is still widely used and accepted within willingness to pay studies. This research has successfully demonstrated that some consumers are willing to pay for an environmental attribute that they believe a particular product possesses. A large majority of the consumers surveyed perceived a returnable glass milk bottle to be more environmentally friendly than plastic, which means that there is precedence for future

research in this area to determine what other products consumers perceive to have an environmental attribute.

Limitations and Extrapolation

In hindsight, some limitations to the study were brought to light. The first limitation was that the survey was only administered at one grocery store within the Lubbock, Texas area. While the sample did represent the general population well, there is concern that not all of the different consumer segments were represented. By doing the survey at different grocery stores in different areas across the city would help to address this problem.

The other limitation of this study resulted from being unable to extract consumer return rates for the returnable glass bottle. This is an important aspect to determine in order to help estimate demand for the product. Also, it is unknown whether or not any grocery stores are willing to participate in a returnable glass operation.

These results, however, can be extrapolated to estimate the WTP for specific consumer segments. The mean WTP within the study is for the entire sample. Since there various regressions reveal which consumers have a higher WTP and those that have a higher likelihood of preferring the returnable glass, a corresponding WTP can be estimated. Dairies cam use this information to extract the highest premium and create a better market toward a target market. This helps the producers to offset the cost of packaging the milk in the returnable glass bottle.

Works Cited

Bajari, P., & Benkard, C. L. 2001. Demand estimation with heterogeneous consumers and unobserved product characteristics: A hedonic approach.

Baker, G. A. 1999. Consumer Preferences for Food Safety Attributes in Fresh Apples: Market Segments, Consumer Characteristics, and Marketing Opportunities. *Journal of Agricultural & Resource Economics*, *24*(1).

Byrne, P. J., Toensmeyer, U. C., German, C. L., & Muller, H. R. 1991. Analysis of consumer attitudes toward organic produce and purchase likelihood. *Journal of Food Distribution Research*, *22*(2), 49-62.

Lopez-Feldman, A. 2012. Introduction to contingent valuation using Stata.

Gallardo, R. K., & Wang, Q. 2013. Willingness to Pay for Pesticides' Environmental Features and Social Desirability Bias: The Case of Apple and Pear Growers. *Journal of Agricultural & Resource Economics*, *38*(1).

Heij, C., P. De Boer, P. H. Franses, T. Kloek, and H. K. Van Dijk. 2004. *Econometric methods with applications in business and economics*. Oxford University Press.

Huang, C. L. 1996. Consumer preferences and attitudes towards organically grown produce. *European Review of Agricultural Economics*, *23*(3), 331-342.

Ilbery, B., & Kneafsey, M. 1999. Niche markets and regional speciality food products in Europe: towards a research agenda. *Environment and Planning A*, *31*(12), 2207-2222.

Johannson-Stenman, O., and P. Martinsson. 2006. Honestly, Why are You Driving a BMW? Journal of Economic Behavior & Organization 60:129–146.

Kremen, A., C. Greene, and J. Hanson. 2004. *Organic produce, price premiums, and eco labeling in US farmers' markets*. Economic Research Service, USDA.

Loureiro, M. L. and Hine, S. 2001. Discovering niche markets: A comparison of consumer willingness to pay for a local (colorodo-grown), organic, and gmo-free product. *American Agricultural Economics Association Meetings*.

Loureiro, M. L., McCluskey, J. J., & Mittelhammer, R. C. 2001. Assessing Consumer Preferences for Organic, Eco-labeled, and Regular Apples. *Journal of Agricultural & Resource Economics*, *26*(2).

Luce, R. D. 2012. *Individual choice behavior: A theoretical analysis*. DoverPublications.com.

Lusk, J. L., and F. B. Norwood. 2009a. Bridging the Gap between Laboratory Experiments and Naturally Occurring Markets: An Inferred Valuation Method. Journal of Environmental Economics and Management 58:236–250.

Lusk, J. L., and F. B. Norwood. 2009b. An Inferred Valuation Method. Land Economics 85500–514.

Misra, S. K., Huang, C. L., & Ott, S. L. 1991. Consumer willingness to pay for pesticide-free fresh produce. *Western Journal of Agricultural Economics*, *16*(2), 218-227.

Nimon, W., & Beghin, J. 1999. Are eco-labels valuable? Evidence from the apparel industry. *American Journal of Agricultural Economics*, *81*(4), 801-811.

Norwood, F. B., and J. L. Lusk. 2011. Social Desirability Bias in Real, Hypothetical, and Inferred Valuation Experiments. American Journal of Agricultural Economics 93:528–534.

Train, K. E. 2009. *Discrete Choice Methods with Simulation*,2nd ed., Cambridge University Press, new York, NY.

Thompson, G. D., & Kidwell, J. 1998. Explaining the choice of organic produce: cosmetic

defects, prices, and consumer preferences. *American Journal of Agricultural Economics*, *80*(2), 277-287.

Toro-González, D., Gallardo, R. K., Yan, J., & McCluskey, J. J. 2013. Quality Differentiation with Flavors: Demand Estimation of Unobserved Attributes. *Journal of Agricultural & Food Industrial Organization*, *11*(1), 1-11.

Zaleski, Walter R. “plastic bottle.” Patent 3,086,671. 23 April 1963.