Identifying Significant Characteristics of Organic Milk Consumers: A CART Analysis of an Artefactual Field Experiment

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Abstract

The organic dairy category is one the fastest growing categories of organic production in the U.S. Organic milk consumers generally cite perceived health benefits and lower risk of food contamination, as well as perceived superior quality and low environmental impact of organic farming methods, as the major motivations for preference of organic over conventional milk. While the properties of organic milk that are valued by consumers are fairly well-known, there is more ambiguity regarding the demographic characteristics of the typical organic milk consumer. This research makes use of experimental data and utilizes a relatively novel non-parametric modeling approach, the CART analysis, in identifying how willingness to pay for organic milk varies with the demographic profile of experiment participants. A more traditional econometric approach utilizing a Tobit regression is also performed to compare the results of the two models. The study finds that perceived taste of organic milk and concern for the risk of consuming conventional milk are major factors that separate experiment participants into groups with high and low WTP for organic milk.

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Introduction

One of the fastest-growing categories of organic production in the United States is in the organic dairy category. Organic dairy products have seen annual retail sales increases ranging from 16% to 34% between 1997 and 2007. This increase in organic dairy sales occurred concurrently with a shift away from conventionally-produced milk sales, and towards rBST-free milk sales, by several large dairy processors and retailers, including Dean Foods, Hood, Kroger, and Wal-Mart.

The simultaneous increase in organic dairy sales and refusal by some large retailers to sell milk containing rBST highlights a possible shift in consumer preferences in favor of foods perceived to be safer and healthier, both of which are characteristics of organic agriculture commonly cited by consumers who prefer to purchase organic products. Along with perceived superior quality and lower environmental impact of organic farming methods, these characteristics of organic production preferred by organic consumers are generally well-known. However, the demographic characteristics of organic consumers are less well-known.

Several studies have attempted to identify the characteristics of organic consumers, often with conflicting results. Studies have had difficulty determining which groups are more likely to purchase organic goods, and the characteristics of organic consumers have been found to change over time (Dimitri and Vicenzie 2007). A 2006 Hartman Group study found that middle-class families with an income of less than $50,000 were most likely to have purchased organic in the last three months, while evidence from dairy scanner data suggests that organic milk purchases are positively related to income (Dimitri and Vicenzi 2007). A study by Bernard and Bernard in 2009 supports the idea that WTP for organic dairy attributes increase with income, and

additionally finds that consumers are willing to pay a premium for the hormone and antibiotic-free attributes found in organic milk. One finding that most studies of organic products agree upon is that families with young children are more likely to purchase organic products than those without children.

With the increasing role organic products, and specifically organic milk, play in the retail arena, it is important to gain a better insight into the characteristics of organic milk consumers. Dairy producers and retailers stand to gain with a better understanding of their consumers. Producers need to understand the organic market in order to make informed decisions on transitioning into, or increasing, organic production (which carries high costs relative to conventional production, but also allows for charging significant price premiums), while retailers stand to gain through more accurate targeting of their marketing activities by advertising the properties of organic milk most likely to appeal to new and existing consumers. Consumers can also capture benefits if they are able to make more informed purchase decisions based on improved marketing by milk producers and retailers.

In this research, we shed some light on the characteristics of organic consumers using Classification and Regression Tree (CART) analysis, a relatively novel approach in the field of agricultural economics. CART analysis is a decision tree method that allows us to separate independent variables into homogenous groups, and determine how these homogeneous groups influence the dependent variables. The CART model is applied to data from an economic experiment using non-student subjects which elicited willingness to pay for organic milk. By utilizing CART analysis, we separate experiment participants into homogenous groups based on their characteristics, and determine how being a member of each group influences the willingness to pay more or less for organic milk. This approach has advantages over traditional

regression techniques; rather than analyzing how the average consumer's WTP changes as we alter independent variables (which may present problems in contexts where many variables interact to determine WTP), we can analyze how being part of a characteristic group influences WTP, and we can allow for experiment participants being members of multiple characteristic groups. This approach is especially attractive for our study, as we are primarily interested in how broad groups of consumers value organic milk; these consumers are likely to be members of multiple groups that have differing values for milk, and understanding how being members of multiple groups affects WTP for organic milk is vital to understanding consumer demand. The CART analysis is compared to a more traditional econometric (two-limit Tobit) model to contrast the differences and similarities in results.

Literature Review

The experimental method utilized in this study contains elements of both measuring actual consumer behavior, as well as consumer attitude based studies such as surveys and contingent valuation studies. Thus it is worthwhile to note that, while both types of studies find similarities in the characteristics of consumers who value organic attributes, there are also differences.

Income has been found to be positively correlated with actual organic milk purchases in some studies, while other studies have found that frequent organic milk purchasers have incomes of below $50,000 per year (Dimitri and Vicenzie 2007, Hill and Lynchehaun 2002). These differing pictures of the organic milk consumer are likely due to the high price premiums associated with organic milk. Lower income consumers may value organic milk attributes; however, their lower disposable income may prevent them from consuming large quantities of

organic products (Hughner et. al. 2007, Krystallis and Chryssohoidis 2005). While high income may be linked with higher levels of organic milk purchases, it is unclear how income relates to attitudes towards organic products. Bernard and Bernard (2009) find that higher income leads to higher WTP for the antibiotic and hormone-free attributes found in organic milk; on the other hand, studies find that young consumers (who tend to have lower income) tend to have very positive attitudes towards organic products (Magnusson et. al. 2001). Consumers with higher levels of education have also been found to purchase more organic products (Govindasamy and Italia 1999, Dimitri and Vicenzie 2007). Since education and income are correlated, it is difficult to determine whether high income leads consumers to purchase organic milk, or whether those with high income tend to be more educated, and therefore more aware of the perceived risks associated with conventional food production.

There tends to be more agreement between the attitudes towards organic milk and actual purchasing behavior with regards to concerns for health and food safety. Zanoli and Naspetti find that health is an important factor for organic purchasers, as do Magnusson et. al. (2003). Hill and Lynchehaun (2002) find that families often take a greater interest in organic foods when a baby arrives, as organic foods are often perceived to be healthier than conventionally produced foods. While many studies find that organic consumers are concerned with health and food safety, this is not guaranteed to lead to organic purchases. Angulo et. al. (2003) found that consumers are indeed concerned with food safety risk, but are unwilling to pay a premium to reduce this risk.

The perceived quality of organic milk has also been found to be a factor in consumer purchase behavior. Magnusson et. al. (2001) found that taste was an important factor in the WTP for organic food. Hill and Lynchehaun(2002) find anecdotal evidence that consumers buy

organic milk due to superior taste. However, while some consumers may cite taste as a motivation for purchasing organic milk, Fillion and Arazi (2002) finds that consumers are unable to differentiate between conventional and organic whole milk in taste tests.

Experimental Design

All of the sessions were conducted in an experimental economics laboratory at a large northeastern university. Adult participants were recruited from the local community via email announcements through the university's online publication. Fifteen sessions were conducted and participants received an average of $15 for their participation in the one-hour experiment.

Participants were assigned a random subject identification number and then were seated at individual computer terminals. Participants made their confidential decisions using Excel spreadsheets that had been programmed with Visual Basic for Applications. Each computer was equipped with a privacy screen and no communication between participants was permitted. The data was stored in an Access database.

Participants were informed that they would be making a number of decisions where they would indicate their highest willingness-to-pay (WTP) for several items. Given its incentive-compatible and demand revealing characteristics, this research used the Becker-DeGroot-Marschak (BDM) (1964) bidding mechanism. In this mechanism, subjects receive an initial endowment, Y, and then submit a bid (B_i) that represented their WTP for the item. After all of the bids had been collected, the administrators would randomly determine the price of the item (P) by having a volunteer participant drop a pen on a random numbers table. Based on the participant's bid and the randomly determined price, subjects would have one of two outcomes:

If $B_i \geq P$, then the participant purchases the item and receives a payment of $Y - P$.

If $B_I < P$, then the participant does not purchase the item and receives a payment of Y.

Several steps were conducted to help the participants understand the BDM mechanism used in this study. First the participants were first given fifteen minutes to read the printed instructions (Appendix), and then the protocols were described verbally with the use of a PowerPoint presentation to ensure consistency across sessions. Participants were explicitly told that it was always in their best interest to submit a willingness-to-pay (WTP) bid that was equal to their highest value that they would have for this item.

Similar to Messer et al. (2010) and Irwin et al. (1998), participants were provided five practice rounds where they submitted bids where they had induced "cash" values. The induced values were $1.00, $2.50, and $4.00. The initial balance in these rounds was $5.00 and the range of costs was $0.00 to $4.99. Participants received payoff from each of these rounds and the exchange rate was one US dollar for each two experimental dollars earned.

The administrator guided the participants through the first five rounds. After everyone had submitted their bids for the round, the administrator displayed, in the front of the room, a list of the WTP bids listed from highest to lowest. The subject identification numbers were not listed with the bids. The administrator then asked the following four questions:

1) Can you identify your bid?

2) Which participants purchased the decision?

3) How much will these participants have to pay and how much will they earn in this round?

4) How much will the participants who did not purchase the decision earn in this round?

Finally, to help participants transition from understanding the BDM mechanism with induced values to using the mechanism with endogenous, "home-grown" values that represented their own consumer preferences, participants were given an endowment of $0.50 and asked to submit a bid for a Ticonderoga pencil where the range of costs would be between $0.00 and $0.49. With the pencil and the subsequent bids on the milk, the exchange rate was set so that participants earned one US dollar for each experimental dollars earned. This part of the experiment also demonstrated that BDM mechanism is not a competitive auction and that subjects did not need to be concerned with the behavior of other subjects—instead it was to their best interest to focus on determining their own value for the item.

In the final part of the experimental session, participants were asked to submit their WTP bids for a quart of different milks. As described in Kanter, Messer, and Kaiser (2009), bids were collected for milk from three different production processes—Organic, Conventional, and rBST-Free. For each production process, three glasses of milks were given to participants on a tasting sheet (Figure 1). One was low fat (skim) milk, one was 2% milk, and one was whole (3.25% fat) milk. The different fat types and different flights were presented to participants in different orders. At the conclusion of the bidding process, the administrators revealed which of the milk choices would result in case earnings. This selection was done randomly, so participants were advised that since each choice had an equal likelihood of being implemented that they should

consider each choice as if that was the one that was going to be selected to determine whether they purchased the product and how much cash earnings they would receive.

The tasting sheet had a space for the participants to put their three five-ounce cups of milk to ensure that they would not get confused. The tasting sheet also had two questions related to the quality and taste of the milks (Chapman and Boor 2001; Chapman, Lawless, and Boor 2001).

> "Please rate how closely this product matches your expectation of fresh, high quality milk (1 = Worse than Expected; 5 = Meets Expectations; 10 = Better than Expected)."
>
> "Please rate how much you like this product (from 1-10, with 10 being most favorable)"

Participants were also given nutritional information that both highlighted the difference in fat contents of the three milks and the general similarities with regards to the other nutritional elements (Figure 2). Participants were also given information on a handout that stated that the organic milk was "produced without the use of antibiotics, synthetic growth hormones, or pesticides." This wording came directly from the labels from the cartons of the original milk.

All of the milk was kept cold and stored at 42 degrees in the lab's refrigerator. The milk was poured into the participants five-ounce cups from clear pitchers so that participants would not be affected by carton packaging or branding. Participants were informed that if they purchased the milk that they would have the option of taking it away immediately following the experiment session, returning to the laboratory between 4-5pm so that people could pick it up on their way home, or have the milk delivered at no charge. The subjects were encouraged to taste the milks, answer the tasting questions, and then submit their WTP bids for each milk. After all

of the bids were submitted, participants completed a questionnaire that included questions related to the participants socio-economic background, milk consumption habits, and risk attitudes.

Results

Classification and Regression Tree Analysis (CART)

In the CART analysis, we used 12 candidate variables as potential variables for classification of experiment participants. Participants' willingness to pay for organic milk is the parent node. Figure 3 illustrates the classification tree generated by the CART analysis. Each node displays the corresponding mean WTP of each group, the standard deviation and the number of observations in each group. As is shown, participants are generally classified by four variables: OTASTE, PRIMSHOP, RISKP and QTYMILK.

The first split is from the OTASTE variable (see Table 1 for variable descriptions) - participants' willingness to pay for the product is separated by their perception of the taste of organic milk. This is an intuitive result: people who enjoy the taste of organic milk are willing to pay a higher price for the product. For participants who have taste values less than 14, their WTP for organic milk is $0.39, 29% of the average WTP of $1.35 for all participants. For those who have taste values higher than 14, the WTP for organic milk is $1.60 – 118% of the average WTP for all participants.

The second classifier, which groups up participants who favor organic milk, is the variable PRIMSHOP. In the survey, subjects were asked whether they are the primary shopper in their household. Note that the participants whose taste values are less than 14 are not separated by any other variables. This indicates that those who dislike organic milk are relatively

homogenous. Primary shoppers have a much higher WTP than whose who are not primary shoppers – their mean WTP is $1.79, 63% higher than non-primary shoppers. Notice that their WTP is higher than the average WTP of participants with OTASTE values greater than 14; that is, if a participant favors organic milk, they are willing to pay a premium relative to those with lower OTASTE values. If they are not only an organic milk lover but also the primary shopper in the household, they are willing to pay an even larger premium - 132% of the average WTP for all participants.

The third classifier, which again separates high WTP primary shoppers, is the variable RISKP. RISKP measures participants' concern about the risks in the milk. In the survey, subjects were asked "How concerned are you about the following in your milk?" The choices include pesticides, antibiotics, artificial hormones and herbicides/fungicides. Each choice is evaluated from 1 to 9, ranging from not concerned to the very concerned. We find that the values corresponding to the answers to these questions are highly correlated[2], thus we use the average score for these four potential risks. Not surprisingly, participants who are worried more about risks associated with milk are willing to pay more for organic milk, likely because they believe the level of risk associated with consuming organic milk is lower than that of consuming conventional milk. Participants who have a RISKP value of more than 3 have a mean WTP of $2.09, 155% of the average WTP for all participants and 17% higher than average WTP for primary shoppers with high OTASTE values. Participants who have a RISKP value of less than 3 have a WTP of $0.84, 47% of the average WTP for primary shoppers with high OTASTE values.

[2] The correlation coefficients between evaluation for pesticides and antibiotics, artificial hormones and herbicides/fungicides are 0.811, 0.822 and 0.964 respectively. The correlation coefficients between antibiotics and artificial hormones and herbicides/fungicides are 0.868 and 0.814 respectively. The correlation coefficient between artificial hormones and herbicides/fungicides is 0.813.

The last classifier continues to extend the subset of subjects with high WTP. Participants who perceive higher risk associated with chemicals in their milk can be further separated by the quantity of milk they consume. In the survey, participants were asked, "In the typical week, approximately how much milk does your household consume?" Individuals whose households drink more than 0.625 gallons per week have a mean WTP of $2.38, while those whose households drink less than 0.625 gallons per week have a mean WTP of $1.59.

Let us reconsider the distribution of participants split up by the four classifiers. The number of observations in the experiment is 444. The WTP for organic milk is characterized by subjects' perception of the taste of organic milk, whether they are primary shoppers, how much they are concerned with chemicals in their milk, and the quantity of milk their households consume. On the top level of the tree, 90 (20%) observations have lower WTP than the remaining 79.73%. This indicates that participants' WTP can be divided by their taste for organic milk; higher WTP is directly associated with higher taste values, thus participants' opinion of the flavor of organic milk is the best predictor of their WTP for the milk. The high-taste value group is then divided by PRIMSHOP, from which 294 observations (83%) are further subdivided by RISKP values at the next node. There are no characteristics that can separate participants following the final node, which separates heavy milk consuming households from lower consumption households. In this last segment, we have 81 observations in which households that drink less milk have lower WTP while 141 observations where households drink more milk each week are in the higher WTP group. Furthermore, the terminal nodes 1, 4, 5, 7 and 8 determine the final classification of participants (5 groups). Figure 1 shows the distribution of participants in different groups. Participants who have taste value higher than 14, who are also the primary shoppers, whose concerns about risk are higher than 3 scale points and whose households drink

more than 0.625 gallons of milk per week, constitute the largest part of the classification, and they also have the highest WTP of $ 2.38. Not surprisingly, participants who do not like organic milk (OTASTE < 14) bid the lowest among five groups. Other variables such as INCOME, FREQ_ORG and EDU are not found significant to characterize consumer groups.

Performance of the CART Analysis

The performance of the model can be evaluated by either the risk estimate or the receiver operating-characteristic (ROC) curve that describes the predictive validity of the model on "rank(ing) a randomly chosen positive instance higher than a randomly chosen negative instance" (Fawcett 2006). In this case, the performance of the CART model can be assessed by analyzing how well the model predicts participants' positive WTP (1=positive WTP) for organic milk over zero WTP. The risk estimate for the CART model is 1.576, which stands for the within-node reference and the variance explained by the model is 29.01%. The area under the curve (AUC) in Figure 4 shows that the probability that the tree ranks a randomly chosen positive WTP higher than a randomly chosen zero WTP is 72 percent. The coordinates of the curve also show that if one wanted to find 76.9% of people with positive WTP, 38.7% of them would be misclassified.

Two-Limit, Random-Effect Tobit Model

We also estimated the influence of variables by using two-limit, random-effect Tobit model. Participants were asked to submit bids for three types of milk and the bids were constrained to from $0 to $5. Thus in this two-limit Tobit model, the WTP is left-censored at $0 and right censored at $5. Since some subjects did not answer all of the survey questions, the total number of observation for the model is 408. In contrast to the CART analysis, the Tobit model also includes the dummy variables for three types of milk content and different experiment sessions, which could not be captured by CART analysis. The session numbers indicate experiment sessions conducted at different times. Additionally, interaction terms for OTASTE and QTYMILK, and OTASTE and EDU have also been included, as perceived taste may vary according to the levels of certain demographic variables.

Table 3 displays the results from the Tobit model. Note that some of the session dummy variables are significant at the 5% level, indicating that the experiment conditions did influence participants' WTP. Similarly, the significance of THIRSTY at the 5% level along with its positive coefficient indicates that participants bid higher for the milk if they were thirsty when doing the experiments. The significance of dummy variables indicating the fat content of the milk (FAT0 and FAT1) also suggests that participants' WTP for three types of milk are different from each other. WTP for skim milk and low fat milk are $0.25 and $0.30 higher than whole milk.

This model again shows that WTP is influenced by OTASTE, PRIMSHOP, QTYMILK, and RISKP (all significant at the 1% level), variables which separated participants into groups in the CART analysis. The interaction terms OTASTE_QTYMILK and OTASTE_EDU are also

significant at the 1% and 5% levels respectively. However, the partial effect of OTASTE, QTYMILK and EDU on the WTP should be explained with care. The partial effect of OTASTE on WTP is the combination of its direct effect and its interaction with the quantity of milk the participants' household drinks per week and the individual's education level. Notice that the coefficients of the two interaction terms are both negative. In other words, the positive effect on WTP brought about by higher OTASTE values is mitigated by higher levels of education and household milk consumption. PRIMSHOP also has a large influence on the WTP, as was the case in the CART analysis. If the participant is the primary shopper of the household, their WTP is $1.391 higher than non-primary shoppers. Recall that in the CART analysis, within the high-taste group, the primary shoppers had an average of $1.426 higher WTP than non-primary shoppers. For the variable RISKP, one more scale point (ranges from 1-9) in concerns about risks associated with milk would result in a $0.21 increase in WTP for organic milk. In addition, CHU10 is found to be significant at 5% level, which is not captured by CART. However, if the number of children under 10 increases by 1, the WTP will decrease by $0.47. As the number of children increases, the household likely has less disposable income, which limits their ability to pay a premium for organic milk.

Comparison of the CART Analysis and Tobit Model

The results from CART analysis and Tobit model confirm the importance of the OTASTE, PRIMSHOP, QTYMILK and RISKP variables. The Tobit model includes a larger set of significant factors that determine consumers' willingness to pay, such as EDU and CHU10, which are not found to be significant in the CART analysis. One advantage of the CART model

is its ranking of the relative importance of classifiers through evaluation of the improvement score at each node. In this model, improvement scores for OTASTE, PRIMSHOP, QTYMILK and RISKP are 0.238, 0.14, 0.073 and 0.193 respectively, indicating an importance rank (from high to low) for these variables of OTASTE, RISKP, PRIMSHOP and QTYMILK.

Conclusion

The results of the CART analysis are largely consistent with the literature on organic milk consumer demographics. While consumers may not be able to distinguish between conventional and organic milks in blind taste tests, many consumers do indeed perceive organic milk as a superior quality product, and their WTP for organic milk reflects this perception. In addition we find that concern for the risk of consuming products containing chemicals is an important determinant in the consumer valuation of organic milk.

We also find that, in this study, factors that are commonly accepted as increasing WTP for organic milk, such as income and the number of children in a family, were not primary determinants of WTP. These results highlight some of the uncertainty still present with regards to the profile of the typical organic milk consumer.

The diversity of results concerning the characteristics of the organic milk consumer highlights the need for continuing research in this field. Organic milk is becoming increasingly available in traditional supermarkets, exposing consumers who typically consume conventional milk to the option of consuming a larger variety of products. While organic milk premiums still remain high relative to the price of conventional milk, this will not necessarily be the case going forward, and it is in the best interests of organic milk producers to understand the expanding

group of consumers who value their products. Similarly, consumers stand to gain if organic milk producers are better able to highlight the aspects of their product that consumers find the most attractive.

References

Angulo, A.M., Gil, J.M., and Tamburo, L. 2005. "Food safety and consumers'willingness to pay for labeled beef in Spain." *Journal of Food Products Marketing* 11(3):89-105.

Becker, Gordon M., M.H. DeGroot, and J Marschak. 1964. "Measuring Utility by a Single-Response Sequential Method." *Behavior Science* 9(3):226-232.

Bernard, J.C., and D.J. Bernard. 2009. "What Is It About Organic Milk? An Experimental Analysis." *American Journal of Agricultural Economics* 91(3): 826-836.

Chapman, K.W., and K.J. Boor. 2001. "Acceptance of 2% Ultra-pasteurized Milk by Consumers 6 to 11 Years Old." *Journal of Dairy Science* 84:951–54.

Chapman, K.W., H.T. Lawless, and K.J. Boor. 2001. "Quantitative Descriptive Analysis and Principal Component Analysis for Sensory Characterization of Ultra Pasteurized Milk." *Journal of Dairy Science* 84:12–20.

Dimitri, C. and Venezia, K.M. 2007. "Retail and Consumer Aspects of the Organic Milk Market." Outlook Report, No.LDPM15501. U.S. Department of Agriculture, Economic Research Service, Washington, DC. Available at Website http://www.ers.usda.gov/publications/LDP/2007/05May/LDPM15501/ldpm15501.pdf (verified 2 April 2011).

Fillion, L, and S. Arazi. 2002. "Does organic food taste better? A claim substantiation approach." *Nutrition and Food Science* 32(4): 153-157.

Fawcett, Tom. 2006. "An introduction to ROC analysis." *Pattern Recognition Letters* 27:861-874.

Govindasamy, R., and Italia, J. 1999. "Predicting willingness to pay a premium for organically grown fresh produce." *Journal of Food Distribution Research* 30(2):44-53.

Hill, Helene, and F. Lynchehaun. 2002. "Organic milk: attitudes and consumption patterns." *British Food Journal* 104(7):526-542.

Hughner, R.S., McDonagh, P., Prothero, A., Shultz, C.J., and J. Stanton. 2007. "Who are organic food consumers? A compilation and review of why people purchase organic food." *Journal of Consumer Behavior* 6:94-110.

Irwin, Julie R., G.H. McClelland, M. McKee, W.D Schulze, and N.E. Norden. 1998. "Payoff Dominance vs. Cognitive Transparency in Decision Making." *Economic Inquiry* 36(2):272-285.

Kanter, C., Messer, K.D., and Kaiser, H.M. 2009. „"Does Production Labeling Stigmatize Conventional Milk?" *American Journal of Agricultural Economics* 91(4):1097-1109.

Krystallis, Athanasios, and G. Chryssohoidis. 2005. "Consumer's willingness to pay for organic food: Factors that affect it and variation per organic product type." *British Food Journal* 107(5):320-343.

Magnusson, M.K., Arvola, A., Hursti, U., Aberg, L., and P. Sjoden. 2001. "Attitudes towards organic foods among Swedish consumers." *British Food Journal* 103(3):209-227.

Magnusson, M.K., Arvola, A., Hursti, U., Aberg, L., and P. Sjoden. 2003. "Choice of organic food is related to perceived consequences for human health and to environmentally friendly behavior." *Appetite* 40(2):109-117.

Messer, K.D., G.L. Poe, D. Rondeau, W.D. Schulze and C. Vossler. 2010. "Social Preferences and Voting: An Exploration Using a Novel Preference Revealing Mechanism." *Journal of Public Economics* 94(3-4): 308-317.

Noussair, Charles; S. Robin, and B. Ruffieux. 2004. "Do Consumers Really Refuse to Buy Genetically Modified Food?" *The Economic Journal* 114(1):102-120.

Zanoli, R., and S. Naspetti. 2002. "Consumer Motivations in the Purchase of Organic Food." *British Food Journal* 104(8):643-653.

Figure 1. Tasting Template

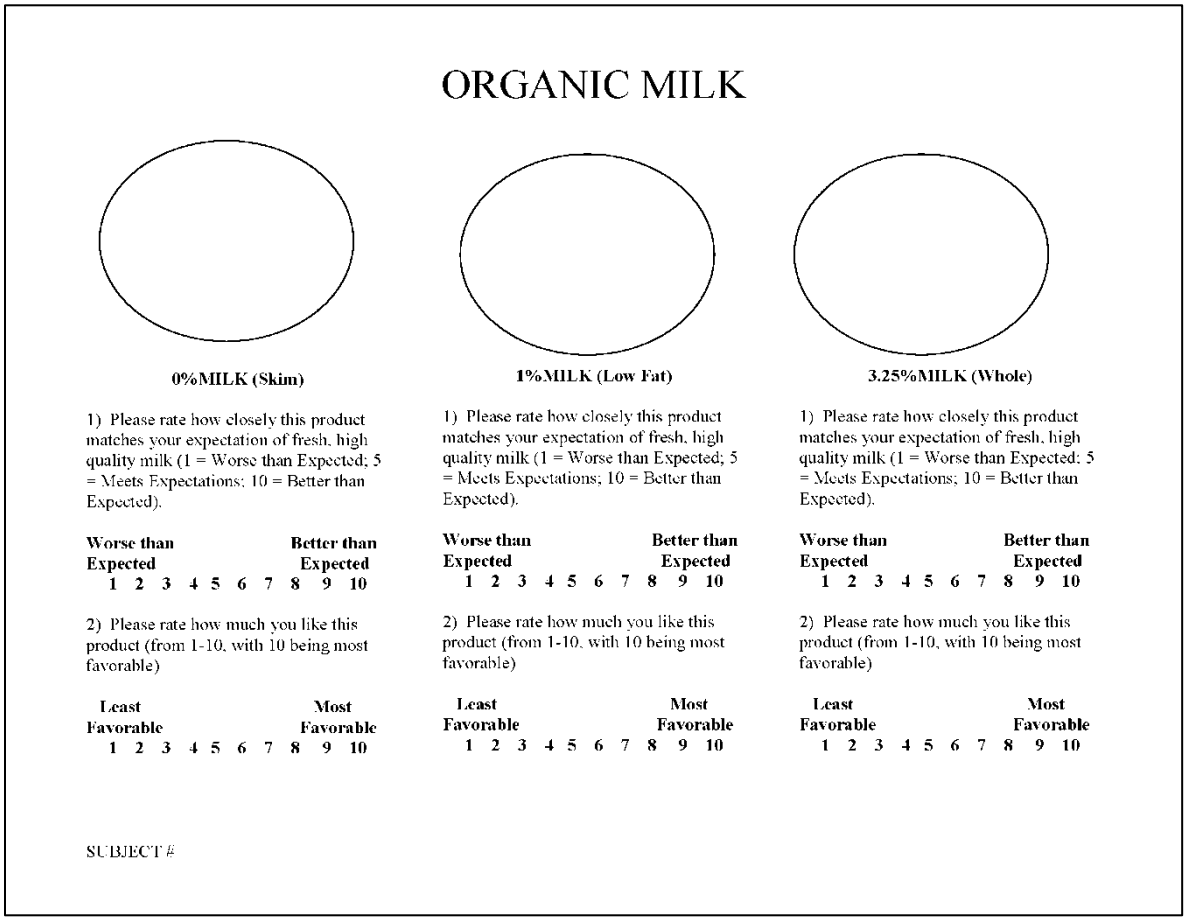

Figure 2. Nutritional Information

Nutrition Information

Nutrition Information: 0% Fat (Skim)

Serving Size:	1 cup (240 mL)	
Calories:	90	
Calories from Fat:	0	
*% Daily Value**		
Total Fat:	0g	0%
Saturated Fat:	0g	0%
Trans Fat:	0g	
Cholesterol:	0-5mg	0-1%
Sodium:	125mg	5%
Carbohydrate:	11-13g	4%
Dietary Fiber:	0g	0%
Sugar:	11-12g	
Protein:	8g	16%
Vitamin A:		10%
Calcium:		30%
Vitamin D:		25%
Vitamin C:		2-4%
Iron:		0%

**% Daily Values are based on a 2000 calorie diet*

Ingredients: Fat Free Milk, Vitamin A Palmitate, Vitamin D3 added.

Nutrition Information: 1% Fat (Lowfat)

Serving Size:	1 cup (240 mL)	
Calories:	100-110	
Calories from Fat:	20	
*% Daily Value**		
Total Fat:	2-2.5g	3-4%
Saturated Fat:	1-1.5g	5-8%
Trans Fat:	0g	
Cholesterol:	10-15mg	3-4%
Sodium:	125-130mg	5%
Carbohydrate:	11-13g	4%
Dietary Fiber:	0g	0%
Sugar:	11-12g	
Protein:	8g	16%
Vitamin A:		10%
Calcium:		30%
Vitamin D:		25%
Vitamin C:		2-4%
Iron:		0%

**% Daily Values are based on a 2000 calorie diet*

Ingredients: 1% Lowfat Milk, Vitamin A Palmitate, Vitamin D3 added.

Nutrition Information: 3.25% Fat (Whole)

Serving Size:	1 cup (240 mL)	
Calories:	150	
Calories from Fat:	70	
*% Daily Value**		
Total Fat:	8g	12%
Saturated Fat:	5g	25%
Trans Fat:	0g	
Cholesterol:	30-35mg	10-11%
Sodium:	120-125mg	5%
Carbohydrate:	11-12g	4%
Dietary Fiber:	0g	0%
Sugar:	11-12g	
Protein:	8g	16%
Vitamin A:		4-6%
Calcium:		30%
Vitamin D:		25%
Vitamin C:		4%
Iron:		0%

**% Daily Values are based on a 2000 calorie diet*

Ingredients: Milk, Vitamin D3 added.

Figure 3. Classification TREE DIAGRAM

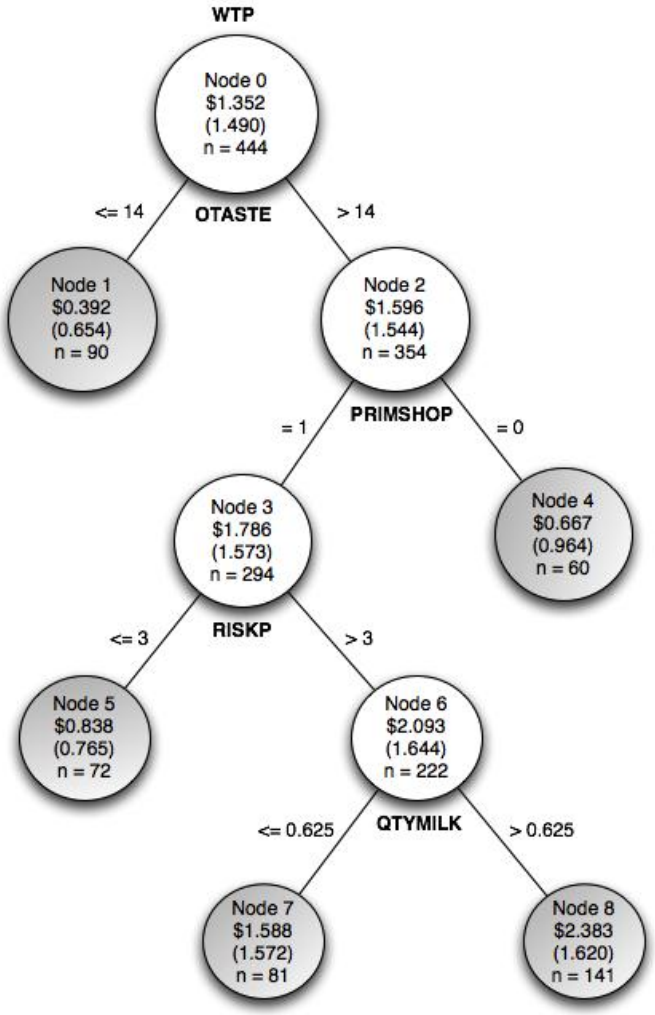

Figure 4. Performance of the Classification Tree as depicted by the ROC curve

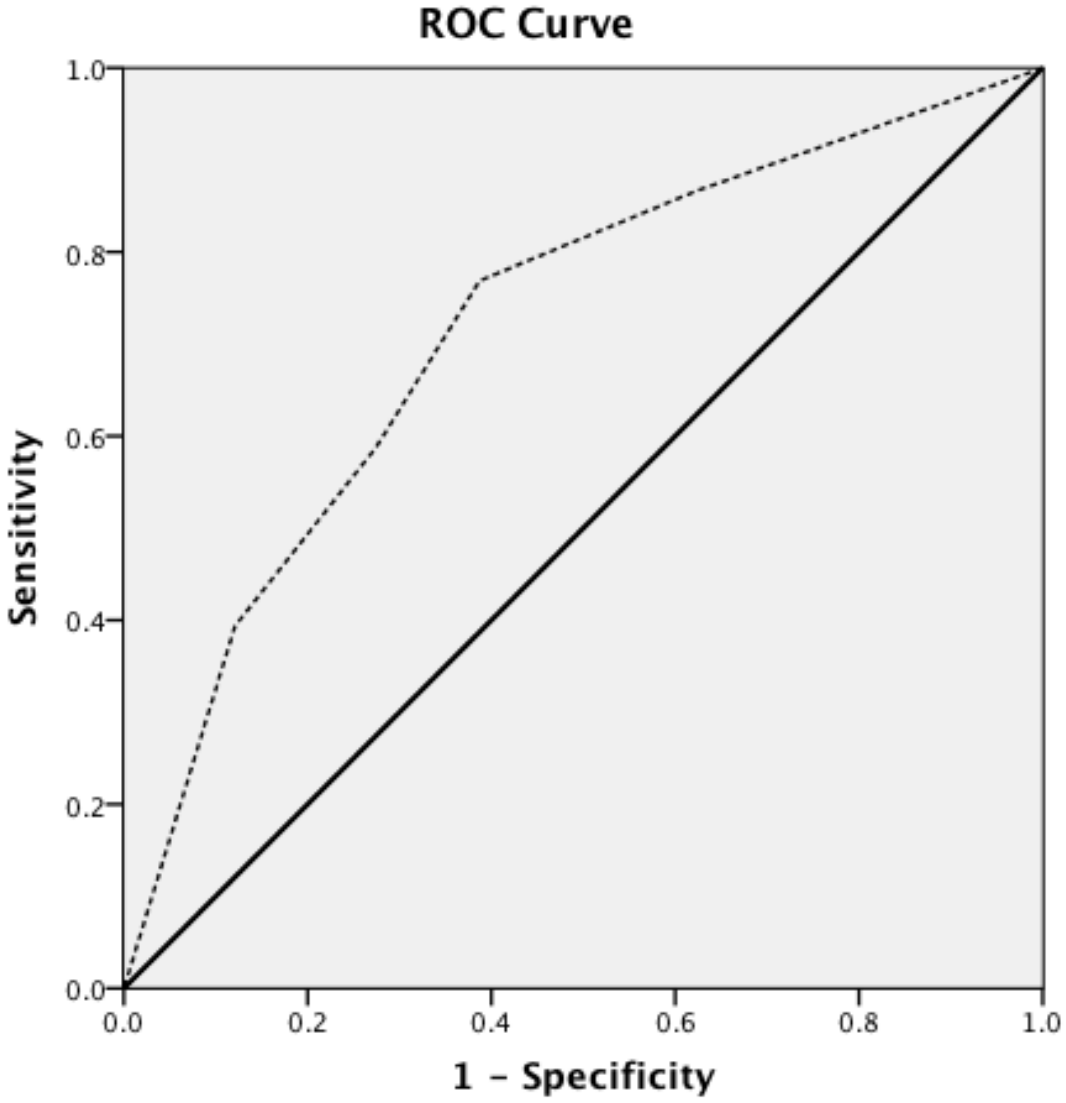

Table 1 Candidate Variables for CART Analysis

Variable	Description	Value
CHU10	# of children under 10 years old	Integer
EDU	What is your highest level of education obtained?	Some High School/Graduate Work (12-20)
FREQORG	How often does your household drink organic milk?	Never/Always (0-4)
INCOME	What is your annual household income?	Integer (5,000-150,000+)
LACTINT	Including yourself, does anyone in your household have any milk allergies or lactose intolerance?	Yes/No (1/0)
MALE	Gender	Male/Female(1/0)
QTYMILK	In the typical week, approximately how much milk does your household consume?	Gallons/week
THIRSTY	How thirsty were you during the experiment?	Not Thirsty/ Very Thirsty (1-9)
US	What is your country of origin?	US/Other (1/0)
OTASTE	Sum of the values from the answers to the questions listed in Figure 1	Integer(10-60)
PRIMSHOP	Are you the primary shopper in your household?	Yes/No (1/0)
RISKP	Mean of the values listed for the question: How concerned are you about (pesticides, herbicides, artificial hormones, antibiotics) in your milk?	Not Concerned/Very Concerned (1-9)

Table 2 Classification of Participants' WTP

Node	Definition	Group Numbers	Percent	Mean WTP
1	OTASTE <= 14	90	20.3%	0.392
4	OTASTE > 14, PRIMSHOP=0	60	13.5%	0.667
5	OTASTE > 14, PRIMSHOP = 1, RISKP <= 3	72	16.2%	0.838
7	OTASTE > 14, PRIMSHOP = 1, RISKP > 3, QTYMILK <= 0.625	81	18.2%	1.588
8	OTASTE > 14, PRIMSHOP = 1, RISKP > 3, QTYMILK > 0.625	141	31.8%	2.383

Table 3 Estimation Results for Tobit Model

Two-Limit, Random-Effect Tobit Model				
Variable	Coeff.	Std. Error	z	P > |z|
CONSTANT	-11.703 **	4.370	-2.68	0.007
OTASTE	0.544 **	0.210	2.65	0.008
FAT0	0.254 **	0.095	2.67	0.008
FAT1	0.298 **	0.095	3.14	0.002
PRIME_SHOP	1.391 **	0.474	2.94	0.003
FREQ_ORG	0.088	0.122	0.72	0.472
QTYMILK	0.937 **	0.360	2.60	0.009
CHU10	-0.465 *	0.227	-2.04	0.041
US	0.012	0.396	0.03	0.976
MALE	0.494	0.327	1.51	0.130
EDU	0.385	0.261	1.47	0.141
INCOME	5.77E-07	0.000	0.15	0.881
THIRSTY	0.144 *	0.061	2.38	0.017
LACTINT	0.465	0.386	1.20	0.228
RISKP	0.207 **	0.055	3.73	0.000
OTASTE_QTYMILK	-0.047 **	0.018	-2.60	0.009
OTASTE_EDU	-0.025 *	0.012	-2.03	0.043
SES2	1.060	0.662	1.60	0.110
SES3	-0.244	0.772	-0.32	0.752
SES4	0.674	0.893	0.76	0.450
SES5	-0.361	0.702	-0.51	0.608
SES6	-0.821	0.805	-1.02	0.308
SES7	0.386	0.974	0.40	0.692
SES8	1.667 *	0.846	1.97	0.049
SES9	0.999	0.854	1.17	0.242
SES10	1.023	0.774	1.32	0.186
SES11	0.228	0.794	0.29	0.774
SES12	1.845 *	0.751	2.46	0.014
SES13	0.844	0.880	0.96	0.338
SES14	0.936	1.071	0.87	0.382
SES15	1.965 *	0.848	2.32	0.020
Log Likelihood	-496.2			
Wald χ^2	115.4			
Prob > χ^2	0			
No. of uncencored	274			
No. of Left-cencored	107			
No. of Right-cencored	27			

Note: ** indicates significance at 1% level and * is for significance at 5% level

Appendix – Experiment Instructions

Instructions – (Part A)

Welcome to an experiment in the economics of decision making. In the course of the experiment, you will have opportunities to earn money. Any money earned during this experiment is yours to keep, thus please read these instructions carefully. Additionally, you are guaranteed a **$5.00 show-up fee** for participating, regardless of what you may earn during the experiment. Please do not communicate with other participants during the experiment. As stated in the **Consent Form**, your participation in this experiment is voluntary.

In today's experiment, you will be asked to indicate the *highest* amount of money you would pay for different purchase decisions. We will refer to this amount as your **bid**. Sometimes a **purchase decision** will refer to a cash value and sometimes it will refer to a food item.

For the first several purchase decisions, the experiment proceeds as follows:
First, you will receive an **initial balance** of $5. You will then be informed of your **cash value** that you would receive if you purchase the decision. Your cash values will vary during the course of the experiment. The possible amounts are $1, $2.50, and $4.

You will then be asked to indicate the *highest* amount that you would pay for this purchase decision. For each decision, you can bid any amount between $0 and your initial balance of $5. Once you have decided your bid, you will type it into the computer spreadsheet, hit ENTER on the keyboard, and then click the "Submit" button. After everyone has submitted their bids, the price for the purchase decision will be determined.

The **price** will be determined by having a volunteer subject drop a pen onto a random number table. Since these numbers have been generated by a random number table each price between $0.00 and $5.00 is equally likely. Whether the decision is purchased depends on your bid and the randomly determined price. There are two possible outcomes:

The decision is PURCHASED: The decision is purchased if your bid is *equal to or greater than* the price. In this case, you will receive the cash value in addition to your initial balance of $5. However, you will also have to pay the randomly determined price. Therefore, your earnings would be your initial balance, plus your cash value, minus the price.

The decision is NOT PURCHASED: The decision is not purchased if your bid is *less than* the price. In this case, you will not receive the cash value, but you will not have to pay the price. Therefore, your earnings would simply be your initial balance of $5.

In this setting, it is in your best interest (i.e. you will make the most possible earnings) if you submit bids equal to your cash value for the decision. Note that while your bid helps determine whether the decision is purchased, your earnings are calculated based on your initial balance, the cash value and the determined price (not your bid). For example, if a decision was *not purchased* and the cash value was $2.50 and the determined price was $4.50, your earnings

would still be $5. However, if the decision was *purchased* with the same cash value and price, your earnings would be $3 (=$5 + $2.50 - $4.50).

Example 1.

Outcome	Initial Balance	Cash Value	Price	Earnings
Purchased	$5.00	$2.50	-$4.50	$3.00
Not Purchased	$5.00	$2.50	-$4.50	$5.00

Consider another example where the cash value was $5 and the determined price was $1. In this example if the decision was *not purchased* your earnings would again be $5, while if the decision was *purchased*, your earnings would be $5.50 ($5 + $2.50 - $1).

Example 2.

Outcome	Initial Balance	Cash Value	Price	Earnings
Purchased	$5.00	$2.50	-$1.00	$6.50
Not Purchased	$5.00	$2.50	-$1.00	$5.00

Calculation of Earnings

After everyone has submitted their bids for the decision and the price has been determined, the administrator will display all of the bids on the screen in the front of the room. These bids will be displayed anonymously from lowest to highest and no subject numbers will be associated with these bids. The administrator will then ask all the participants the following questions:

1) Can you identify your bid?
2) Which participants purchased the decision?
3) How much will these participants have to pay and how much will they earn in this round?
4) How much will the participants who did not purchase the decision earn in this round?

Then you will be asked to click the RECEIVE button and the computer will display whether you purchased the decision and calculate your earnings. The computer will add your experimental earnings for all of the rounds, and convert this amount to US dollars by applying an exchange rate of 2 experimental dollars to $1 USD. For example, if you earn 20 experimental dollars, your monetary payoff from this part of the experiment would be $10 USD.

Instructions - Part B

Pencil as the Purchase Decision

You will be asked to indicate the *highest* amount of money you would pay for a pencil using the same procedures as discussed previously. In this case, your starting balance will be $0.50 and you can submit any bid between $0 and $0.50. The random price will again be determined using a random numbers table, however, now the price will range from $0.00 to $0.50. In this part, there will not be an exchange rate as one experimental dollar will equal $1 USD.

Note that in the case, you will need to determine the "highest amount" that you would pay to purchase this pencil. Again, it is in your best interest to submit a bid equal to this highest amount, since, if you purchase the pencil, you will pay the randomly determined price not your bid. The two possible outcomes are as follows:

The pencil is PURCHASED: The pencil is purchased if your bid is *equal to or greater than* the price. In this case, you will receive the pencil in addition to your initial balance of $0.50. However, you will also have to pay the randomly determined price.

The pencil is NOT PURCHASED: The pencil is not purchased if your bid is *less than* the price. In this case, you will not receive the pencil, but you will not have to pay the price. Therefore, your cash earnings would simply be $0.50.

After everyone has submitted their bids and the price is determined, the administrators will distribute the pencils to the participants which purchased them.

Instructions – (Part C)

The procedures are similar to the ones used in Part B of the experiment, with some important differences.

You will receive an initial balance of $5. The purchase decision is one quart of milk. One quart of milk is equal to one-quarter gallon, or 32 fluid ounces. The milk is cold and fresh and is being stored in the refrigerator in the lab.

You will be making a total of nine purchase decisions regarding milk. However, only one of the nine milk types will be selected for implementation and will result in cash earnings. The type of milk that will be selected for implementation has been randomly determined prior to the experiment and this information has been placed in a dated, sealed envelope that will be opened at the end of the experiment. Each of the milk types is equally likely to be implemented. Therefore consider each decision as if it is the one that will be actually implemented.

You will be served a series of three flights of milk that you will be invited to taste. Each flight of milk consists of three different milk types. The milks will be placed a tasting sheet that provides information related to the milk you will be tasting.

After sampling each milk type, please complete the questions related to the milk you tasted and then submit a bid for each of the milks. Again, your bid should represent the *highest amount that you would be willing to buy that one-quart of milk today*. You may bid any amount between $0 and $5 for each milk type. The price for the decision will be determined in the same manner as in Part A using a new random number table.

There are two possible outcomes:

The milk is PURCHASED: The carton of milk is purchased if your bid is *equal to or greater than* the price. In this case, you will receive the carton of milk in addition to your initial balance of $5. However, you will also have to pay the randomly determined price.

The milk is NOT PURCHASED: The carton of milk is not purchased if your bid is *less than* the price. In this case, you will not receive the carton of milk, but you will not have to pay the price. Therefore, your cash earnings would simply be $5.

Please do not submit your bid until instructed by the administrator.

In the event that the milk is purchased, you may either take it with you immediately, or store it in the lab until the end of the day. Milk that is stored in the lab may be picked up between 4 p.m. and 5 p.m.

It is important that you clearly understand these instructions.
Please raise your hand if you have any questions.
Please do not talk with other participants in the experiment