ANALYZING CONSUMER WILLINGNESS TO PAY FOR A PECAN SNACK PRODUCT

by

KATY SWICKARD

(Under the Direction of John McKissick)

ABSTRACT

Demand for pecans has been stagnant over that last seven years, leading pecan producers to look for new ways of increasing demand. With new storage techniques it may be possible to produce snack products of pecans similar to that of peanuts. A national survey of 913 people was performed in order to obtain data on the demographics and buying habits of pecans consumers. A Tobit model was used to analyze the survey data to determine the mean Willingness to Pay for a pecan snack product. The mean willingness to pay was estimated to be \$0.89 for a snack size bag of pecans. In addition, the average pecan consumer does not purchase pecans very often, fewer than three times a year, with most purchasing one pound bags of halves. Almost eight percent of pecan consumers surveyed indicated that they had had a problem with rancidity in pecans.

INDEX WORDS: Pecans, Willingness to Pay, Demand, Snacks, Contingent Valuation, Consumer Survey

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ANALYZING CONSUMER WILLINGNESS TO PAY FOR A SNACK PECAN PRODCUT

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Chapter 1

Introduction

The pecan, *Carya illinoinensis* is the only native tree-nut grown for commercial production in the United States. According to historians, the word pecan is of Algonquin origin used to describe any "nut requiring a stone to crack" (Taylor, 2001). It is indigenous to the Southwestern United States and Mexico, and grows up along the Mississippi River into Indiana and Illinois. The pecan served as a staple of the Native Americans diet long before the Europeans arrived. Later, pecans were traded for furs and tobacco (Rosengarten, 1984).

The pecan is a nutritional and tasty nut that appeals to a wide array of people. The desirable flavor, texture and appearance make pecans attractive as an ingredient in baked goods, candies, confections, snacks, salad toppings, ice cream, and various meat and vegetable dishes. The flavor of the pecan is compatible with most foods as they are often eaten sugared, spiced or raw. The pecan's texture allows it to be used in halves or pieces (Hubbard et al., 1987). A study by Park and Florkowski (1999) determined that consumers identified pecans as premium nuts along with almonds, pistachios, and macadamias.

Pecan Production Overview

Pecans are perennial in growth and production; they begin to bear nuts normally in ten to twelve years. Pecan trees have an alternate bearing pattern meaning one year a tree will have a heavy crop while the next year will be lighter. There are two general types of pecans: native/seedling and improved varieties. The natives and seedlings are harvested from trees that

are wild and have not been genetically altered. These generally do not have any variety name. Improved varieties are produced on trees that have been grafted or budded. In general, improved varieties produce a more consistent crop with a more desirable quality such as size of kernel and color. According to Hubbard et al. (1987), Georgia has an initial comparative advantage in the pecan industry. The orchards are established, producing, and being expanded and renewed. Growers have been replacing old, traditional varieties with new improved varieties. The newer varieties are of better quality and better suited for the gift trade industry (Hubbard et al., 1987). In the southeast more than 80 percent of pecan production comes from improved varieties. About 37 percent of Georgia pecans are of the new variety (Hall et al., 1998).

Large scale production began in the late 1880's on the Mississippi Delta and in the early 1900's; hundreds of thousands of acres were planted in the southeastern states, mostly of Stuart variety (Taylor, 2001). Production areas in the U.S. are defined into two categories: the Southeastern area includes Georgia, Alabama, Florida, Mississippi, North Carolina, South Carolina; and the Southwestern area includes Texas, New Mexico, Arizona, Oklahoma, Louisiana, Arkansas, and California (Hubbard et al., 1987). Texas accounts for one-third of the U.S. pecan farms (with almost twice as many trees as Georgia), however Georgia has the greatest output (USDA, May 2003). The United States produces about 75 percent of the total world supply of pecans followed by Mexico producing about 20 percent (Johnson, 1998). Figure 1.1 on page 3 is a map of the United States and Mexican pecan producing states. In addition to Mexico, pecans are also grown in Australia, Brazil, South Africa, Israel, and a few other countries in limited quantities.



Figure 1.1 Map of the United States and Mexican Pecan Producing States

LEGEND



U.S. PECAN PRODUCING STATES MEXICO PECAN PRODUCING STATES Pecans have increased in production in the U.S. from 2.2 million pounds in 1922 to over 400 million pounds in 1999. The average crop is 260 million pounds annually (Taylor, 2001). As the statistics above demonstrate, the pecan industry in the U.S. grew dramatically in the Twentieth century. Georgia accounts for 40 percent of the total US production followed by Texas with 22 percent (USDA, October 2003). Figure 1.2 on page 5 shows pecan production in the United States over the past twenty years. The variation in production from year to year due to the alternate bearing cycle of the pecan tree is apparent in Figure 1.2. Again, the U.S. saw the largest crop in 1999 with 4.06 million pounds of pecans produced that season. The years since, production has been lower whether it is an "on" year or not.

Georgia's forecasted production for 2004 was 40 million pounds with it being an alternate year (a low-bearing crop). This amount is down 47 percent from the previous year and down 11 percent from 2002. Texas has forecasted 50 million pounds for the same year. The last time that Texas out-produced Georgia was in 1992 (USDA, 2004). The reason behind the low yield for crops in 2004 was due to the damage from Hurricanes Frances and Jeanne.

Pecan Market Structure

In the U.S. pecans are harvested from late October extending into early February (Taylor, 2001). Until the early 1900's, pecans were allowed to drop from the trees naturally and then were harvested by hand from the ground. These practices have been replaced by mechanical systems which include, tree shakers, nut sweepers, vacuum harvesters, conveyors, and trash separators. Pecans can be harvested now almost without ever being touched by the human hand (Rosengarten, 1984).



Figure 1.2 Total United States Utilized Pecan Production

Source: USDA, 2004

Once harvested the moisture content must be reduced in order to obtain higher quality pecan products. The pecans are taken to shellers or sold to accumulators or buyers who then sell to shellers or wholesalers. Wholesalers, normally resell to retail or industrial outlets, while shellers are responsible for separating the nutmeat from the shell. After pecans have been shelled, the nut meat is sized, graded, and packaged. Quality is determined by the percentage of kernel in shell (amount of nut meat), color (lighter brown being most desired), shell thickness, and oil content. Improved varieties tend to have more favorable attributes (USDA, May 2003). (Lillywhite et al., 2003). The size of packages most commonly used for pecan halves and pieces is either smaller packages of 2 to 12 ounces or 30 pound boxes.

The smaller packages are sold to retail outlets and wholesale distributors, while the larger boxes are sold to processing companies such as confectioners, bakers, and ice cream manufacturers (Lillywhite et al., 2003). Bakeries and confectioners are the largest users of shelled pecans with the lesser quantities going to retailers, ice cream manufacturers, and wholesalers. Pecans for processing compete with other tree nuts such as almonds, walnuts, filberts, and hazelnuts. Peanuts do not directly compete with pecans since they are not in the same price range. Peanuts are usually found in candies and salted mixes, while tree nuts dominate the bakery and ice cream products (Lillywhite et al., 2003). In recent years there has also been an increase in demand for pecans due to the gift trade and school fundraisers.

Neither the state nor the federal governments have any influence on the supply or price of pecans. This makes the industry a competitive-free market (Wood, 2000). At the farm level, pecans contributed over \$275 million dollars to the U.S. economy. The highest valued crop on record was during the 1999/2000 season at \$330 million. This particular season also had the highest production yield on record. In Georgia, pecans contribute significantly to the economy.

In 2003, pecans contributed \$69 million in total farm value to the economy as seen in Figure 1.3 on page 8. The farm value of pecans tends to follow a similar pattern to that of total farm production in the sense that there is a distinction between alternate bearing years of the pecan tree. Higher production volume correlates to higher value of production.

Pecan Import and Export Markets

About two-thirds of the United States total tree-nut production is exported with the quantity of pecans exported being less than 20 percent of U.S. production. Pecan exports increased eight percent from 1980-1990 and have been steadily increasing since 1990. The U.S. exports a significant amount of pecans to Canada, Mexico, and Europe (Johnson, 1998). Pecan markets in China have been growing quickly since 2001. In-shell exports were almost non-existent until 2000 and since 2003 China has become the second largest export market for U.S pecans (USDA, May 2003). The pecan trade relationship between the United States and Mexico is considered complementary in that exports to Mexico have increased while imports to the U.S. have increased as well (Peña et al., 2001). It is believed that the higher quality pecans produced in Mexico are exported to the U.S. to supplement for low production years and lower quality pecans.

Imports from Mexico boost total supply and stock levels. Imports are about one quarter the size of the U.S. crop. Figure 1.4 on page 9 illustrates how significant pecan imports have become as a part of total U.S. pecan supply. The supply of pecans (production + imports + beginning stocks) has outpaced use or demand (domestic consumption + exports), which has gradually increased stock levels during the recent years (Johnson, 1998).



Source: USDA, 2004

Figure 1.4 Total United States Pecan Supply



Percent

Source: USDA, 2004

The cyclical nature of the pecan industry can easily be seen in Figure 1.4. Also, beginning stocks are usually greater following a high production year due to the larger amounts of pecans being stored.

Imports are greater during low production years and lower during higher production years. As seen in Figure 1.5 on page 11 the U.S. has become a net importer of pecans. The balance of trade turned negative as imports began to exceed exports during the 1980's and since the 1990's imports have comprised a large percentage of total U.S. supply. In the mid-1980's in-shell pecan imports increased 37 percent which was around the same time that exports began to increase.

After the North America Free Trade Agreement (NAFTA) was implemented in 1994, imports increased 50 percent. Shelled imports in the U.S. expanded roughly 350 percent before NAFTA in the mid-1980's, but only 31 percent afterward (Peña, 2001). Figure 1.4 shows U.S. total pecan exports and imports over a period of twenty years.

Pecan Prices

Statistically, pecan supply explains only a part of the variation in prices from year to year. Pecan growers must sell their crop in a short time period where there are relatively few buyers. There are other economic factors that influence prices such as the size of the Mexican crop, current availability of improved versus native pecans, stocks, and supplies and prices of competitive tree-nuts (Johnson, 1998). In addition to the above factors, pecan crop quality can also be a determinant in prices.

Throughout the 1990's, pecan prices grew at an average annual rate of 12 percent (USDA, May 2003). Since 1990, pecan grower prices on a per-pound shelled basis have been higher than the same for almonds, walnuts and hazelnuts.



Figure 1.5 United States Pecan Imports and Exports

Source: USDA, 2004

Pecan Consumption

Pecans account for 25 percent of total nut tree-nut consumption on a per pound basis. This places them directly after almonds and walnuts in terms of consumption. Since the 1980's, pecan consumption has been stagnant and has actually trended downward since 1998. The average annual pecan consumption in the U.S. over the past five years was approximately 0.42 pounds. This is a slight decrease from previous year's averages. Walnut consumption is closer to that of pecans with 0.47 pounds per capita consumed annually (USDA, 2004). As seen in Figure 1.6 on the following page, consumption patterns have been similar for pecans and walnuts from 1980 until recently. In the past generally, more pecans were consumed than walnuts. However, since 2002 walnuts have outpaced pecans. The consumption of almonds has also increased rapidly the past fifteen years compared to pecans and walnuts. The reasons behind this phenomenon may include crop size, consumer attitudes and preferences towards certain nuts, and the industries' marketing strategies.

In recent years, the consumption trend for "heart-healthy fats" has increased. Pecans contain nearly 65 percent monounsaturated and 28 percent polyunsaturated fats; these are considered good fats (Taylor, 2001). Table 1.1 below presents the breakdown of fat content of pecans.

Fatty Acid	%	Туре
Palmitic	5	Saturated
Stearic	2	Saturated
Oleic	65	Monounsaturated
Linoleic	26	Polyunsaturated
Linolenic	2	Polyunsaturated

Table 1.1 Fatty Acid Content of Pecan Oil

Source: Pecan Storage, Wagner 1980



Figure 1.6 Pecan, Almond, and Walnut Consumption from 1980-2002

Source: USDA, 2004

Consumers are encouraged to eat foods with these types of fats in place of those high in saturated fats. The FDA recently approved a claim regarding pecans and other nuts in their roles in reducing heart disease (ilovepecans.org, 2003). Many tree nut industries have begun to use these healthy claims in their marketing designs. The pecan industry could benefit from labels or other such marketing techniques involving this approach to increase pecan consumption.

Storing Pecans

Pecans are semi-perishable, and unless stored properly may become inedible due to rancidity, mold, and insects. It has been shown that adequate drying, packaging, and refrigeration are the most important facts in preserving the quality of a shelled pecan. Proper storage is one of the solutions to the problem of carryover of pecans from heavy crops to lighter crops the next year (Woodruff, 1979).

Experiments conducted by the Georgia Experiment Station have shown that controlled refrigerated storage can retard rancidity while preserving the natural color, flavor, and texture. High moisture in nuts is the most significant cause of deterioration during pecan storage and it can cause a nut to become inedible within two weeks.

Research has established that storage life of pecans can be extended by the addition of antioxidants. In the early 1970's BHA, BHT, and propyl gallate were being used to treat nuts. It was determined that nut meats treated with TenoxBHA and TenoxBHT used in baked goods had about twice the shelf life as untreated nuts (Woodruff, 1979). Research has also shown that shelled pecans stored in vacuum pack bags keep longer than those kept in boxes alone. Pecans in vacuum-packed bags stored at 32°F can last for two to three years.

Problem Statement

Georgia pecan farmers have experienced highly variable prices and profits. Pecan producers are examining new ways to market pecans and thus increase pecan consumer demand, leading to higher farmer prices. The shelf life of pecans is viewed as a problem in the pecan processing industry. Consumers tend to purchase pecans seasonally, thus making long-term storage an important issue for Georgia pecan growers. While most other snack nut products are shelf-stable, pecans on the other hand tend to become rancid and bitter in a relatively short period of time due to their high oil content. For this reason, pecans are kept in cold storage until used by the processor.

New technologies are being developed that may give the pecan industry the potential to develop a shelf-stable pecan snack product. One such technology currently being researched is the use of supercritical carbon dioxide which infuses pecans with an antioxidant in order to extend the shelf-life and retard rancidity development. An important research question is whether or not consumers are willing to purchase products treated to extend shelf-life. Such a question would have to be answered before producers invest the capital required for this new technology.

In addition to researching the potential demand for new extended shelf-life products, it is also important for policy makers and pecan industry leaders to understand the factors affecting domestic consumption of pecans. This should help determine how the low consumption trend of the industry could be reversed. For example, the pecan has been an important product during the winter holiday season of November and December. Producers would like to adjust these consumption patterns to expand purchases throughout the market year. In order for this to occur, the reasons why consumers do not purchase pecans throughout the year must be elucidated. In

addition, why consumers' use pecan, what form do they purchase pecans, prices paid, and consumer profiles may help determine the best way to capture more of the tree nut market. A national survey of consumers could clarify the importance of these factors.

The major objective of this study is to determine the likelihood of consumer's willingness to purchase and how much they are willing to pay for a new single service size pecan snack product using socio-demographic and attitudinal characteristics. In addition, the study will evaluate consumers purchasing and consumption practices in regard to the pecan as a snack nut. This would include their knowledge and uses of pecans.

Specific Objectives are:

- 1. Determine current consumer uses, and attitudes/perceptions of pecans
- 2. Determine the demographic profile of potential pecan snack consumer
- Determine the willingness-to-pay and willingness-to-purchase of a 2.5 ounce singleserving snack size bag of pecans

Chapter 2

Literature Review

Contingent Valuation Method (CVM) has become a useful tool in determining willingness to pay (WTP) over the past fifteen years. Dasgupta et al. (2000), Loueiro and Umberger (2002), Blend and van Ravenswaay (1999), Misra et al. (1991), Govindasamy and Italia (1998), Wessells and Anderson (1995) among others, have performed research in this area. Recently, WTP and CV have been used to research demand for safer meat products, eco-labeled foods, and organic products. However, there have been few WTP studies for new, hypothetical products, and none in the tree nut industry. Most manufactured food companies that provide and market snack products, including tree nut products, normally conduct field tests to get an idea of what consumers will pay for a product. In these tests, companies will produce a new item and choose an area to market the item. By selling the product at different prices and quantities, the company will be able to analyze the product's acceptance level and the demand. This chapter will highlight studies that have utilized the CVM to identify consumer's WTP for products or estimate the products value to consumers.

Contingent Valuation Method and Willingness to Pay

Researchers generally find the contingent valuation method the most appropriate for measuring the value of non-market goods. The CVM is more flexible and has a relatively low cost compared to other methods such as experimental markets. Questions have been raised about direct methods such as the CVM, dichotomous choice questioning and experimental markets reliability as the best methods in determining a mean willingness to pay. One issue is that consumers may not have enough information about the risks and therefore may give an inaccurate monetary evaluation from risk avoidance. Another problem is the extension of WTP results to other foods. Within the CVM, most of the analyses are hypothetical situations in which the consumer may take less seriously than a real one and therefore tend to overestimate or underestimate their true WTP. This creates unwanted bias which affects the true mean WTP for a product (Hanemann, 1991).

Researchers have used a variety of models over the years to analyze the WTP and determine the level of WTP. For example, a study that was conducted by Rimal and Fletcher (2002) focused on measuring the impacts of nutritional consideration indices and household socioeconomic characteristics on market participation and purchase levels of snack peanuts. The authors used data from a household peanut purchasing survey conducted by Gallup in 1997 and three models were evaluated to test the relationship between nutritional awareness and demand for a commodity. Snack peanuts account for twenty-five percent of the domestic edible peanut use. The market share of snack peanuts in the U.S. snack food industry had been declining over the past several years.

According to Rimal and Fletcher (2002), Cragg's double hurdle model is more general, though a consumer must pass two obstacles before determining a positive level of consumption of peanuts. The consumer must be a potential consumer of snack peanuts and consume some of the product. They found that this so called "double hurdle" model provided the best representation of consumer's purchase level decisions of snack peanuts. The Tobit and Complete Dominance models underestimated the impact of the explanatory variables on household's decision to purchase snack peanuts. Household Income was found to be one the most important factors in participation and frequency of purchases in the double hurdle model.

The variable Race also had an effect on frequency of snack peanut purchases. Nutritional considerations were found not significant on the decision to participate in the peanuts; however, they were significant in making purchasing decisions. Residence and gender were insignificant factors in market participation, though significant for purchasing frequency. Number of children in a household had a negative effect on the decision of how often the household would purchase snack peanuts. The authors concluded that peanut producers should separate their products from the general snack category. In other words, it seems that labeling peanuts as a snack has a negative effect on purchasing habits. Producers need to expand on the positive nutritional attributes of peanut products.

Huang (1993) developed a theoretical model to analyze consumer risk perceptions, attitudes, and behavior intentions regarding pesticide use on agricultural commodities. The model is a three-equation simultaneous framework in which the three dependent variables are based on data collected from a Georgia consumer survey. The first variable, consumers' risk perception toward the use of pesticide in fresh produce (RP) was constructed from a binary scale. The second variable ATTI, which defines a consumer's attitude toward regulatory actions on the use of pesticides, was also binary. For the last variable, the willingness to pay (WTP) was measured using a scale from one to five for willing or not willing to pay a higher price for certified residue free (CRF) produce.

At first each equation was estimated by regressing each dependent variable on all independent variables. The reduced forms of RP and ATTI were then estimated by the maximum likelihood Probit model. Ordinary least squares (OLS) was used for the reduced WTP equation. When estimating the third equation, both RP and ATTI are independent variables used to evaluate the WTP. Fitted values were then found for each of the dependent variables giving

way to new terms RP_{hat} , $ATTI_{hat}$, WTP_{hat} . In the second stage, the maximum likelihood Probit and OLS was used to estimate the structural parameters for the fitted terms.

Huang's (1993) results indicate that attitude was linked to perception and willingness to pay which then affects consumers' attitudes toward pesticide use. The study suggests that those who have used or have knowledge of chemical pesticides for home gardening were less likely to be worried about the use of pesticides on fresh produce. Another finding was those consumers who wanted fresh produce tested for residues were willing to pay another three percent than those who did not.

Huang (1993) found most of the socioeconomic and demographic variables were statistically significant. Married females with one or more children and are employed have more concern about the use of pesticides. Income was also found to be a statistically significant predictor of willingness to pay for certified free of pesticide produce. The negative signs found on education and household size indicate that respondents with larger families and higher education are less likely to pay a premium for CRF produce. This may be due to the fact that they believe the benefits of pesticide use offset potential risks. Huang (1993) suggested that consumers need more education about nutrition and food safety risks which would help reduce misinformation and aid in the understanding of health risks carried by some foods.

Mukhopadhaya et al. (2004) estimated consumers' willingness to pay for a hypothetical vaccine that would deliver a 1-year, 5-years, and 10-years, or lifetime protection against *Salomenella, E. coli*, or *Listeria*. The contingent valuation method was used to estimate the WTP that would protect a person from the major food borne pathogens. A survey was conducted and a dichotomous choice question was used to elicit the WTP. The yes or no responses are translated

into mean or median WTP. A Tobit model was used to estimate the dollar amounts that consumers were willing to pay for the duration of protection.

Respondents were randomly selected for the telephone survey and the bid amounts were randomly assigned to those respondents. The analysis included some important socioeconomic variables such as age, income, education, home setting, and current health conditions. The researchers used a number of dummy variables to indicate if a respondent was a member of a certain group or not. The empirical analyses were performed using the dollar values for the willingness to pay as the dependent variable. The results from the Tobit model indicate that consumers were willing to pay for protection against food borne pathogens. They are willing to pay more for longer protection time. It was also found that the respondents would pay more for protection against *E. coli* compared to the other two diseases. Decision makers can use WTP studies such as this to set policy that affects both consumers and producers.

Dasgupta et al. (2000) used a Probit model to analyze the results of a telephone survey of consumers conducted to determine preferences for trout steak and the feasibility of such a product. At the time the study was conducted, the trout industry had been losing market share. The survey was used to extract consumer attitudes and purchasing behaviors toward various seafood and meat products. Trout steaks were the main focus of the survey. The survey was also intended to extract consumers' willingness to purchase fresh or frozen trout steaks. They found that consumers were more receptive to fresh trout steaks than frozen steaks. The researchers used an ordered Probit regression analysis that identified consumer attributes that affected their willingness to purchase the trout steaks, fresh or frozen. In this study, ethnicity, education, income, household size and price perception significantly affected trout-steak purchasing decisions. The chief implication is the preference of fresh trout steaks by Hispanics,

consumers with a large household size, and those who consider trout to be more expensive than other meats. These results were intended to help the trout industry determine how to market fresh and frozen trout steaks.

CVM and WTP for Organic, Eco-labeled, and Country-of-Origin Products

There has been a plethora of studies on improved food-safety and labeling of foods. Most are due to increasing consumer concerns of pesticide use, safety issues, and disease-free meats.

Loueiro et al. (2002) conducted a WTP and socioeconomic study for Eco-labeled apples. The objectives of this study were to analyze the impact of factors influencing consumers' WTP for eco-labeled apples and estimate a mean WTP for the eco-labeled apples. They surveyed consumers in grocery store locations where there was a variety of produce offered. From the survey they obtained information of the consumers' attitudes about the environment and food safety, knowledge and perceptions of eco-labels and socio-demographic information. To estimate the mean WTP, Loueiro et al. (2002) used a double-bounded Logit model because it had been shown as it was more efficient than a single-bounded model. The researchers conclude that consumers are willing to pay a small percentage (about 5 percent) above the base price for ecolabeled apples. They also conclude that the important significant variables were children under 18 years old and being female. In a similar study, Blend and van Ravenswaay (1999) conducted a telephone survey to determine the consumer demand for eco-labeled apples. The survey was conducted giving respondents different scenarios with and without eco-labeling. Open-ended questions were used to determine quantities of eco-labeled apples one would purchase. They used both a Cragg double hurdle model and Tobit model to estimate demand. They determined

over half of the respondents would be willing to purchase eco-labeled apples. As the price premium increases, the probability of purchasing the eco-labeled apples decreases. Even with a premium of \$0.40, over 40 percent of respondents were still willing to try these apples.

A survey conducted by Misra et al. (1991) allowed them to gather data to determine consumers' willingness to pay for fresh produce that is certified as free of pesticide residues. It had been noted previously that perceptions among Americans about pesticide residue were high and induced some private markets to do some testing on labeling programs. Questions were asked on the consumer survey to elicit consumers' perceptions, attitudes, and concern towards the use of pesticides in the production of fruit and vegetables. For the willingness to pay section, consumers were asked if they would pay a higher price for fresh produce that had been certified as residue-free. If they answered yes, then they were then asked how much more they would pay with five percent increments. Misra et al. (1991) used the Probit model to estimate the probabilities of the consumers' willingness to pay. The results suggested that consumers were generally not likely to pay a premium for produce certified as free of residues. Most variables were significant at the 0.1 level. Concern expressed about pesticides, the importance of testing for pesticide, age and income were all significant variables. The negative sign on income may imply that consumers in lower income groups will be less likely to pay a premium than consumers in higher groups. More than half of the respondents either refused to pay a higher price or were not sure. One factor they noted was that consumers may reason that food safety is a public good and therefore the government should have a role in ensuring that produce is free of pesticide residue.

Govindasamy and Italia (1998) estimate consumers' willingness to purchase integrated pest management (IPM) labeled produce. IPM is pest control system developed to tackle

problems with pests that build immunity to chemical pesticides. It is more cost-effective than organic production and potentially safer than other agricultural processes. Through the survey, they found that consumers were receptive to the IPM produce. Two Logit models were used to determine the effects of sociodemographic factors that influence the willingness to purchase conventional and IPM grown produce. They chose the Logit model because its "asymptotically characteristic constrains the predicted probabilities to a range of zero to one" (Govindasamy and Italia, 1998). The results show that consumers would be willing to purchase IPM labeled produce and many would be willing to switch grocery stores to purchase IPM produce. Using a label with IPM could help growers differentiate and add value to their products. Direct market establishments such as roadside stands and farmers' markets would work well to introduce IPM labeled produce. Income, age, suburban or rural locations, and those who have previous knowledge of IPM affect purchasing decisions. The willingness to purchase IPM produce increase with Income and decreases with Age with the opposite results for conventionally produced goods. Educating consumers of IPM produce will increase acceptance and demand. The results from this study were quite positive, especially for producers interested in IPM systems on their farms.

Country-of-origin labeling is a method to allow consumers to identify where the foods that they purchase are produced. Loureiro and Umberger (2002) performed an analysis of consumers' preferences and the economic effect of country of origin labels on beef. They also calculated premiums for U.S. labeled beef versus imported beef. Consumers in grocery stores were selected randomly to participate in the survey which elicited purchasing behavior, desirable beef qualities, food safety attitudes, WTP for a tax program to support mandatory country-oforigin labels and WTP for a U.S. labeled steak and hamburger. For the analysis of the survey

they used independent Logit models. WTP estimates were calculated using the "grand constant" formula (see Giraud et al., 1999). Confidence intervals were constructed using a bootstrapping technique. Loureiro and Umberger's (2002) results show that consumers are concerned about food-safety issues and are willing to pay a premium for the mandatory country-of-origin labeling program. Also, consumers are willing to pay a premium for U.S. labeled steaks and hamburger. Education, food safety attitudes, number of children in household, and gender were all significant variables.

Wessells et al. (1999) created a survey for participants to compare seafood products that were certified with an eco-label and those without any certification. The Logit model was applied to the collected data. Results indicate that preferences for eco-labeled fish will differ across regions and consumer groups. One significant variable is the premium paid for certified products. The results of this study indicated that as the premiums paid for certified products increased, consumers are less likely to choose certified products. In general, consumer preferences affected the probability of choosing certified seafood products. Respondents who tend to purchase frozen seafood are less likely to choose a certified product. Eco-labels will only be applicable to those who purchase seafood. Lastly, consumer education about fish stocks will need to take place in order to have a successful certification program.

Value-Added Produce

Other studies have focused on the demand for domestically labeled products as well as locally grown foods. Examples of existing labeled products are Vidalia onions, Washington apples, Idaho potatoes, California raisins and Florida orange juice. There are also statewide programs that allow consumers to identify where their produce comes from; "Arizona Grown",
"Jersey Fresh", and "Ohio Proud". The next two studies center on the impacts of labels for potatoes and locally grown produce.

Loureiro and Hine (2001) studied the demand for local, organic, and GMO-free potatoes in Colorado. They have found that farmers have been forced to find new markets for their goods and one method is value-added marketing. Their goal was to determine the potential for potatoes in a niche market and find the WTP premiums for a value-added potato that could be labeled as organic, GMO-free, or Colorado-Grown. Loureiro and Hine (2001) used a consumer survey involving payment cards at grocery stores around Colorado to elicit sociodemographic information, preferences for organic, local, and GMO-free foods, as well as their WTP for each of those types of potatoes. Through the information gained from the payment cards, a Probit model was utilized to analyze the data obtained and confidence intervals were calculated to determine the mean WTP. They found that WTP estimates were higher for the locally labeled potatoes than the organic and GMO-free potatoes. However, consumers who were highly concerned about freshness were willing to pay more for organic potatoes. Age was negatively correlated with the WTP for the organic potatoes. Also the variable Children which stands for the presence of children, had a negative effect on purchase decisions in this study. Age is negative and statistically significant for GMO-free potatoes. They also concluded that in order for a locally labeled potato to find a place in the niche market, the potatoes must be of greater quality in order to gain the higher premiums.

Another survey for marketing local goods was conducted across Indiana to determine the demographic and perceptions of consumers in purchasing locally grown produce. The participants were asked to rank their degree of brand loyalty and then rank the importance they place on the produce freshness when shopping. Jekanowski et al. (2000) analyzed data from the

statewide survey using an ordered Probit model. The results indicated a strong WTP to purchase local produce. They conclude that loyalty to one's state will play an important factor in purchasing foods. Also, consumers want to purchase products grown in their home state. Jekanowski et al. (2000) found that household income was positively related to the probability of purchasing locally produced goods. Other significant variables were education, gender, and perception of quality. The information is useful in designing state-sponsored agricultural promotion programs, which could complement national programs.

Several contingent valuation surveys have been performed with results showing a small difference between willingness to pay and willingness to accept (WTA). Researchers have had a difficult time explaining the differences. Hanemann (1991) attempts to explain the differences in WTP and WTA by "showing that the theoretical presumption of approximate equality between WTP and WTA is misconceived" (Hanemann, 1991). He discusses two cases of zero and perfect substitution between public and private goods. By holding income effects constant, the smaller the substitution effect, the greater the difference between WTP and WTA. The general awareness of individuals surveyed was that the private goods are imperfect substitutes for the public good under significance can explain the difference in WTP and WTA.

There have been authors who find that there is a significant difference between the WTP distributions from the initial and follow-up question responses. Herriges and Shogren (1996) developed a model of starting point bias using a Monte Carlo simulation to try to explain possible bias in WTP estimates. Herriges and Shogren (1996) point out that the chief disadvantage of dichotomous choice surveys is that the outcomes reveal very little about an individual's WTP. The follow-up questions are used to try and improve the efficiency of these surveys. However, they find that the gains associated with the follow-up questions will most

likely be reduced. One explanation is that the extra question may be complexing, which would reduce the efficiency gains by discouraging responses.

There are studies about the bias that can occur with CVM surveys while others discuss the models used in junction with the surveys to determine WTP for a good or service. Yoo et al. (1998) compare methods of determining a WTP from a survey using the Tobit model and the least absolute deviations (LAD). They collected data in Korea concerning a reduction of greenhouse gases policy. Typically, data from CVM surveys are censored at zero, which makes the assumptions needed for the Tobit model not appropriate. Heteroscedasticity and normality of the distribution tend to be violated. Through comparing the two models, Yoo et al. (1998) find that the LAD estimation is robust under the assumptions listed above. LAD improved the WTP equation coefficients. It was deemed better than the Tobit model; however, it is not widely used due to the fact that the estimator cannot be attained in a closed form.

This chapter offers a brief overview of several types of studies that have been conducted to determine a consumer's willingness to pay for some specific good or service. Most of the studies focus on food safety and labeling issues. While a handful of economists have begun to apply the Vickery auction in a market setting, the majority of researchers use the contingent valuation method to elicit prices from consumers. The next chapter will focus on the theoretical background of consumer supply and demand, willingness to pay functions and the contingent valuation method.

Chapter 3

Theoretical Framework

Measuring the Economic Value of a Product

Demand for products comes from consumers' willingness and ability to purchase those products. In addition to the ability to purchase a product, this willingness to purchase has its theoretical underpinnings in utility theory. One of the basic assumptions is that any rational consumer will always choose a bundle of goods that provides them the most consumer satisfaction or "utility". This chapter outlines the role utility plays in demand derivation, the basis for determining a consumer's willingness to pay.

Utility and Demand

One problem that economists face is deciding how to determine the value for a hypothetical good that has some real life market potential. Fleisher et al. (1987) describe utility as the well-being we obtain from spending our income. When an individual receives benefits or pleasure from some good or service, those benefits shape the individual's utility function. From this, comes the assumption that utility is a measure of consumers' satisfaction. In theory, utility can be described by both cardinal and ordinal measures, but in practice it is considered an ordinal measure of the benefits ensuing to an individual from the consumption of a commodity (Randall, 1987).

A mathematical representation of an individual's utility preferences can be stated in the form of what is called a utility function. It is important to note that individuals are constrained by their income as to the level of utility they can attain. Utility is maximized subject to the individual's budget constraint which consists of product prices, income, and the quantities of each good. The general form of a direct utility function can be written as:

Max
$$U_i = U(X_1, X_2, ..., X_N)$$
 s.t. $Y_i > \Sigma(P_X X_N)$ 3.1

where $X_1, X_2, ..., X_N$ is a vector of commodities that are available for individual i's consumption and U_i is total utility, Y_i is the individual's income, and P_X is the price of commodity X. (Varian, 1990).

Figure 3.1 on page 31 shows the various combinations of commodity bundles that form individual i's indifference curves. Utility is maximized for the consumer when the ratio of the product prices (X1 and X2) is equal to the marginal utility ratio of the consumer derives from the products for a given budget constraint. This point is where the slope of the budget constraint is equal to (tangent to) the slope of the consumer's indifference curve.

The result from this maximization process yields the Marshallian demand functions below

$$\mathbf{x}_{i} = \mathbf{h}(\mathbf{P}, \mathbf{Y}) \tag{3.2}$$

By substituting the demand functions into Equation 3.1, the indirect utility function can be obtained.

$$\mathbf{v}_{i} = \mathbf{f}(\mathbf{Y}_{i}, \mathbf{P}_{\mathbf{X}} | \mathbf{S}_{i}) \tag{3.3}$$

where Y_i is individual i's income, S_i represents a vector of socioeconomic and demographic variables of individual i, and P_X is the vector of prices for X_N commodities. Equation 3.3 is

similar to Equation 3.6 on page 34 which is used to determine the change in consumer surplus so as to calculate consumers' WTP.

Figure 3.1 Maximum Utility Level Derived by Indifference Curves and Budget Constraint.



While demand can be defined as how much of a commodity consumers are willing and able to purchase at a given price (Wetzstein, 2005), it is also important to know the relationship between price and quantity of a good. Demand can be shown as a graphical representation of the relationship between quantities of goods and services that buyers are willing and able to purchase at specific prices. Demand curves demonstrate the relationship between price and quantity demanded for a product. The Law of Demand tells us that as price increases quantity demanded decreases. Since this relationship is an inverse relationship the demand curve has a negative slope when graphed. The demand curve can be affected by changes in many factors including income, changes in the prices of other goods, and changes in consumers' tastes and preferences. Figure 3.2 on page 32 shows a linear "smooth" demand curve for good X_1 . The vertical axis (Y axis) illustratess the unit price of the commodity, and the horizontal axis (X axis) shows the total

amount of that commodity consumed at each of the prices. Demand curves for normal goods always reflect the fact that the higher the price of the good or resource, the lower its quantity demanded will be. The inverse of this is also true, as the price falls, quantity demanded for the good will increase.





Alternatively, the Marshallian demand function can be written as:

$$Q(P) = a - bP \qquad 3.4$$

where both Q is the dependent variable that measures the quantity of the good that is demanded, and its relationship with price. In this equation, a is the x-intercept term or quantity intercept where the price of the good or resource equals zero, b is the slope, or the change in Q given a change in P, with P being the price of the good. Assuming the Law of Demand holds, the value of b will always be negative, indicating that P and Q will move in opposite directions. In order to determine the value that consumers place on goods or willingness to pay, the inverse of the demand curve would need to be taken. The inverse demand curve describes P as a function that is dependent on Q. The function P(Q), which is also linear, is the inverse of the function Q(P) (www.econtools.com, 2004). The corresponding inverse demand equation is written as

$$P(Q) = a - bQ 3.5$$

where the variables are identical to that of an ordinary demand curve. However, in Equation 3.4, price, P, is the independent variable with quantity being dependent upon that price. In Equation 3.5, quantity, Q is independent and price is dependent upon that quantity.

Willingness to Pay

Willingness to pay (WTP) is defined as the amount that can be taken away from the person's income while keeping his or her utility constant in exchange for providing them a good or service. It can also be defined as a measurement of the maximum amount of money an individual is willing to give up to obtain a product with a quality, q or exchange a product with quality q_0 for a product with quality q_1 (Lusk and Hudson, 2004). Marginal willingness to pay is another name for the Hicks-compensated inverse demand curve.

Another way of determining consumers' WTP is to find the level of consumer surplus associated with the product. Consumer Surplus is a method which compares the value a consumer places on each unit of a commodity consumed against the price of that commodity. Since there is no actual method for measuring a consumer's utility due to the inability to quantify changes in individual satisfaction due to price changes, consumer welfare is measured as the difference between the maximum amount a consumer would be willing to pay and what they

actually paid (market price) (www.digitaleconomist.com). Thus, the level of consumer surplus is shown by the area under the demand curve and above the market price. Consumer surplus is graphically represented by area A under the curve in Figure 3.3 shown below. Inverse demand and consumer surplus create a way to aggregate consumer's valuations of the bundles they consume. Adding individual consumer surpluses is equivalent to using the market demand curve to compute consumer surplus for a market (http://turnbull.sk.tsukuba.ac.jp/Teach/Micro/ohp14.pdf).





By measuring the change of an individual's consumer surplus, one can attempt to place a value (WTP) on their utility for a certain good or service. For example, this study will focus on a new pecan snack product and the following model is one way to determine WTP for the new product. Measuring the change in quantity (Q) will allow for the measurement of the change in consumer surplus. This can be accomplished through the indirect utility function:

$$U^{\circ} = v(P^{\circ}, Y^{\circ} - CS, Q^{1}) = v(P^{\circ}, Y^{\circ}, Q^{\circ})$$
 3.6

Where, P° is the price of the good or service

Y° is the income for the individual

CS is consumer surplus

Q° is with no pecan snack products

 Q^1 is the quantity of pecan snack products.

The measure of CS is calculated by the difference in the income that allows the consumer to be on the same indifference curve or level of utility as the initial situation. This can be determined by using an exact welfare measure called compensation surplus. Compensation surplus can be defined as the amount of money, paid or received, which places an individual at his or her initial utility level after a change in quantity, where optimizing adjustments are not allowed (Allen, 2004). By using compensation surplus, economists can determine if the benefits from a policy change to the gainers outweigh the costs to the losers. This idea is consistent with Pareto improvements. Individuals should have the right to the initial situation and can be measured by using the expenditure function. The expenditure function determines the minimum income needed to provide a general level of utility.

$$\mathbf{e} = \mathbf{e}(\mathbf{P}, \mathbf{Q}, \mathbf{U}) \tag{3.7}$$

Where P represents price of the good

Q represents the quantity of the good

U denotes the utility level of the individual

The underlying Hicksian demand function can be defined as:

$$\frac{de}{dP} = h = h(P,U)$$
 3.8

where h is the Hicksian demand function.

Based on the expenditure function, the welfare measure or willingness to pay in this case can be shown as:

WTP = C = {
$$[e(P^{\circ}, Q^{1}, U^{\circ}) = Y^{1}] - [e(P^{\circ}, Q^{\circ}, U^{\circ}) = Y^{\circ}]$$
} 3.9
= $|Y^{1}-Y^{\circ}|$
Where, $Q^{1} > Q^{\circ}$, and
 $Y^{\circ} > Y^{1}$

Compensating surplus is the individual's willingness to pay for a higher level of Q, or WTP in the case of an increase in quantity. This is the Hicksian compensating welfare measure. Compensating surplus is considered an income decrement because the individual states that they are willing to decrease their income by some amount to remain at the initial level of the consumption.

According to Champ et al. (2003) the expenditure function is the "ticket to welfare economics". The benefit of the Hicksian demand functions is that they take utility into account whereas the Marshallian demand functions only utilize prices and quantities.

Consumer surplus can be calculated by using the Equivalent Surplus (ES). Freeman (2003) describes ES as the change in income required, given old prices and consumption level of a good to make an individual as well off as that person would be with the new price set and consumption level. This is the same principal as compensating surplus; however it assigns the rights to the subsequent quantity level, as opposed to the initial quantity level. For an imposed quantity decrease, ES is an income decrement.

Another method of determining the WTP of a pecan snack product, a market good, is to determine the Marshallian consumer surplus. Utility is still the basis of determining a price, though finding the compensating surplus or equivalent surplus will not be necessary. This can be

obtained by maximizing utility subject to a budget constraint as performed in Equation 3.1. Here, utility is a function of two quantities and is subjected to a budget constraint.

max U =
$$f(Q_p, Q_A)$$
 subject to $Y^{\circ} = (P^{\circ}_{p} * Q^{\circ}_{p}) + (P^{\circ}_{A} * Q^{\circ}_{A})$ 3.10

where Q_p is the quantity of a pecan snack product, Q_A is the quantity of all other goods, and Y is income. Q_p and Q_A are functions of price and income described as

$$Q_p = f(P^\circ_{p}, Y^\circ)$$
$$Q_A = f(P^\circ_{A}, Y^\circ)$$

By maximizing utility, the Marshallian demand functions will allow the willingness to pay to be determined. If Q_p increases from Q_p° to Q_p^1 , then the amount Q_A will decrease from Q_A° to Q_A^1 . WTP is the difference between Q_A° and Q_A^1 that ensures the consumer will remain on the indifference curve (Allen, 2004). Figure 3.4 below depicts the WTP and differences between quantities.

Figure 3.4 Utility Maximization for WTP



Utilizing Contingent Valuation to Determine WTP

Contingent Valuation (CV) is the most widely used method to measure consumers' willingness to pay. Contingent valuation is a method of estimating the value that a person places on a good. The CV approach elicits willingness to pay (WTP) to obtain a specified good, or willingness to accept (WTA) to give up a good directly from potential consumers rather than inferring from observed market behaviors.

Telephone, mail surveys, or face-to-face interviews can be used to elicit consumer's willingness to pay for some unobservable good, given a hypothetical scenario. Consumers will give their answers about willingness to pay for a specified level of a good, or a change in the quality or attribute of some good.

Contingent valuation has been successfully used for commodities that are not exchanged in regular markets, or when it is difficult to observe market transactions under desired conditions. According to Barry Field (1994), contingent valuation has been performed most often for environmental factors such as the value of amenities, preservation of wildlife and land, recreational opportunities of resources, and others. More recently, however, CV has been used for commodities available for sale in regular marketplaces such as pesticide-free produce, certification requirements on beef and seafood, and potential products and services. There are also many CV surveys found on food safety valuation studies (Buzby et al, 1998; Wessells and Anderson, 1995; and Boccaletti and Nardella, 2001).

The Contingent Valuation Method is used in this study because of the need to measure hypothetical pecan product values. Since a measure of the total economic value of pecans is required, CV is the best option available. The first step in this approach is to calculate the indirect utility function:

$$V_i = v_i(Y_i, Z, P_x) + e_i$$

Where:

Y_i is individual i's income

Z is the amount of pecan snack product

 P_x is the price of all other goods

 $e_i = random disturbance$

It is assumed that the amount of pecan snacks is fixed at 1, so Z=1. In order to determine the probability of a yes or no answer to the dichotomous choice questions used in the CV format, the change in utility with and without the pecan snack product must be determined.

$$v_i(Y_i - P_z, 1, P_x)$$
 :the utility associated with one pecan snack product, P_z is the price
of the pecan snack product

 $v_i(Y_i, 0, P_x)$: the utility associated without the pecan snack product

$$\Delta v_i = [v(Y_i - P_z, 1, P_x) + e_1] - [v(Y_i, 0, P_x) + e_0]$$

if $\Delta v_i > 0$, then consumer will say 'yes' to the bid amount

 $\Delta v_i < 0$, then consumer will say 'no' to the bid amount

 $\Delta v_i = 0$, then consumer will be indifferent

In terms of probability, the probability of a YES response is:

$$Prob[``YES''] = Prob[\Delta(v_i) \ge \Delta(e_i)] = F[\Delta(v_i)]$$
3.12

where F is the cumulative density function, CDF.

The goal of contingent valuation is to measure the compensating or equivalent variation for some good. Compensating variation is a measure used when the person must purchase a good. Equivalent variation is used if the person faces a loss of the good. Both variations can be elicited by asking a person to state a willingness to pay a monetary amount for some good or service. For standard neoclassical demand theory, demand equations can be derived which express the quantity of a particular commodity as a function of the price of the commodity, prices of related commodities, household income and other socioeconomic variables which are related to a systematic change in preferences (Allen, 2004). An individual's willingness to pay for a commodity can be expressed by the bid function:

WTP = f(Bid, Income, Education, Age, Gender, ...etc). 3.13





In a contingent market using an open-ended question, maximum WTP is stated directly by individuals. The amount of WTP is estimated for a given individual utility change. The individual's utility change depends upon the estimation of benefits gained from consuming a single serving snack size bag of pecans. The benefits may vary across individuals because of differences in income, initial offer price, socioeconomic variables, and preferences. The equation may be specified in a linear or logarithmic form to estimate WTP for a single serving snack size bag of pecans and estimated using ordinary least squares (OLS).

Chapter 4

Data Collection and Results

Obtaining primary data on potential consumer purchases of agricultural commodities is difficult at best. A consumer survey is one of the tools available to gather information about consumer preferences and attitudes for agricultural products. In this study the contingent valuation method is used to estimate the willingness to pay (WTP) for a 2.5 ounce single serving snack size bag of pecans. Both simple statistical analysis and regression analysis is used to determine the factors associated with consumers' expected WTP for the pecan snack product. In this case, the Tobit model was chosen for the regression portion of the analysis as the appropriate model to analyze the data and will be explained later in the chapter.

Potential consumer purchasing behavior is assumed to be a function of several factors including perceptions of the quality and value of the product in question, prior shopping experiences, the consumer's loyalty for certain nuts, as well as demographic composition of the household. Consumer perceptions about certain products and food issues tend to be a major factor in determining the WTP. Other sociodemographic variables such as education, income, number of children, gender, and age could be important determinants. Residency has the potential to affect respondents' decisions to purchase pecan products. This is due to the regional availability of pecans and regional respondents' customs.

Survey Design

The issue of the relative influence of economic, physical, and other personal factors on a potential pecan snack product was a question in this study. In order to obtain such data, a nationwide survey was designed and implemented. This U.S. household survey was used due the to regionality of pecan production. A nationwide survey allows for a national representation of consumers. Consumer data was collected to estimate consumer willingness to pay (WTP) for a 2.5 single serving snack size bag of pecans. The survey was created and designed using the contingent valuation method format. The CVM with a willingness to pay construction was deemed the most efficient way to measure these values.

The data was collected by the Survey Research Center of The University of Georgia using a computer assisted telephone interview (CATI) system. The telephone interview method that the Survey Research Center used was a random digit dialing method. When conducting these interviews, the selection of whom to contact in each household was done based on the "youngest male, oldest female" technique. Essentially, the interviewer calls a phone number and asks to speak to the youngest male, 18 years of age or older, who lives in the household. If not available, they will then ask to speak with the oldest female who lives in the household. This procedure tends to generate more male respondents, which are typically under represented in sample surveys. The Survey Research Center conducted the survey during December 2004 and January 2005 using the random digit dialing sample that yielded 913 interviews.

The survey was designed to allow only those who answered "yes" to "Have you purchased pecans in the last 24 months?" to continue and complete the rest of the survey. If the respondent had not purchased pecans, then the question, "Why have you not purchased pecans in the last 24 months?" was asked and the survey ended for that particular respondent. By using this

format, some information about general nut consumption was obtained and more obtained for those who had actually purchased pecans in the last two years. The Survey Research Center was asked to obtain 500 completed surveys of those who answered "yes" to Question 4.

Since it would be expensive and very nearly impossible to have every consumer in the United States be given the survey instrument, a sample must be taken. As the survey sample size increases, the ability of that sample to accurately represent the population increases as well. The rationale for asking that 500 surveys be completed was that it would set the confidence level for the inferences made from the survey at 95 percent. To have a confidence level of 95 percent means that the inferences made from this sample would be consistent with the population 19 times out of 20. In order for the inferences to be statistically significant at the 0.95 confidence level, it was determined that a minimum of 480 surveys would need to be completed.

Of those 500 surveys that were requested, only 474 were useable. Once the survey results were reviewed, an additional 136 surveys were deleted due to incomplete answers for household income. This reduced the number of observations to 338, decreasing the overall confidence level for the inference to 0.94. Although most researchers seem to strive for at least 95 percent confidence, the confidence level of 94 percent attributed to this sample size is still sufficient.

Table 4.1 below shows the reasons respondents gave for not having purchased pecans in the last 24 months. For those respondents who do not purchase pecans, 50 percent said it is due to the fact that they just do not like the taste of pecans. Fifteen percent reported either having a pecans tree or having friends who have trees and therefore do not need to purchase pecans. Thirteen percent indicated being allergic or having some other medical reason. Other reasons included the lack of availability (seven percent), pecans are too expensive (five percent), and 'other' (three percent).

The 'other' category included those who have bought pecans in the past but have not in the past 24 months. Also respondents were categorized as 'other' if they said that they just do not buy them.

Table 4.1 Reasons for Not Purchasing			
Pecans in the Past 24 Months and			
Percentages			
Reasons	Percent		
Do not like pecans	58%		
Have a tree/Friends Have			
Trees	15%		
Allergic/Medical	13%		
Availability	7%		
Too Expensive	5%		
Other	3%		

The respondents who continued the survey were asked a series of questions to measure their perceptions of snack nuts and more specifically about pecans. First, a series of questions was used to gauge attitudes and perceptions towards pecans and their uses. Secondly, the respondents were asked questions designed to gather information on primary food shoppers' willingness to purchase pecans and the additional amount they are willing to pay for a potential snack pecan product. Finally, demographic characteristics including, gender, age, household income, education, food expenditures, as well as other socioeconomic and demographic information was collected from each respondent to complete the survey. Table 4.2 on page 45 presents the definition of variables and the descriptive sample statistics of the sample. A copy of the survey can be found in Appendix A.

Variable	Description	Mean 60 77	St. Dev.
		00.77	32.00
Home	Number of persons in household	2.84	2.119
Kids	Number of children living in household	0.86	1.550
Married	=1 if respondent is married, 0 otherwise	0.6547	0.47596
Food	Dummy Variable, weekly food expenditures \$1-100=1,	1 6484	0 77171
	\$101-200=2, >\$200=3	1.0101	0.,,,,,,
Age	Age of respondents	49.58	15.111
Female	=1 if respondent is female, 0 otherwise	0.73	.422
Education	=1 if respondent attended or graduated from college, 0	4.5	400
	otherwise	.45	.498
White	=1 if respondent is white, 0 otherwise	0.80	0.404
Hispanic	=1 if respondent is Hispanic, 0 otherwise	0.05	0.210
Black	=1 if respondent is black, 0 otherwise	08	2716
		.00	.2710
Region	Respondent's geographic location, 1=Northeast,	2.47	0.9734
	2=Midwest, 3=South, 4=West		
Purchasep	=1 if respondent purchased pecans in the last 24 months,	1.00	0.000
	0 otherwise	1.00	0.000
LTP_any	=1 if respondent is very likely or somewhat likely to		
	purchase one or more varieties of new pecan snack	0.8926	0.3099
	product, 0 otherwise		
Often_snack	How often a respondent ate pecans as a snack =1 once a		1 1 1 1 0
	week, =2 once a month, =3 once a year, 0 otherwise	1.7261	1.1419
Nutmoney	Dollar amount of money spent on nuts in last 6 months	36.37	51.437
Numbbuy	Number of times respondent purchased pecans since		
	January 1st	2.88	5.378
Snack	=1 if respondent has purchased pecans as a snack, 0 other	0.40	0.491
Expenisve nuts	=1 if the price of nuts is expensive relative to other		
· _ ···	snacks. 0 otherwise	0.7284	0.4452
Exp pecans	=1 if pecans are very or somewhat expensive compared		
r_r	to other 0 otherwise	1.4547	0.7544

Table 4.2 Definition and Summary of Sample Characteristics

Table 4.2 Continued

Variable	Description	Meen	St Day
Taste	=1 if respondent strongly agrees or agrees that becaus are	wiean	SI. Dev.
	a good tasting nut, 0 otherwise	0.9621	0.1911
Nutritional	=1 if respondent strongly agrees or agrees that pecans are		
	a nutritional snack nut, 0 otherwise	0.8926	0.3099
Specialty	=1 if respondent strongly agrees or agrees that pecans are	0 (590	0 4746
	a specialty food item, 0 otherwise	0.6589	0.4746
High_Income	=1 if respondent strongly agrees or agrees that pecans are	0 1726	0 2782
	for high income people, 0 otherwise	0.1720	0.5785
Modern	=1 if respondent strongly agrees or agrees that pecans are	0 4484	0 4878
	for modern people,0 otherwise	0.1101	0.1070
Old_Fashioned	=1 if respondent strongly agrees or agrees that pecans are	0 3242	0 4656
	for old fashioned people, 0 otherwise	0.3212	0.1020
Baking	=1 if respondent strongly agrees or agrees that pecans	0.9579	0.2010
	have many uses in baking, 0 otherwise		
High_Fat	=1 if respondent strongly agrees or agrees that pecans	0.5053	0.5005
	have a high fat content, 0 otherwise		
Well_Known	=1 if respondent strongly agrees or agrees that pecans are	0 9642	0 1859
	a well known nut, 0 otherwise	0.9012	0.1007
Low_Carb	=1 if respondent strongly agrees or agrees that pecans are	0.4463	0.4976
	a low-carb snack, 0 otherwise	0.1102	0.1370
BadExp	=1 if respondent had a bad experience with pecans, 0	0 16	0 365
	otherwise	0.10	0.500
FirstNut	=1 if respondent's first choice was pecan when asked	0.0613	0 2401
	what snack nut comes to mid, 0 otherwise	0.0015	0.2101
FaveNut	=1 if respondent's first choice was pecan when asked	0 1851	0 3886
	their favorite nut	0.1001	0.5000
Nutspast	=1 if pecans were purchased in the last 24 months, 0	0 3286	0 4699
	otherwise	0.5200	0.1099
AloneNut	=1 if respondent's first choice was pecan when asked	0 1368	0 3440
	which nut they prefer to eat by itself, 0 otherwise	0.1200	0.5110
WTP	Dollar amount respondent is willing to pay for a snack	0 4544	0 6198
	size pecan product from dichotomous choice question	0.1011	0.0170

Respondents were given a series of statements regarding attributes of pecans. The answers were based on a four point Likert Scale ranging from Strongly Agree to Strongly Disagree. These questions allowed the respondent perceptions and attitudes towards pecans to be determined. For example, the first statement in the series is...

"Pecans are of high nutritional value."

- 1. Strongly Agree
- 2. Agree
- 3. Disagree
- 4. Strongly Disagree
- 9. Refused to answer/ don't know/ no answer.

The answers to each perception question and the mode are presented in Table 4.3. The mode is used to describe the variables since it is difficult to describe or explain the averages. For example, if the average for "Pecans are of high nutritional value" was 2.5, it would be hard to distinguish those who agree or disagree. The mode shows the responses most often chosen. The majority of people agree that pecans are a good tasting nut, which is as important in future decision to purchases one snack nut over another.

(Pecans are a/101)		
Variable	Mode	Interpretation
High Nutritional Value	2	Agree
Specialty Item	2	Agree
Many Uses for Baking	2	Agree
Well Known Nut	2	Agree
High Fat	2	Agree
Good Tasting	2	Agree
Low Carb Nut	2	Agree
People with Higher Income	3	Disagree
Modern People	3	Disagree
Old-Fashioned People	3	Disagree

Table 4.3 Consume	r Pecan Perceptions
("Decema and a/for	"

Some explanation of the variables used in this study and expectations of results are useful before examining the results of them. A number of dummy variables needed to be created. Dummy variables are useful in order to indicate the absence or presence of a quality or attribute such as female/male, race, religion and other nominal scale variables (Gujarati, 2003). In general, gender should not affect WTP (Mukhopadhaya et al., 2004). Although, eating behaviors of males and females can be quite different. Females often times are more involved in the purchasing and handling of food products. Therefore, the female consumption and purchasing of snacks may be different from that of males. Food purchases and consumption can also be closely related to ethnicity, race, and culture of respondents.

AGE was considered to be an important factor and was computed based on the participant's response to a question asking the respondent to specify their age, in years. From Rimal and Fletcher's (2002) study on snack peanuts it can be expected that as the respondent's age increases, the amount she/he is willing to pay will increase.

The household income variable, INC_000, represents the respondent's self-reported household income (before taxes) category levels in 2003. The variable was recorded from eleven ranges of income. The ranges were then grouped into four smaller ranges and the mid point was taken for each group. This allows one to use an actual dollar amount rather than the range which is preferred by economists to be able to explain the effects of income on the dependent variable. These numbers were then divided by 1,000 to reduce the magnitude between variables and allow the coefficients to be more manageable. It is expected that respondents with higher income will pay more for a snack size bag of pecans.

The survey recorded the state that each respondent resided in and was then grouped into regions. These regions were coded as follow: 1=Northeast, 2= Midwest, 3=South and 4=West. It

is thought that those residing in regions further away from where pecans are produced and readily available may be willing to pay more for the snack product.

A weekly food expenditure variable, FOOD, was created in order to determine if those households who spend more on weekly food purchases will be willing to pay more for a snack product. Other studies have found that those with more members in the household may not necessarily be willing to pay more for an item due to the amount of money spent per person on food (see Govindasamy and Italia, 1998).

Several dummy variables were included to account for respondents' attitudes and perceptions towards nuts and pecans in particular. For example, if a person believes that pecans are a good tasting nut, they may be more likely to purchase a snack size bag of pecans. If pecans are their favorite nut, they may be willing to pay more for the snack product. FAVENUT is a dummy variable that assigns a one to those who said that pecans were one of their favorite nuts. The survey also asked the respondents how many times since January 1st they have purchased pecans, NUMBBUY. Those who purchase pecans more often throughout the year may be willing to pay more.

A series of questions were asked in similar fashion to the ones that used the Likert Scale discussed earlier. These questions consisted of various flavors and coatings of pecans that could potentially be offered in a snack size bag. Each respondent was asked how likely they would be to purchases each of these types of pecans: flavored such as chocolate or honey mustard, salted, spicy, roasted, glazed, sugar and spice, or raw. They were asked if they would be very likely, somewhat likely, unlikely, or very unlikely. If a respondent answered "very likely" or "somewhat likely," then the respondent is considered likely to buy at least one of the varieties of

pecan snack products. For those individuals a dummy variable, LTP_ANY, is assigned a value of 1, and would receive a 0 for any other response.

Empirical analyses were performed using the dollar values for the willingness to pay dependent variable. The dependent variable is considered to be a censored variable. It is considered censored data because the actual WTP for a person who did not accept any bid was not asked. Those respondents were assigned a zero, when in fact they may have been willing to pay some price other then the choices offered. The question that was not asked was: how much more are you willing to pay over the specified bid amount? The censoring limits differ by individuals, and a Tobit regression model was estimated to take into account this censoring to avoid biased and inconsistent estimates of the parameters in the model.

Willingness to pay was elicited by using the dichotomous choice format. Beginning values were randomly assigned to each respondent and are as follows: \$0.79, \$0.99, \$1.19, \$1.39, \$1.59. Using \$0.99 as an example, the respondent was asked "Would you be willing to pay \$0.99 for a 2.5 ounce single serving snack pecan product?" A second question is then asked in regards to the answer to the first question. If the respondent answered "yes" to the first price, they were then asked if they would be willing to pay a predetermined 25 percent price increase. In this case the person would be asked if they would be willing to pay \$1.24; the answer is recorded and the surveyor moves on to the next question. If the answer to the first question asking the person if they would pay \$0.99 is "no", the respondent is asked if they would be willing to pay a predetermined 25 percent, they would be willing to pay a predetermined 25 percent price decrease. In this case, the person would be asked if they would be willing to pay a predetermined 25 percent price decrease. In this case, the person would be asked if they would be willing to pay a predetermined 25 percent price decrease. In this case, the person would be asked if they would be willing to pay a predetermined 25 percent price decrease. In this case, the person would be asked if they would be willing to pay \$0.74 for the single serving snack bag of pecans. Again, the response is recorded and the questioner moves on to the next question. Table 4.4 on the next page presents the descriptive statistics of the willingness to pay questions.

(Inglici/lower	old amounts)		
Initial Bid	0/ Vac	% Accepted	% Accepted
Amount (\$)	70 I ES	Higher Bid	Lower Bid
\$0.70	61.8%	74.6%	52.7%
ФО. 79	01.070	(\$0.99)	(\$0.59)
\$0 QQ	53 6%	69.2%	55.7%
\$0.99	55.070	(\$1.24)	(\$0.74)
\$1 10	61.8%	60.3%	70.3%
ψ1.17	01.070	(\$1.48)	(\$0.89)
\$1.39	55 7%	44.9%	62.1%
\$1.57	55.770	(\$1.73)	(\$1.04)
\$1.59	38 4%	48.5%	44.3%
ψ1.37	50.470	(\$1.98)	(\$1.19)

Table 4.4 Descriptive Statistics of Answers to WTP Question. (Higher/lower bid amounts)

In () are the additional bid prices used

As seen in the table, however, the percentage of respondents who accepted the first bid offered does not necessarily decrease as the bid increases. The reason for this is that the bids were randomly assigned to the survey respondents and are unrelated to each other. For example, the respondent who is asked if he or she would accept the first bid of \$1.19 is not aware that there is a possibility of the price being lower, and therefore may believe that \$1.19 to be a good price.

The percentages represent the number of respondents who accepted a bid. Again using the example of \$0.99, 53.6 percent of those respondents who were given this bid accepted it. Of those 53.6 percent, 69.2 percent accepted \$1.24. Of the 45.4 percent who did not accept \$0.99, 55.7 percent did accept the lower bid of \$0.74.

U.S. and Survey Respondent Characteristics

The average age of the respondent was 49 years old with a range from 18 to 85 years of age. This average is much higher than the national average age of 36 years, however, the national age includes those people less than 18 years of age as well. The genders of the

respondents were 73.6 percent female and 26.4 percent male. This is also not representative of the national average of 51.1 percent female and 48.9 percent male (U.S. Census, 2000). It is likely that the argument that more females are home during the day and are more likely to be the main food purchaser of the household. Forty-five percent of the respondents earned a bachelor degree or higher. Only 26.5 percent of the national population has a bachelor degree or more. Forty-nine percent of respondents are employed full-time with 25.3 percent being retired. These statistics are lower than the national percentage of 60.67 percent employed and 7.6 percent unemployment. Again, this could be due to the survey respondents likely being available at home to take care of children, households, and other responsibilities. On average, the respondents held a full-time job. The midpoint for the household income categories for the survey respondents earning over \$105,000 annually. The sample household income is somewhat higher than the nation's at \$41,994.

The racial and ethnic makeup of the respondents is not quite representative of the U.S. Eighty-two percent of respondents were white, 8.3 percent African American, 5 percent Hispanic, and 6.7 percent indicated they were multi-racial. The 2000 U.S. Census reports that 76.2 percent of the nation is white, 12.2 percent are African American, and 1.9 percent is multiracial. The respondent's median household contained two people living in a single home with the average being 2.84. This is close to the U.S. average household size of 2.61 persons per single housing unit.

Sixty-seven percent of respondents reported being married; 18.1 percent are single. Fifty-four percent of the US population is married with 27.49 percent reported as single. Of the participants surveyed, 59.6 percent said there were no children less than 18 years of age living in the household; 30.4 percent indicated one or two children living in the household. The

percentage of the US households reporting at least one child less than 18 years of age in a household is 35.44 percent. Food expenditures for households were requested and 23.3 percent of respondents spend between \$76 and \$100 weekly for food.

The survey was administered to a national sample, and was broken down into four regions: West, Northeast, Midwest, and South. The percentage of respondents from the groups above are listed, respectively 19.6 percent, 28 percent, 36.2 percent, and 14.7 percent. For the narrowed population of 343 respondents who were asked to continue the survey, the representations of the four regions are a bit skewed to the South. This could be due to the availability of pecans in the South creating greater Southern consumer access to purchases. Fourteen percent, 18.4 percent, 28.6 percent, and 39.1 percent of the participants live in the West, Northeast, Midwest, and the South respectively.

One of the objectives of this thesis is to construct a demographic profile of pecan consumers. The survey was designed to screen out respondents that have not purchased pecans during the previous 24 months. The reason for screening out these individuals was they could not provide the types of information we were looking to collect since they do not purchase or eat pecans regularly. The survey instrument included a number of demographic questions that can be compared against the U.S. population to determine whether the two populations are demographically similar.

Survey Respondent Characteristics of Pecan Snack Consumers

The survey methodology was designed to incorporate a random sampling procedure to ensure a random sample of the U.S. population. The random sampling procedure ensures that every person in the United States with a phone number has an equal chance of being contacted

for the survey. This allows one to look for differences in the characteristics of those respondents who consume pecans on a regular basis to the rest of the general population. These differences would enable a pecan processor to target consumers that fit a specific demographic profile.

Table 4.5 on the following page, provides a demographic profile of consumers who indicated they eat pecans as a snack, once a month or more. This is a sub-sample of 206 respondents from those who indicated they have purchased pecans in the last 24 months. The demographic information collected on these individuals are compiled and then compared to corresponding 2000 U.S. Census data. The survey collected information on consumers who have purchased pecans over the last year; however, there is a core group of consumers that eat pecans on a regular basis. These consumers who purchase pecans frequently are more likely to purchase new pecan snack products.

The frequent pecan consumer is older than the average American being somewhere between 35-54 years old, with the median being 52 years old which is significantly older than the U.S. population median age of 35 years. Female pecan snack consumers comprise 72 percent of the respondents. This is not surprising given that females are more likely to purchase groceries than are males. However, it is important when marketing products to take into account female perceptions of the new snack product as they appear to be the gate keeper to the family.

The midpoint of the household income categories of the frequent pecan snack consumer is \$49,999 which is noticeably higher than the median for the U.S., \$41,994. The income data suggests that consumers whose household income is less than \$15,000 annually are not as likely to purchase pecans as a snack as are more affluent consumers. The income data also suggest that affluent consumers, those whose annual household income exceeds \$105,000 are more likely to purchase pecans for a snack.

Demographic Variables	Eat Pecans More than	US Population	
Аде			
18-19	4%	7 4% *	
20-34	13%	16%	
35-54	42%	34%	
55-64	21%	10%	
65+	23%	12%	
Mean	52 years	35 years	
Gender	- j		
Male	28%	49%	
Female	72%	51%	
Household Income		• - / •	
Less than \$15,000	3%	16%	
\$15,000 - \$24,999	11%	13%	
\$25,000 - \$34,999	10%	13%	
\$35,000 - \$44,999	18%	17% (\$35-\$49K)	
\$45,000 - \$54,999	13%		
\$55,000 - \$64,999	9%		
\$65,000 - \$74,999	6%	20% (\$50-\$75K)	
\$75,000 - \$84,999	6%		
\$85,000 - \$94,999	4%		
\$95,000 - \$104,999	3%	10% (\$75-99K)	
\$105,000 or more	18%	12% (>\$100K)	
Median	\$49,999	\$41,994	
Education	,		
Less than high school degree	3%	20%**	
High school diploma/GED	22%	29%	
Some college/technical school	29%	21%	
College graduate	35%	22%	
Post-graduate degree	10%	9%	
Race/Ethnicity			
White	74%	75%	
Black	11%	12%	
Asian	1%	4%	
American Indian	4%	1%	
Multi-racial	6%	2%	
Hispanic	5%	5%	
Marital Status			
Married	61%	54%***	
Divorced	9%	10%	
Separated	0%	2%	
Widowed	10%	7%	
Single	20%	27%	

 Table 4.5 Frequency of Purchasing Pecans as a Snack (206 Respondents)

Demographic Variables	Eat Pecans More than Once a Month	US Average
Region		
Northeast	18%	22%
Midwest	21%	22%
South	44%	31%
West	17%	25%

 Table 4.5 Frequency of Purchasing Pecans as a Snack

*this percentage is for ages 15-19, only data available

** Ages 25 and older

***Ages 15 and older

Examining the educational attainment data reveals that frequent pecan snack consumers are more educated than the U.S. population as whole. Frequent pecan snack consumers are significantly more likely to have attained a degree in higher education, 45 percent, than U.S. population where only 31 percent have a bachelor's degree.

In terms of race and ethnicity, the White, Black, and Hispanic populations are similar to those of the national average. According to the responses, Asians are less likely to purchase pecans and Native Americans and people of Multi-racial backgrounds are more likely to purchase pecans. Married and Widowed people are more likely to purchase pecans as a snack while Single and Separated people are less likely. Northeasterners and Westerners are not as likely to purchase pecans as are Southerners.

From analyzing the demographic data of the frequent pecan purchasers one can conclude that the average consumer is older, more affluent and educated. This is a good profile and suggests that pecans are not being consumed by younger Americans. It would be appropriate for the pecan industry to focus on marketing strategies to younger consumers to increase the demand for pecans. Also, pecan snacks need to be heavily marketed and promoted in the Northeast and Western U.S. as they are less likely than Southerners to eat pecans on a regular basis.

Additional Demographic Characteristic Analysis

In addition to the above demographic profile, more information can be gleaned from the survey results using cross tabular analysis. Table 4.6 on below shows the results from the type of store or where pecans are purchased by the regions where the consumers live. From this table it can be seen that most individuals across the United States tend to buy most of there pecans at the grocery store. Eighteen percent of the consumers in the South said that they purchase pecan at some other place than the five locations that were given as possible places.

Table 4.6 Places Pecans are Purchased the most By Region				
	Northeast	Midwest	South	West
Grocery store	83%	80%	69%	76%
Catalog order	0%	0%	1%	0%
Specialty store	5%	5%	5%	9%
Through a fund-raiser	2%	3%	4%	0%
Road side stand	0%	4%	4%	1%
Other	10%	8%	18%	14%

Table 4.7 shows the consumers' mean willingness to pay for a 2.5 ounce snack pack of pecans at the four different income categories. The willingness to pay was highest for the income level of \$49,999.50 at \$0.95, with the lowest being for both the highest and lowest income levels at \$0.91.

Table 4.7 WTP for each Income			
Income Level	WTP		
\$17,499.49	\$ 0.91		
\$49,999.50	\$ 0.95		
\$79,999.50	\$ 0.94		
\$109,999.50	\$ 0.91		

It was thought that the region that a consumer lived in would also have an effect on their mean willingness to pay for a pecan snack product. According to the results shown in Table 4.8,

consumers that live in the Northeast have the highest willingness to pay at \$0.92 for a 2.5 ounce snack pack of pecans. The lowest, with \$.080 per 2.5 ounce pack was the West. The South had the second highest willingness to pay at \$0.91.

Table 4.8 WTP for each Region			
Region	WTP		
Northeast	\$ 0.92		
Midwest	\$ 0.87		
South	\$ 0.91		
West	\$ 0.80		

Next, willingness to pay was found for those consumers living in a certain region of the country with a certain income level. As shown in Table 4.9 those living in the Northeast and having the lowest level of income are willing to pay the most (\$1.30) for a pecan snack product. Those living in the South with the same level of income are willing to pay the least (\$0.80) for the hypothetical product. At the next higher level of income the West is willing to pay the least (\$0.76), while the other three regions are all willing to pay over \$0.90 per pack. In the second to highest income bracket, the West pays the most at \$1.07 per pack. At the highest level of income the mean willingness to pay is the highest for the Northeast at \$0.99 per pack.

Table 4.9 Mean WTP by Income Levels and Regions				
Income Level	Northeast	Midwest	South	West
\$17,499.49	\$ 1.30	\$ 0.92	\$ 0.80	\$ 0.85
\$49,999.50	\$ 0.92	\$ 0.98	\$ 0.98	\$ 0.76
\$79,999.50	\$ 0.83	\$ 0.91	\$ 0.97	\$ 1.07
\$109,999.50	\$ 0.99	\$ 0.91	\$ 0.89	\$ 0.83

Table 4.10 on the next page, shows the mean willingness to pay by region and the outlets where pecans are purchased. Those living in the South who purchase their pecans through

	Northeast	Midwest	South	West
Grocery Store	\$ 0.94	\$ 0.92	\$ 0.97	\$ 0.90
Specialty Store	\$ 0.58	\$ -	\$ 0.84	\$ 0.72
Fund-Raiser	\$ 0.37	\$ 0.98	\$ 1.22	\$ -
Roadside Stand	\$ -	\$ 0.73	\$ 0.99	\$ -
Other	\$ 1.09	\$ 1.00	\$ 0.67	\$ -

Table 4.10 Mean WTP by Region and Where Pecans Most Often Purchased

fundraisers tend to be willing to pay more (\$1.22) per pack. According to the table, there is not much difference between regions when looking at the willingness to pay for a pecan snack product and those who purchase pecans at grocery stores.

The following table is similar to Table 4.10 except that region has been replaced with income level. According to Table 4.11, those consumers with an income level of \$49,999.50 who purchase pecans through fundraisers would be willing to pay the most for a pecan snack product. Their mean willingness to pay was estimated to be \$1.39 per pack. Consumers who purchase pecans at roadside stands and through fund-raisers in the mid-income groups may be a target market due to their higher mean willingness to pay.

1 arenabea					
	\$17,499.49	\$49,999.50	\$79,999.50	\$109,999.50	
Grocery Store	\$ 1.05	\$ 0.98	\$ 1.00	\$ 0.88	
Specialty Store	\$ -	\$ -	\$ -	\$ 0.97	
Fund-Raiser	\$ 0.99	\$ 1.39	\$ 1.29	\$ 1.23	
Roadside Stand	\$ -	\$ 1.17	\$ 1.24	\$ 0.62	
Other	\$ 0.86	\$ -	\$ 0.78	\$ 0.91	

Table 4.11 Mean WTP by Income Level and Where Pecans Most Often Purchased

Table 4.12 on the following page shows the mean willingness to pay for a pecan snack product by the level of income and size of packaging most often purchased. Those who purchase a quarter pound bag of pecans and whose income level is \$49,999.50 have the highest mean

willingness to pay at \$1.44. Also in the same income level, the next highest willingness to pay

(\$1.42) was found for those purchasing two pounds or more.

are wost often i urchased								
	\$ 1′	7,499.49	\$49	9,999.50	\$79	9,999.50	\$1()9,999.50
Quarter lb	\$	1.11	\$	1.44	\$	1.09	\$	0.52
Half lb	\$	0.98	\$	1.08	\$	1.09	\$	1.27
One lb	\$	1.21	\$	0.77	\$	0.74	\$	-
Two lbs	\$	0.85	\$	0.85	\$	1.18	\$	1.24
More than Two								
lbs.	\$	0.81	\$	1.42	\$	1.02	\$	0.54
Any Size	\$	0.93	\$	1.12	\$	-	\$	1.24
Two lbs More than Two lbs. Any Size	\$ \$ \$	0.85 0.81 0.93	\$ \$ \$ \$	0.77 0.85 1.42 1.12	\$ \$ \$	1.18 1.02	\$ \$ \$	1.24 0.54 1.24

Table 4.12 Mean WTP by Income Level and the Size of Bag that Pecans are Most Often Purchased

When the respondents were asked of their likelihood to purchase a pecan snack product, those who responded very likely did not differ much by region, as shown in Table 4.13 on the below. The percentages shown are calculated from the number of consumers in each region who responded to their likeliness to purchase the raw pecan snack product. Those consumers from Northeast had the highest response of Very Unlikely. Overall, across the four regions, the majority of the respondents are very or somewhat likely to purchase a raw pecan snack product.

0	Northeast	Midwest	South	West
1-Very likely	30%	28%	33%	28%
2-Somewhat				
likely	28%	28%	30%	23%
3-Unlikely	16%	20%	14%	29%
4-Very unlikely	26%	24%	23%	20%
Mean	2.39	2.40	2.26	2.42

Table 4.13 Percent Likely to Purchase a Raw Pecan Snack Product by Region

The respondents were then asked about a variety of different pecan snacks and their likelihood to purchase them. Again, percentages are calculated by the total number of

respondents in each region and according to their likeliness to purchase each variety of pecan snack product. Tables 4.14 through 4.19 show the results. Table 4.14 shows that a small proportion of respondents were not very likely to purchase a sugar and spice pecan snack product. These responses were not different by region as well. A larger proportion of the respondent in all regions stated that they were more unlikely to purchase this pecan snack than likely.

	Northeast	Midwest	South	West
1-Very likely	15%	14%	17%	15%
2-Somewhat				
likely	29%	22%	28%	22%
3-Unlikely	22%	34%	25%	33%
4-Very unlikely	34%	30%	30%	30%
Mean	2.75	2.81	2.67	2.78

Table 4.14 Percent Likely to Purchase a Sugar and Spice Pecan Snack Product by Region

The percentages in Table 4.15 show that across all regions, the majority of consumers are very or somewhat likely to purchase a roasted pecan snack product. Thirty-five percent of those living in the South have the highest percentage of those very likely to purchase this particular variety.

Region				
	Northeast	Midwest	South	West
1-Very likely	26%	29%	35%	30%
2-Somewhat				
likely	42%	43%	44%	45%
3-Unlikely	14%	12%	9%	16%
4-Very unlikely	18%	16%	12%	9%
Mean	2.24	2.14	1.98	2.04

Table 4.15 Percent Likely to Purchase a Roasted Pecan Snack Product by Region
The next table describes the percentage of respondents who are likely to purchase a flavored pecans snack product such as chocolate covered or honey mustard. According to Table 4.16, those living in the Northeast are evenly divided in their likelihood to purchase a flavored pecans snack product. The highest mean WTP belongs in the category of those living in the South and reporting they are somewhat likely to purchase a flavored product.

Region					
	Northeast	Midwest	South	West	
1-Very likely	20%	16%	20%	17%	
2-Somewhat					
likely	33%	38%	39%	26%	
3-Unlikely	25%	18%	19%	27%	
4-Very unlikely	22%	28%	22%	30%	
Mean	2.48	2.59	2.43	2.71	

Table 4.16 Percent Likely to Purchase a Flavored Pecan Snack Product by Region

Table 4.17 below represents the percentage of pecan consumers' likelihood to purchase a salted pecan snack product. The percentages are similarly dispersed among each region with the majority likely to purchase the salted variety.

Region				
	Northeast	Midwest	South	West
1-Very likely	19%	21%	26%	23%
2-Somewhat				
likely	37%	34%	37%	34%
3-Unlikely	22%	19%	20%	23%
4-Very unlikely	22%	26%	17%	20%
Mean	2.47	2.50	2.29	2.40

Table 4.17 Percent Likely to Purchase a Salted Pecan Snack Product by Region

The percentages provided in Table 4.18 below are unlike the previous tables. The majority in this table are less likely to purchase a spicy pecan snack product. In each region more than 60 percent of the consumers were unlikely or very unlikely to purchase this product.

Region				
	Northeast	Midwest	South	West
1-Very likely	18%	6%	14%	12%
2-Somewhat				
likely	19%	17%	19%	24%
3-Unlikely	23%	39%	31%	29%
4-Very unlikely	41%	39%	36%	35%
Mean	2.87	3.10	2.90	2.88

Table 4.18 Percent Likely to Purchase a Spicy Pecan Snack Product by Region

The final table in this series provides percentages of those likely or unlikely to purchase a glazed pecan snack product across the United States. Again, it seems that the percentages across regions are somewhat evenly dispersed. Consumers in the Northeast and the South have higher combined percentage for somewhat or very likely to purchase than the Midwest or West.

0				
	Northeast	Midwest	South	West
1-Very likely	29%	20%	27%	24%
2-Somewhat				
likely	28%	32%	33%	28%
3-Unlikely	19%	21%	22%	30%
4-Very unlikely	24%	27%	18%	18%
Mean	2.39	2.56	2.31	2.42

Table 4.19 Percent Likely to Purchase a Glazed Pecan Snack Product by Region

Survey Results to Selected Pecan Consumption Questions

Only 16 percent of the respondents reported that they have had a bad experience with pecans. Almost half of those who did have problems, indicated rancidity was the cause of their

bad experience (45.9 percent). Other reasons included a flavor different than expected (20.3 percent); piece of shell in pecans (14.9 percent), color was different than expected (1.4 percent), and smaller than expected (4.1 percent).

Eighty-nine percent of the survey participants indicated they would be likely to purchase some form of pecan snack product. As discussed previously in the chapter, a dummy variable was used to describe those who are likely to purchase a pecan snack product.

During the survey interview, participants were asked if they have purchased pecans for a gift, for a snack, or for cooking or baking. A follow up question was then asked as to which form of pecans they purchase for each purpose. Only 8.4 percent indicated they have purchased pecans as a gift. Less than 11 percent reported purchasing pecans as a snack and 22.5 percent for cooking and baking purposes. The majority of respondents indicated they purchase pecan halves for each use.

Survey respondents were asked several questions about how much they pay, where they purchase their pecans, and how they store them. The average price per pound of pecan halves reported was \$4.50. This reported price was much lower than the average retail price of \$9.00 per pound in 2005. The following statistics include all forms of pecans. Eighteen percent prefer to purchase pecan halves opposed to in-shell, pieces, or granules. Seventy-six percent prefer to purchase their pecans from the grocery store, and 41.6 percent reported only purchasing pecans during the holidays (Thanksgiving, Christmas, and New Years) and special occasions. Thirty-three percent responded to purchasing pecans on a regular basis throughout the year. These statistics include all forms of pecans.

Survey participants were also queried on their purchase decision on snacks and snack nuts. When asked if the respondent has ever purchased a single serving snack size bag of nuts,

31.4 percent have said they have purchased almonds. Cashews were second with 22.5 percent, peanuts follow with 15.7 percent, pecans and macadamia nuts were close with 2.3 percent and 2.1 percent receptively. Other nuts mentioned were purchased at one percent or less.

Respondents were also asked how they perceived the price of snack nuts compared to other snack foods such as chips, cookies, etc. Forty-six percent felt that snack nuts were somewhat more expensive compared to other snack products. Twenty-nine percent believe that snack nuts are expensive or very expensive compared to other snack products. Survey respondents were also asked what they believed the price of pecans was compared to other snack nuts. Nearly half, 46.2 percent, of respondents felt that pecans were priced about the same as other snack nuts, with 40 percent and 6.5 percent believing they are more expensive or less expensive respectively. During the survey interview the respondents were asked where they most often purchased snack nuts. The response was a majority purchase them at the grocery store, 58.5 percent. Other responses included convenience stores, gas stations, and vending machines with the following respective percentages 22.4, 9.0, and 4.9.

When asked how often the respondents eat pecans as a snack, 35.3 percent replied they eat pecans as a snack about once a year. Only 16.8 percent said they eat pecans once a week as a snack. Fifty-seven percent reported eating roughly one handful of pecans in one sitting. An average handful was determined to be about two ounces of pecans or about ten pecan halves.

Chapter 5

Empirical Results and Analysis

Overview of the Tobit Model

The Tobit model, named after James Tobin, is an extension of the Probit model and is one approach to dealing with censored data. Censored data as defined by Gujarati (2003) is "a sample in which information on the regressand is available only for some observations". In other words, $y = y^*$ if y^* falls in some range and y = some limit values otherwise. The Tobit model assumes observed consumption of a good by household i, y_i , is determined by a latent variable, y_i^* , that can be modeled as a linear function of a vector of independent variables X_i , a vector of coefficients β , and an error e_i , which has the normal distribution $N(0, \sigma^2)$. Observed consumption can be described as follows:

$$y_i = y_i^* = X_i^{`}\beta + e_i$$
 if $X_i^{`}\beta > -e_i$
 $y_i = 0$ if $X_i^{`}\beta \le -e_i$ $i = 1, 2, ..., N$ 5.1

This is a censored regression model because it is possible to view the problem as one where observations of y* at or below zero are censored (Johnston and DiNardo, 1997). According to McDonald and Moffitt (1980), the model assumes there is an underlying stochastic index equal to $X_i \beta + e_i$ which is observed only when it is positive. Therefore, McDonald and Moffitt (1980) believe this qualifies as an unobserved latent variable. The expected value of y in the model is

$$E[y] = X_{i}\beta\Phi + \sigma\phi \qquad 5.2$$

where ϕ is the unit normal density, Φ is the cumulative normal distribution function, and σ is the standard error of the model. The expected value of y for observations above the limit, called y* is $X_i^{\hat{\beta}}\beta$ plus the expected value of the truncated normal error term:

$$E[y^*] = E[y|y > 0]$$

= $E[y|e > - X_i^{\beta}]$
= $X_i^{\beta} + (\sigma \phi)/\Phi$ 5.3

The basic relationship between the expected value, E[y], the expected value condition on being above the limit, $E[y^*]$, and the probability of being above the limit, Φ is

$$E[y] = \Phi E[y^*]$$
5.4

McDonald and Moffitt (1980) point out that the Tobit model uses all observations, above the limit and at the limit, to estimate a regression line. In general, it is preferred that a regression equation with observations above the limit be estimated. They offer a decomposition of the analysis to show that Tobit can be used to determine both changes in the probability of being above the limit and changes in the value of the dependent variable if it is above the limit. From above the decomposition can be obtained by considering the effect of a change on the ith variable of X on y:

$$\frac{\partial Ey}{\partial X_i} = \Phi\left(\frac{\partial Ey^*}{\partial X_i}\right) + Ey^*\left(\frac{\partial \Phi}{\partial X_i}\right)$$
5.5

The LIMDEP manual offers another way to write the decomposition equation. This method is used to perform the actual calculation in LIMDEP.

$$\frac{\partial E[y \mid X]}{\partial X} = \left[\Phi\left(1 - \left(\frac{\phi}{\Phi}\right)\left(\beta^{*}X + \frac{\phi}{\Phi}\right)\right) + \phi\left(\frac{\beta^{*}X}{\sigma} + \frac{\phi}{\Phi}\right)\right]\beta$$
5.6

The total change in y can be broken into two parts, the change in y of those observations above the limit, weighted by the probability of being above the limit, in this case zero; and the change in the probability of being above the limit, weighted by the expected value of y if above the limit (McDonald and Moffitt, 1980).

With both market participation and consumption levels determined by the same equation, zero consumption observations in the Tobit model are assumed to result from a corner solution to the utility maximization problem. These zero observations may occur because pecan prices are too high or other factors that limit market participation such as supply constraints, high transaction costs, or consumer characteristics, and seasonality of product (Fuller et al, 2004). Recall in Chapter 3 that we defined willingness to pay by the equality of indirect utility functions and can be represented in terms of WTP:

$$U((I - WTP), S^{1}, D) = U(I, S^{0}, D)$$
 5.7

where U represents the indirect utility function, I is income, D represents a set of demographic and socioeconomic characteristics, and S^1 and S^0 indicate pecans purchased in the last 24 months or not. In the case of the dichotomous (yes or no) response question, WTP is not directly observable. Let z be the observable portion of the indirect utility function U. An individual will response "yes" to the random bid if:

$$z((I - Bid), S^{1}, D) + e^{1} \ge z(I, S^{0}, D) + e^{0}$$
 5.8

Where e^1 and e^0 are identically and independently distributed random variables with zero means. The above equation can be rewritten by specifying z as the functional form of a statistical model,

$$\alpha_1 + \beta(\mathbf{I} - \mathbf{Bid}) + \mathbf{e}^1 \ge \alpha_0 + \beta * \mathbf{I} + \mathbf{e}^0$$
5.9

where α_1 , α_0 , and β are functions of D. Therefore,

$$PR('yes') = Pr(\alpha_1 + \beta(I - Bid) + e^1 \ge \alpha_0 + \beta * I + e^0)$$
 5.10

$$= \Pr(e^{0} - e^{1} \le \alpha_{1} - \alpha_{0} - \beta^{*}Bid)$$

$$= \Pr(e \le \alpha_{1} - \alpha_{0} - \beta^{*}Bid) \text{ where } e = e^{0} - e^{1} \text{ is the error term.}$$

$$5.11$$

The Tobit formulation in the study is as follows:

$$WTP_{i} = WTP_{i}^{*} \qquad \text{if } WTP_{i}^{*} < Bid_{i}$$
$$= Bid_{i} \qquad \text{if } WTP_{i}^{*} \ge Bid_{i}, \qquad 5.12$$

where WTP_i is the stated WTP of respondent i and WTP^{*}_i is the corresponding latent variable that is observed for values less than Bid_i and is censored for values greater than or equal to Bid_i. The estimation of the Tobit model assumes that the errors are normal and homoscedastic (Long, 1997).

According to demand theory, factors that determine demand are income, own product price, prices of related goods (substitutes and complements), and tastes and preferences. The regressors that were chosen for this model theoretically should demonstrate these variables by displaying a significant level of decision–making power for the respondent to accept or reject the bid amount. The functional relationship for the willingness to pay curve is expressed as:

$$\begin{split} \text{WTP}_{i} &= \beta 0 + \beta 1 \text{INC} + \beta 2 \text{AGE} + \beta 3 \text{FEMALE} + \beta 4 \text{KIDS} + \beta 5 \text{WHITE} + \beta 6 \text{REGION} + \\ & \beta 7 \text{EXPENSIVE} + \beta 8 \text{HIGH}_{\text{FAT}} + \beta 9 \text{TASTE} + \beta 10 \text{FAVENUT} \\ & + \beta 11 \text{LTP}_{\text{ANY}} + \beta 12 \text{NUTSPAST} + \mu \end{split}$$

where:

WTP_i = survey respondent's willingness to pay (in dollars)
INC= household income level (in 1000's of dollars)
AGE= respondent's age in years
FEMALE= gender of respondent

(1 = Female, 0 = Male)

KIDS= Number of children present under 18 years of age

WHITE= race/ethnicity of respondent

(1= White, 0 otherwise)

REGION= indicator for the region of the U.S. in which the respondent lives

(1= Northeast, 2= Midwest, 3= South, 4=West)

EXPENSIVE= pecans are more expensive compared to other snack nuts

(1 = Yes, 0 = otherwise)

TASTE= pecans are a good tasting nut

(1 = Yes, 0 = otherwise)

FAVENUT= if pecans were mentioned as the respondents favorite nut

LTP_ANY= if respondent is likely to purchase any type of processed pecan p

product (1= Somewhat/Very Likely, 0 = otherwise)

NUTSPAST= if pecans were purchased in the past 24 months

(1 = Yes, 0 = otherwise)

Table 5.1 on page 71 gives the descriptions for those variables used in the model. The numbers are slightly different from those in Table 4.1 due to the reduced number of observations in the sample used in the model. The mode for REGION was reported due to the fact that it describes the variable better than using the mean, whereas the mean was 2.63.

Model Results

The econometric software used to analyze the Tobit model along with the decomposition is LIMDEP (Greene, 1992). The name reflects the programs used to estimate limited dependent variable models.

Variable	Description	Mean	Standard Deviation
Income	Household Income (divided by 1,000)	60.772	32.606
Age	Age of Respondent	48.43	14.229
Female	=1 if Female, 0 Male	0.73	0.444
Kids	Number of children living in household	0.91	1.241
White	=1 if White, 0 otherwise	0.80	0.401
Region	Respondent's geographic location, 1= Northeast, 2= Midwest, 3= South, 4=West	2.48	0.948
Expensive	=1 if the price of nuts is expensive relative to other snacks, 0 otherwise	0.91	0.293
High_Fat	=1 if respondent strongly agrees or agrees that pecans have a high fat content, 0 otherwise	0.76	0.429
Taste	=1 if the respondent strongly agrees or agrees that pecans are a good tasting nut, 0 otherwise	0.97	0.178
Favenut	=1 if respondent's first choice to their favorite nut was pecans, 0 otherwise =1 if respondent is vary likely or likely	0.50	0.501
LTP_Any	to purchase one or more varieties of new snack pecan product 0 otherwise	0.31	0.465
Nutspast	=1 if pecans were purchased in the last 24 months, 0 otherwise	0.62	0.485

Table 5.1 Variable Descriptions for Tobit Model

Greene (1992) designed the software, LIMDEP, to be flexible for estimating regression models most frequently analyzed with cross section data.

After running the model, it was suspected that heteroscedasticity may be present. Recall that the Tobit assumes the error terms to be normal and homoscedastic. With heteroscedasticity, the variances among observations are not the same. This means the specific $\hat{\beta}$ is no longer the Best Linear Unbiased Estimator or BLUE. It remains unbiased and consistent; however the

Beta does not have the minimum variance of the unbiased estimators and is therefore no longer efficient (Gujarati, 2003).

The appropriate hypothesis was used to test for heteroscedasticity. The null hypothesis indicates that the variance of the homoscedastic model and heteroscedastic model are equal. The alternative hypothesis basically tests that the variances are different from one another, usually due to a difference in the residuals, z_i .

H₀: Var[
$$e_i$$
]= σ^2

H₁: Var[e_i] = $\sigma^2(1+\alpha' z_i)$

If $\alpha' = 0$ then the model reduces to a homoscedastic model. There are many useful tests for heteroscedasticity; however, they cannot be used with the Tobit model. Since it was suspected that INCOME may be affecting the model this variable was used to correct for heteroscedasticity. In LIMDEP, the default correction method uses a weighted regression. The weighting variable is the reciprocal of the variance. The heteroscedastic Tobit model was run using INCOME as the weighted variable. The likelihood ratio test was used to determine if the homoscedastic or heteroscedastic model should be used. The results indicate that the likelihood ratio statistic of 4.4642 is greater than the critical value of the chi-square, χ^2 , 3.84146 at the five percent significance level and one degree of freedom. The degree of freedom was determined by *n-1*, in which n=2, the number of variables which may affect heteroscedasticity; in this case the CONSTANT and INCOME are the two variables. Therefore the likelihood ratio test suggests that the homoscedastic model should be rejected in favor of the heteroscedastic Tobit model. The likelihood ratio was found as follows:

2 * [Log Likelihood Function (Upper) - Log Likelihood Function (Lower)] = 2 * [-373.9912 – (-376.3142)]

= 4.6462

The results of the heteroscedastic model are similar to those of the homoscedastic model. All the signs are consistent and the estimated coefficients are similar between the two models. Most importantly, the results suggest that the heteroscedastic estimator is more efficient than the homoscedastic estimator. The majority of the t-values associated with coefficients in the heteroscedastic model are greater than those in the homoscedastic model. For a comparison between the homoscedastic and heteroscedastic model, please refer to Appendix B.

Table 5.2 on page 74 provides the estimated coefficients, t-statistic, and p-values from the effects of the heteroscedastic Tobit model. For the demand equation, coefficients associated with FAVENUT and FEMALE are significantly different from zero at the ten percent level. Coefficients associated with AGE, EXPENSIVE, and HIGH_FAT are all significant from zero at the five percent level. Only one variable is significant at the one percent level and that is LTP_ANY. The estimated heteroscedastic Tobit model is as follows

WTP = 0.2180 + 0.0013(INCOME) - 0.0072(AGE) + 0.1701(FEMALE)- 0.0346(KIDS) - 0.0851(WHITE) - 0.0176(REGION) $+ 0.2189(EXPENSIVE) - 0.2067(HIGH_FAT) + 0.2747(TASTE)$ $+ 0.2020(FAVENUT) + 0.6785(LTP_ANY) - 0.1466(NUTSPAST)$ = 0.8908

The mean willingness to pay for a 2.5 ounce single serving snack size bag of pecans is \$0.89 when evaluated at the variables' mean. This amount was computed by the Tobit regression and is similar to the mean of the dependent variable WTP which is \$0.93. The difference between the two numbers is due to rounding during the regression. The mean WTP is much

lower than the expected WTP, \$1.23. The expected WTP was found by taking the mean of those

respondents with bids greater than zero.

Variable	Heteroscedastic Model	P-value
Constant	0.2180 (0.702)	0.4824
INC	0.0012 (0.864)	0.3878
Age	-0.0072** (-2.114)	0.0345
Female	0.1701* (1.757)	0.0789
Kids	-0.0346 (-0.856)	0.3923
White	-0.0851 (-0.760)	0.4473
Region	-0.1759 (-0.394)	0.6935
Expensive	0.2189** (2.281)	0.0225
High_Fat	-0.2067** (-2.172)	0.0298
Taste	0.2778 (1.357)	0.1747
Favenut	0.2020* (1.832)	0.0670
LTP_Any	0.6785*** (4.774)	0.0000
Nutspast	-0.1466 (-1.536)	0.1246

Table 5.2 Regression Results for the Tobit Model for a Single Serving Snack Size Bag of Pecans

*** Indicates significance at the 0.01 level

** Indicates significance at the 0.05 level

* Indicates significance at the 0.10 level

^a Values in parentheses are the t-statsitc for each coefficient

As expected, the sign associated with those who believe that pecans are high in fat is negative; the results suggest that respondent's who find pecans to be higher in fat are willing to pay less for a snack size bag of pecans. Although the sign associated with the household income was positive as expected due to pecans being a normal good, the results suggest that the impact of income on willingness to pay was not statistically significant. It is surprising that income did not play a significant role in this study. Similarly the results indicate that the number of children under the age of 18 in the household, the region the households are located, and race of the respondent do not have any significant impact on the willingness to pay for a single serving snack size bag of pecans.

The model results indicate that females are more willing to pay for a single serving snack size bag of pecans. As the number of females indicating they would pay for the snack bag of pecans increases the mean willingness to pay increases by 0.1701. Another significant variable is AGE. As the age of the respondent increases, the willingness to pay decreases by .0072. The variable LTP_ANY is significant at the one percent level. As more respondents are likely to purchase any variety of pecan snack product, the willingness to pay increases by .6785. Again the varieties of pecan snacks offered to the respondents were raw, sugar and spice, flavored, roasted, spicy, and salted. The variable EXPENSIVE is significant at the five percent level, though the sign on the coefficient is somewhat unexpected. One would assume if a person finds nuts to be more expensive than other snacks, their willingness to pay for pecans snacks would decrease. However, the sign on this variable's coefficient is positive indicating that they would pay more for a snack size bag of pecans.

Two more variables, FAVENUT and NUTSPAST, were thought to have a significant impact on a person's WTP for a pecan snack product. From the results it can be seen that only FAVENUT had any significant effect. Therefore, if a person chose pecans as his or her favorite snack nut, he or she would be willing to pay more for a pecan snack product. The sign on NUTSPAST is opposite of what one may have expected to find, but the variable is found to be insignificant.

It was assumed that the more people found pecans to be a good tasting nut, the more they would be willing to pay for a single serving snack size bag of pecans. However, the variable did not turn out to have a significant impact on the willingness to pay for the snack pack.

The regression parameters in Table 5.2 cannot be directly interpreted in the same manner as those obtained from OLS. It is the case that the expected value of y is no longer X β as in the case of OLS regression. To assess the marginal effects of the independent variables on the dependent variable, WTP, the partial derivatives of Equation 5.5 must be evaluated. The magnitudes not only depend on whether on the level that the dependent variable is greater than zero but also the probability that it is greater than zero. The effect of a given change of an independent variable on the willingness to pay for a single serving snack size bag of pecans is affected by both the level of positive bids and the probability that the bid levels are greater than zero, or the probability of market entry.

The elasticities for each variable are computed for the heteroscedastic Tobit model and presented in Table 5.3 on page 77. The elasticities are decomposed into two components representing the conditional and market entry elasticities. This is the McDonald and Moffitt Decomposition discussed earlier in this chapter. The conditional elasticity indicates the change in conditional expected value given that the probability of purchasing a pecan snack product is positive. The market entry elasticity indicates the change in probability of purchasing a pecan snack product given that the conditional expected value is positive. In general, the decomposition disaggregates Tobit effects into (1) effects on the probability of being above zero and (2) effects conditional upon being above zero.

Variable	Total	Conditional	Market Entry
Constant	0.1743	0.0876	0.0867
Inc_000	0.0604	0.0304	0.0300
Age	-0.0052	-0.0026	-0.0025
Female ^b	6.5774	3.3136	3.2638
Kids	-0.0201	-0.0101	-0.0100
White ^b	-0.0543	-0.0273	-0.0270
Region	-0.0355	-0.0176	-0.0174
Expensive ^b	0.1585	0.0797	0.0787
High_Fat ^b	-0.1252	-0.0629	-0.0622
Taste ^b	0.2125	0.1069	0.1056
Favenut ^b	0.0802	0.0403	0.0399
LTP_Any ^b	0.1701	0.0855	0.0845
Nutspast ^b	-0.0731	-0.0368	-0.0363

Table 5.3 Estimated Elasticities^a of the Heteroscedastic Tobit Model

^a Elasticities calculated at the mean level

^b Due to binary responses, percent changes do not have the same meaning

The results shown in Table 5.3 suggest that the conditional elasticity and the market entry elasticity equally account for the effect of change in socioeconomic and consumer characteristics on the willingness to pay for a snack size bag of pecans. The elasticities describe the percent change in each variable as it relates to the level or probability of the WTP. A one percent increase in age will result in a .25 percent decrease in the probability of market entry. The level of WTP is affected by the positive amounts. Another way to look at these elasticities is that if there is an increase in age, then 0.25 percent of the population will drop out of the market completely. The variable that has the highest effect on market entry is FEMALE followed by TASTE, though TASTE was found to be insignificant.

Chapter 6

Summary and Conclusions

Conclusions

Pecan production occurs in the Southeastern and Southwestern United States down through the northern Mexican states. The majority of pecans are grown in Georgia while Texas actually has more pecan trees. Georgia pecan trees tend to be older and have been in production for many years, while other states have newer, younger trees which may take longer to provide higher volumes. As consumption increases, imports have been slowly increasing. The U.S. imports high quality pecans from Mexico to supplement low production years. Also, exports have been slowly increasing in the past few years due to increased overseas consumption China looks to be an up and coming important importer.

Since pecans have an alternate bearing pattern which yields greater quantities of pecans one year with a lower quantity the following year, storage becomes an important issue for growers and shellers. The variation in production leads to variation of prices from year to year which often makes it difficult for producers, shellers, and wholesalers to market their crop without storage. New technologies in storage that would decrease costs of storage and improve the quality could help the industry be more profitable and could also lead to the opportunity to market a snack product more easily.

Currently pecans tend to be a seasonal item purchases widely during the November through January holidays. The Georgia Pecan Growers Association consists of pecan growers throughout the state of Georgia who are trying to find new ways to market pecans and increase

the demand throughout the year. One option examined is to create a snack size bag of pecans that one may find in the snack aisle at the local grocery or conveniences store or even the gas station.

In this study, phone survey results about consumers' purchasing behaviors, preferences, and attitudes towards pecans were analyzed using simple statistical procedures and regression analysis. The survey was conducted on a national level in hopes of providing a national representation of pecan consumers. The first objective was to determine from the survey, current consumption patterns and the demographic makeup of the potential snack pecan consumer. Currently the majority of pecan consumption occurs during November through early March and is when pecans are available fresh. Almost one-third of the respondents who indicated purchasing pecans in the past 24 months live in the Southern portion of the United States. The survey results show that out of the pecan consumer survey, 16.8 percent eat pecans more than once a week as a snack. In addition, a little less than half of the survey respondents have purchased pecans as a snack.

The survey results also show that the average pecan consumer does not purchase them very often, fewer than three times a year, with most purchasing one pound bags of halves. A six month average of the dollar amount spent on pecans is \$36.37.

Early in the survey, consumers were asked if they had purchased pecans in the past 24 months. The complete survey was not administered for those consumers who answered 'no' to this question. However, they were then asked one additional question, "Why have you not purchased pecans in the past 24 months?" There were several major reasons consumers gave for not purchasing pecans. Over 50 percent indicated they do not consume pecans because they do not like the taste of them. Other reasons included, owning a pecan tree or have friends that own

a tree, have an allergy or some other medical reason, not readily available to them, or they consider pecans too expensive. Some respondents were categorized as 'other' which contained reasons such as they may purchase pecans for baking but have not done so in the last 24 months and just do not purchase them.

The second objective in this study was to determine the demographic profile of a pecan snack consumer. The demographic profile of a pecan snack consumer can be determined by analyzing the responses that are specific to a pecan consumer who indicated they eat pecans as a snack once a month or more. The results indicate that the household income of a pecan snack consumer is considerably higher than that of the average American. Also, those consumers earning more than \$105,000 annually are more likely to purchase pecans as a snack. Forty-five percent of those respondents have obtained a bachelor's degree or higher as compared to 31 percent for the national average. Seventy-two percent of the respondents who indicated they purchase pecans as a snack once a month or more were female, which is much greater than the U.S. female population average of 51 percent. The median age of the typical pecan snack consumer is 52 years of age compared to the U.S. median age of 35 years. The results seem to indicate that the average pecan snack consumer would be older, more affluent and educated. It would be appropriate for the pecan industry to focus on marketing strategies to younger consumers to increase the demand for pecans. Also, pecan snacks need to be heavily marketed and promoted in the Northeast and Western U.S. as they are less likely than Southerners to eat pecans on a regular basis.

Statistical analysis revealed that the majority of pecan consumers purchase their pecans at the grocery store. This has implications when the industry begins to focus on where to market the snack products. The next largest percentage of places where people purchase pecans was the

'other' category. There were more responses for the category 'other' than for roadside stand, fundraiser, catalog orders, or specialty.

The mean willingness to pay was calculated for several categories such as income level, region, where pecans are purchased, and bag size most often purchased to determine if there are differences among these characteristics. When comparing across income levels, the mean WTP was found to be similar in all categories. The mean WTP was consistent across regions in the Untied States. However, those living in the Northeast and the South have a slightly higher mean WTP than those in the Midwest and West.

Using cross-tabular analysis, those living in the Northeast and having the lowest level of income are willing to pay the most (\$1.30) for a pecan snack product. Additionally, those living in the South with the same level of income are willing to pay the least (\$0.80) for the hypothetical product. At the income level of \$49,999.50, the West is willing to pay the least (\$0.76), while the other three regions are all willing to pay over \$0.90 per pack.

Consumers were also questioned about their likelihood to purchase different varieties of pecan snack products. From the results it appears that roasted pecans have the potential to be a successful product with the majority of the people stating that they would be likely to purchase the product. This was consistent across all regions of the U.S. Over 50 percent of the consumers questioned stated that they were somewhat or very likely to purchase a raw pecan snack product. The South had the highest percentage at 63 percent. Although the percentage did not change across regions, the South had the highest percentage of likeliness to purchase a raw pecans snack product.

A glazed pecan snack product had around 50 percent of consumer responding that they would be somewhat or very likely to purchase. The Northeast had the highest percent of very

likely responses for this product with 29 percent, which was much higher than the Midwest 20 percent. The only variety of pecan snack product, with an overwhelming response of unlikely or very unlikely to purchase was spicy. Seventy-eight percent of those in the Midwest stated that they were unlikely or very unlikely to purchase a spicy pecan snack product. Northeasterners had the highest percentages of somewhat or very likely to purchase with 37 percent.

The third objective of the study was to determine consumers' mean willingness to pay for a 2.5 ounce single serving snack size bag of pecans using the data from the survey analysis. The Tobit procedure was used to determine the mean WTP for a 2.5 ounce snack size bag of pecans. From the Tobit model, the mean WTP was estimated to be \$0.89 per 2.5 ounce single serving snack size bag of pecans. This price is less than the expected WTP, \$1.23.

The results of the survey analysis may provide a start to developing a marketing plan for pecan products. Pecan producers and processors need to be able to increase the frequency of pecan purchases, leading to an increase in overall demand. By directing efforts toward marketing to people more likely to purchase pecans; their time and capital may be better spent. This analysis can provide producers with a product price which will be useful in determining the feasibility for new snack product markets.

Limitations and Future Research

Though the phone survey results provided a pecan consumer profile and a WTP, test marketing may be more suitable to determine the actual willingness to pay for a pecan snack product. Providing a consumer with the actual product should enhance the quality of the results. Combining a supermarket situation with a taste test will also provide more insight as to how much a person would be willing to pay for a single serving snack size bag of pecans. In this

study, the consumer is not actually in the position to purchase the product which therefore may inflate their stated willingness to pay.

Since the mean WTP was estimated to be a relatively low price of \$0.89, additional research could be conducted to determine what consumers are actually willing to pay if interest is present for such products. It is uncertain that the pecan industry will benefit from producing and marketing this pecan snack product at a price this low. By producing the product and performing a test market, the willingness to pay can be better observed through actual purchases. However, this does require a pecan processor to create the single serving snack size bag of pecans. Having the option to purchase the actual product in a market setting may give more realistic prices than from the survey. The surveyors could also set up a taste panel and test which flavors or forms of pecans are preferred. One additional option would be place the product on store shelves and monitor purchases through these stores with the pecans being sold at different price levels. This will allow one to observe quantities and frequencies of the pecan snack product, focusing on those groups who have the highest mean WTP such as the group of participants with an income level of \$17,499.49 and residing in the Northeast (\$1.30).

However, if a follow-up survey were conducted instead or addition to the test marketing, it should include a price-quantity question. The particular question could ask the respondent how much of the snack pecan product they would be willing to purchase at their stated price. This would allow for a hypothetical demand curve to be formatted. Such a survey could also be phrased to determine how many times a week/month would one purchase a snack size bag of pecans.

REFERENCES

- Allen, Christopher. <u>Measuring Values for Wetlands Protection in a Developing Country from</u> <u>Domestic and International Citizen Groups.</u> Master's Thesis, University of Georgia, Dept. of Agricultural and Applied Economics. 2004.
- Blend, Jeffrey R. and Eileen O. van Ravenswaay. "Measuring Consumer Demand for Ecolabeled Apples." <u>American Journal of Agriclutral Economics.</u> 81(5): 1072-1077, 1999.
- Boccaletti, Stefano and Michele Nardella. "Consumer Willingness to Pay for Pesticide-Free Fresh Fruit and Vegetables in Italy." <u>International Food and Agribusiness Management</u> <u>Review.</u> Vol 3. p.297-310, 2001.
- Buzby, Jean C., John A. Fox, Richard C. Ready, and Stephen R. Crutchfield. "Measuring Consumer Benefits of Food Safety Risk Reductions." <u>Journal of Agricultural and Applied</u> <u>Economics.</u> 30(1): 69-82, 1998.
- Champ, Patricia A, Kevin J. Boyle, and Thomas C. Brown. <u>A Primer on Non-Market Valuation</u>. Kluwer Academic Publishers, 2003.
- Dasgupta, Siddhartha, John Foltz, and Bonnie Jacobsen. "Trout Steaks: Consumer Perceptions of a New Food Item." Journal of Food Distribution. 31(3):37-48, November 2000.
- Field, Barry C. Environmental Economics: An Introduction. McGraw-Hill, Inc, 1994.
- Fleisher, Belton M., Edward J Ray, and Thomas J. Kneisner. <u>Principles of Economics.</u> Wm. C. Brown. 1987.
- Freeman III, A. Myrick. <u>The Measurement of Environmental and Resource Values.</u> Resources for the Future, Washington D.C. 2003.
- Fuller, Frank H., John C. Beghin, and Scott Rozelle. "Urban Demand for Dairy Products in China: Evidence from New Survey Data." Working Paper 04-WP 380. Iowa State University, 2004.
- Giraud, Kelly, John Loomis, and Richard Johnson. "Two Valuation Questions in One Survey: Is it a Recipe for Sequencing and Instrument Context Effects." <u>Applied Economics</u>. 31:957-964, 1999.
- Green, William H. <u>LIMDEP: User's Manual and Reference Guide</u>. Version 6.0. Econometric Software, Inc, 1992.
- Govindasamy, Ramu and John Italia. "A WIllingess-to-Purchase Comparison of Integrated Pest Management and Conventional Produce." <u>Agribusiness.</u> 14(5):403-414, 1998.

Gujarati, Damodar N. Basic Econometrics. Fourth Edition. McGraw Hill, 2003.

- Hall, Charles R., Carl E. Shafer, Lance D. Pate, and Corey S. Anderson. *Characteristics and Marketing Practices of Texas Pecan Shellers*. Texas A & M University Faculty Paper Series 98-12, May 1998.
- Hanemann, W. Michael. "Willingness to Pay and Willingness to Accept: How Much Can they Differ?" <u>The American Economic Review.</u> 81(3):635-647, 1991.
- Heckman, James J. "Sample Selection Bias as a Specification Error." <u>Econometrica.</u> 47(1):153-162, 1979.
- Herriges, Joseph A and Jason F. Shogren. "Starting Point Bias in Dichotomous Choice Valutaion with Follow-Up Questioning." Journal of Environmental Economics and Management. 30(8): 112-131, 1996.
- Huang, Chung L. "Simultaneous-Equation Model for Estimating Consumer Risk Perceptions, Attitudes, and Willingness-to-Pay for Residue-Free Produce." <u>The Journal of Consumer</u> <u>Affairs.</u> 27(2):377-396, 1993.
- Hubbard, Eugene E., Joseph C. Purcell, and Stephen L. Ott. "Purchasing and Marketing Practices of Georgia Pecan Accumulators and Shellers." The Georgia Agricultural Experiment Station Research Report544, December 1987.
- Jekanowski, Mark D., Daniel R. Williams II, and William A. Scheik. "Consumer's Willingness to Purchase Locally Produced Agricultural Products: An Analysis of an Indiana Survey." <u>Agricultural and Resource Economics Review.</u> 29(8): 43-53, April 2000.
- Johnson, Doyle C. "Economic Trends in the U.S. Pecan Market with an Overview of The U.S. and World Tree Nut Complex." United States Department of Agriculture, Economic Research Service. Fruit and Tree Nuts Outlook Report: Special Article. FTS-282. Washington D.C. March 1998.

Johnston, Jack and John DiNardo. Econometric Methods. McGraw-Hill, 1997.

- Lillywhite, Jay M., Ereney Hadjigeorgalis, and Esteban Herrera. *Marketing Channels for Pecans*. Guide Z-307. Las Cruces, NM: New Mexico State University, Coop. Ext. Ser., 2003.
- Long, J.S. <u>Regression Models for Categorical and Limited Dependent Variables</u>. Thousand Oaks, CA. Sage. 1997

- Loureiro, Mary J. and Wendy J. Umberger. "Estimating Consumer Willingness-to-Pay for Country-of-Origin Labels for Beef Products." Paper selected for 2002 American Agricultural Economics Association Annual Meetings, Long Beach, CA July 28-31. 2002.
- Loureiro, Maria L., Jill J. McCluskey, and Ron C. Mittelhammer. "Will Consumers Pay a Premium for Eco-Labeled Apples?" <u>The Journal of Consumer Affairs.</u> 36(2): 203-219, 2002.
- Loureiro, Maria L. and Susan Hine. : Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for a Local(Colorado-Grown), Organic, and GMO-free Product." Paper selected for the 2001 American Agricultural Economics Association Annual Meeting.
- Luck, Jayon L. and Darren Hudson. "Willingness-to-Pay Estimates and Their Relevance to Agribusiness Decision Making." <u>Review of Agricultural Economics.</u> 26(2): 152-169, 2004.
- McDonald, John F. and Robert A. Moffitt. "The Uses of the Tobit Analysis." <u>The Review of</u> <u>Economics and Statistics</u>. 62:318-321, 1980.
- Misra, Sukant K., Chung L. Huang, and Stephen L. Ott. "Consumer Willingness to Pay for Pesticide-Free Fresh Produce." <u>Western Journal of Agricultural Economics.</u> 16(2): 218-227, December 1991.
- Mukhopadhaya, Kaushik, Bishwa Adhikari, Gerald Mumma, and Mario Teisl. "Consumer's Willingness to Pay for Food Safety: A Pathogen Specific Analysis." Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Denver, CO, August 2004.

National Pecan Growers Association, http://www.ilovepecans.org/.

- NIST/SEMATECH e-Handbook of Statistical Methods. "Related Distributions." 1.3.6.2 http://www.itl.nist.gov/div898/handbook/eda/section3/eda362.htm#CDF /, 2005.
- Park, John L. and Oral Capps Jr. "Demand for Prepared Meals by US. Households." <u>American</u> <u>Journal of Agricultural Economics.</u> 79(3):814-824, 1997.
- Park, Timothy A., and Wojciech Florkowski. "Demand and Quality Uncertainty in Pecan Purchasing Decisions." <u>J. of Agricultural and Applied Economics</u>. 31(1):29-39 April 1999.
- Peña, Jose G., Parr Rosson III, and Flynn J. Adcock. U.S. Pecan Imports and Exports and the Effect on Trade. Texas A & M University, Extension Agricultural Economics Faculty Paper Series. March 6, 2001.

- Randall, Alan. <u>Resource Economics: an Economic Approach to Natural Resources and</u> <u>Environmental Policy.</u> New York: Wiley. 1987.
- Rimal, Arbindra P. and Stanley M. Fletcher. "Snack Peanuts Purchase Pattern: Effects of Nutritional Considerations and Household Characteristics." <u>Journal of Agricultural and</u> <u>Applied Economics.</u> 34(1): 51-65, April 2002.

Rosengarten Jr, Frederic. Book of Edible Nuts. Walker Publishing Co, Inc 1984.

- Sales, Anne E., Mary E. Plomondon, David J. Magid, John A. Spertus, and John S. Rumsfield. "Assessing Response Bias from Missing Quality of Life Data: The Heckman Method." <u>Health and Quality of Life Outcomes.</u> Online 2(49), September 16, 2004.
- Taylor, Susan. "Pecans in Bakery Foods" National Pecan Shellers Association Technical Bulletin 23(8) August 2001.
- Turnbull, Stephen J. "MBA: Microeconomics" Class Lecture Notes. http://turnbull.sk.tsukuba.ac.jp/Teach/Micro/ohp14.pdf
- United States Census Bureau. 2000.
- United States Department of Agriculture, Economic Research Service. Fruit and Tree Nuts Outlook Report: Commodity Highlight. FTS-304. Washington D.C. May 2003.
- United States Department of Agriculture, Economic Research Service. Fruit and Tree Nuts Outlook Report: Commodity Highlight. FTS-2003. Washington D.C. October 2003.
- United States Department of Agriculture, Economic Research Service. Fruit and Tree Nuts Outlook Report: Commodity Highlight. FTS-2004. Washington D.C. October 2004
- Varian, Hal R. Intermediate Microeconomics: A Modern Approach. W.W> Norton and Company, New York. 1996.
- Wagner, Al. "Pecan Storage: An Important Post-Harvest Practice in Preventing Nut Damage." <u>Pecan South</u>. p. 40-43 September 1980.
- Wessells, Cathy R., Robert J. Johnston, and Holger Donath. "Assessing Consumer Preferences for Ecolabled Seafood: The Influence of Species, Certifier, and Household Attributes." <u>American Journal of Agricultural Economics.</u> 81(5): 1084-1090, 1999.
- Wessells, Cathy R. and Hoan G. Anderson. "Consumer Willingness to Pay for Seafood Safety Assurances." Journal of Consumer Affairs. 29(1): 85-108, 1995.

Wetzstein, Michael J. Microeconomic Theory. South-Western, 2005.

- Wood, B.W. "Price: Production Relationship and Production Characteristics of U.S. Pecan Industry." Proceedings of the 92nd Southeastern Pecan Growers Association Annual Convention, March 14-16, (2000): 117-132.
- Woodruff, Jasper Guy. <u>Tree Nuts: Production, Processing, Products.</u> University of Georgia. 1979.

www.digitaleconomist.com

www.econtools.com

http://turnbull.sk.tsukuba.ac.jp/Teach/Micro/ohp14.pdf

Yoo, Seung-Hoon, Seung-Jun Kwak, and Tai-Yoo Kim. "Modeling Willingness to Pay for Responses from Dichotomous Choice Contingent Valuation Surveys with Zero Observations." <u>Applied Economics.</u> 33(4):523-29, 1998.

APPENDICES

Appendix A:

Consumer Pecan Use Survey 2004

CATI Format

Consumer Pecan Use Survey 2004

Hi, I'm [NAME] from the University of Georgia Survey Research Center, calling for the UGA Center for Agribusiness and Economic Development. We are conducting a short study of food preferences. Do you have a few minutes right now to answer a few questions?

[INTERVIEWER: THE SURVEY SHOULD LAST ABOUT 15 MINUTES]

In order for the results of the survey to be representative of the state's population, I need to speak with the youngest male, 18 years of age or older, who lives in the household. Would that be you?

- 1. Yes [CONTINUE]
- 2. No [MAY I SPEAK TO THE OLDEST FEMALE 18 OR OLDER?]

[REINTRODUCE YOURSELF AND THE STUDY OR ARRANGE TIME FOR CALL-BACK AND GET THE RESPONDENT'S FIRST NAME]

Thank you. Before we begin, let me assure you that all of the information that you provide will be kept strictly confidential. We are interviewing a number of people like you, and all the information we collect will be combined and reported together. The interview is voluntary, and if you don't want to answer any particular question, just tell me and we'll skip to the next one. Also, my Supervisor may listen to part of the interview for quality control purposes. Thank you for agreeing to complete this survey for the Center for Agribusiness and Economic Development of the University of Georgia Extension Service.

Q1. To begin, when you think of snack nuts, what first comes to mind?

[INTERVIEWER NOTE: CHOOSE ALL MENTIONED, PROMPT IF NECESSARY] [PROGRAMMER NOTE: ORDERED]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts
- 5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):_____
- 11. Ref/DK/NA
- 12. Exit

Thinking about the various snack nuts, which, if any, is your favorite nut? What is your next favorite?

[INTERVIEWER NOTE: CHOOSE ALL MENTIONED, PROMPT IF NECESSARY]

[PROGRAMMER NOTE: ORDERED]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):
- 11. No favorites
- 12. Ref/DK/NA
- 13. Exit

Q3.

Q2.

Which nuts have you purchased in the past 24 months?

[INTERVIEWER NOTE: CHOOSE ALL MENTIONED, PROMPT IF NECESSARY]

[PROGRAMMER NOTE: ORDERED]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts
- 5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):
- 11. None
- 12. Ref/DK/NA
- 13. Exit

[PROGRAMMER NOTE: IF Q3 DOES NOT EQUAL 7, ASK Q4 AND Q5, OTHERWISE SKIP TO Q6]

Q4. Have you purchased pecans in the last 24 months?

1. Yes [SKIP TO Q6] 2. No

9. Ref/DK/NA

Q5. Why have you not purchased any pecans in the last 24 months?

[PROGRAMMER NOTE: END SURVEY AND CODE 1110—COMPLETE, NO PECANS (SAVE DATA)]

Q6. Are you familiar with any of the following nuts? [INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: YES/NO TOGGLE]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts
- 5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):
 - 11. None
 - 12. Ref/DK/NA
 - 13. Exit

Q7 Which snack nuts do you eat most often by themselves?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY, PROMPT WITH, "WHAT OTHERS?"]

[PROGRAMMER NOTE: ORDERED]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts
- 5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):

- 11. None
- 12. Ref/DK/NA
- 13. Exit
- Q8. Please estimate the amount of money you spent on nuts and nut products such as raw nuts for baking, chocolate covered nuts, salted mixes, etc. in the last 6 months.

dollars

999 - Ref/DK/NA

[RANGE: 0 – 999]

Q9. How many times have you bought pecans since January 1^{st} ?

____ times

999 - Ref/DK/NA

[RANGE: 0 – 999]

[PROGRAMMER NOTE: IF Q9 = 0 OR 999, SKP TO Q13]

Q10.1 Did you buy pecans as a gift?

- 1. Yes
- 2. No [SKIP TO Q10.3]
- 9. Ref/DK/NA [SKIP TO Q10.3]
- Q10.2 In what form do you generally buy pecans for a gift?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: YES/NO TOGGLE]

- 1. In-shell
- 2. Pecan halves
- 3. Pecan pieces
- 4. Do not buy pecans for gifts
- 5. Ref/DK/NA
- 6. Exit
- Q10.3 Did you buy pecans to eat as a snack?
 - 1. Yes
 - 2. No [SKIP TO Q10.5]
 - 9. Ref/DK/NA [SKIP TO Q10.5]

Q10.4 In what form do you generally buy pecans to eat as a snack?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: YES/NO TOGGLE]

- 1. In-shell
- 2. Pecan halves
- 3. Pecan pieces
- 4. Do not buy pecans for snacks
- 5. Ref/DK/NA
- 6. Exit

Q10.5 Did you buy pecans for cooking or baking?

- 1. Yes
- 2. No [SKIP TO Q10.7]
- 9. Ref/DK/NA [SKIP TO Q10.7]

Q10.6 In what form do you generally buy pecans for cooking or baking?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: YES/NO TOGGLE]

- 1. In-shell
- 2. Pecan halves
- 3. Pecan pieces
- 4. Do not buy pecans for cooking or baking
- 5. Ref/DK/NA
- 6. Exit

Q10.7 Did you buy pecans for some other reason that we haven't mentioned?

- 1. Yes
- 2. No [SKIP TO Q11a e]
- 9. Ref/DK/NA [SKIP TO Q11a e]

Q10.8 What reason was that?

- 1. Enter response _____
- 9. Ref/DK/NA

[PROGRAMMER NOTE: RANDOMLY SELECT ONE SET OF QUESTIONS FROM Q11a – 11e TO BE GIVEN TO EACH RESPONDENT]

Q11a- Would you be willing to pay \$0.79 for a 2.5 ounce single snack pecan product?

- 1. Yes
- 2. No [SKIP TO Q11a2]
- 9. Ref/DK/NA [SKIP TO Q11a2]

Q11a1 – Would you be willing to pay \$0.99 for a 2.5 ounce single snack pecan product?

- 1. Yes [SKIP TO Q12.1]
- 2. No
- 9. Ref/DK/NA

Q11a.2 – Would you be willing to pay \$0.59 for a 2.5 ounce single snack product?

- 1. Yes [SKIP TO Q12.1]
- 2. No [SKIP TO Q12.1]
- 9. Ref/DK/NA [SKP TO Q12.1]
- Q11b Would you be willing to pay \$0.99 for a 2.5 ounce single snack pecan product?
 - 1. Yes
 - 2. No [SKIP TO Q11b2]
 - 9. Ref/DK/NA [SKIP TO Q11b2]
- Q11b1 Would you be willing to pay \$1.24 for a 2.5 ounce single snack pecan product?
 - 1. Yes [SKIP TO Q12.1]
 - 2. No
 - 9. Ref/DK/NA

Q11b2 – Would you be willing to pay \$0.74 for a 2.5 ounce single snack pecan product?

- 1. Yes [SKIP TO Q12.1]
- 2. No [SKIP TO Q12.1]
- 9. Ref/DK/NA [SKIP TO Q12.1]

Q11c – Would you be willing to pay \$1.19 for a 2.5 ounce single snack pecan product?

- 1. Yes
- 2. No [SKIP TO Q11c2]
- 9. Ref/DK/NA [SKIP TO Q11c2]
- Q11c1 Would you be willing to pay \$1.48 for a 2.5 ounce single snack pecan product?
 - 1. Yes [SKIP TO Q12.1]
 - 2. No
 - 9. Ref/DK/NA
- Q11c2 Would you be willing to pay \$0.89 for a 2.5 ounce single snack pecan product?
 - 1. Yes [SKIP TO Q12.1]
 - 2. No [SKIP TO Q12.1]
 - 9. Ref/DK/NA [SKIP TO Q12.1]

Q11d – Would you be willing to pay \$1.39 for a 2.5 ounce single snack pecan product?

- 1. Yes
- 2. No [SKIP TO Q11d2]
- 9. Ref/DK/NA [SKIP TO Q11d2]
- Q11d1 Would you be willing to pay \$1.73 for a 2.5 ounce single snack pecan product?
 - 1. Yes [SKIP TO Q12.1]
 - 2. No
 - 9. Ref/DK/NA
- Q11d2 Would you be willing to pay \$1.04 for a 2.5 ounce single snack pecan product?
 - 1. Yes [SKIP TO Q12.1]
 - 2. No[SKIP TO Q12.1]
 - 9. Ref/DK/NA [SKIP TO Q12.1]

Q11e - Would you be willing to pay \$1.59 for a 2.5 ounce single snack pecan product?

- 1. Yes
- 2. No [SKIP TO Q11e2]
- 9. Ref/DK/NA [SKIP TO Q11e2]

Q11e1 – Would you be willing to pay \$1.98 for a 2.5 ounce single snack pecan product?

- 1. Yes [SKIP TO Q12.1]
- 2. No
- 9. Ref/DK/NA
- Q11e2 Would you be willing to pay \$1.19 for a 2.5 ounce single snack pecan product?
 - 1. Yes
 - 2. No
 - 9. Ref/DK/NA
- Q12.1 Since January 1st, approximately how many pounds of the pecans that you bought were pecan halves?

_____ pounds

99 – Ref/DK/NA

[RANGE: 0 – 999]

[PROGRAMMER NOTE: IF Q12.1 = 0 OR IF Q12.1 = 99, SKIP TO Q12.2]

Q12.1a When you purchase packaged pecan halves, what size do you prefer?

- 1. A quarter pound (4 oz)
- 2. A half pound
- 3. A pound
- 4. Two pounds
- 5. More than two pounds
- 6. Any size
- 9. Ref/DK/NA
Q12.1b Typically, how much do you pay per pound for pecan halves?

[INTERVIEWER NOTE: ENTER EXACT AMOUNT]

dollars

99.99 - Ref/DK/NA

[RANGE: 00.00 – 99.99]

Q12.1c. How do you store your pecan halves?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: ORDERED]

1. Store them in the refrigerator

- 2. Keep them in the pantry
- 3. Store them in the freezer
- 4. Keep them on the counter
- 5. Other (Specify)
- 6. Ref/DK/NA
- 7. Exit
- Q12.2 Since January 1st, approximately how many pounds of the pecans that you bought were pecan pieces?

_____ pounds

99 - Ref/DK/NA

[RANGE: 0 – 99]

[PROGRAMMER NOTE: IF Q12.2 = 0 OR IF Q12.2 = 99, SKIP TO Q12.3]

Q12.2a When you purchase packaged pecan pieces, what size do you prefer?

- 1. A quarter pound (4 oz)
- 2. A half pound
- 3. A pound
- 4. Two pounds
- 5. More than two pounds
- 6. Any size
- 9. Ref/DK/NA

Q12.2b Typically, how much do you pay per pound for pecan pieces?

[INTERVIEWER NOTE: ENTER EXACT PRICE. PECAN PIECES ON OVERAGE COST \$7.29 PER POUND]

_____ dollars

99.99 - Ref/DK/NA

[RANGE: 00.00 – 99.99]

Q12.2c. How do you store your pecan pieces?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: ORDERED]

- 1. Store them in the refrigerator
- 2. Keep them in the pantry
- 3. Store them in the freezer
- 4. Keep them on the counter
- 5. Other (Specify)_____
- 6. Ref/DK/NA
- 7. Exit

[PROGRAMMER NOTE: PECAN MEAL AND PECAN GRANULE QUESTIONS WERE DELETED]

Q12.3 Since Jaunary 1st, how many pounds that you bought were in-shell pecans?

____pounds

99 – Ref/DK/NA

[RANGE: 0 – 99]

[PROGRAMMER NOTE: IF Q12.3 = 0 OR IF Q12.3 = 99, SKIP TO Q13]

Q12.3a When you purchase packaged in-shell pecans, what size do you prefer?

- 1. A quarter pound (4 oz)
- 2. A half pound
- 3. A pound
- 4. Two pounds
- 5. More than two pounds
- 6. Any size
- 9. Ref/DK/NA

Q12.3b Typically, how much do you pay per pound for in-shell pecans?

[INTERVIEWER NOTE: ENTER EXACT PRICE. IN-SHELL PECANS ON AVERAGE COST ABOUT \$4.00 PER POUND]

dollars

99.99 - Ref/DK/NA

[RANGE: 00.00 – 99.99]

Q12.3c. How do you store your in-shell pecans?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: ORDERED]

- 1. Store them in the refrigerator
- 2. Keep them in the pantry
- 3. Store them in the freezer
- 4. Keep them on the counter
- 5. Other (Specify)_
- 6. Ref/DK/NA
- 7. Exit

Q13. Where do you generally purchase your pecans?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY, PROMPT WITH, "WHERE ELSE?"]

[PROGRAMMER NOTE: ORDERED]

- 1. Grocery Store
- 2. Internet Order
- 3. Catalog Order
- 4. Specialty Store
- 5. Through a fund raiser
- 6. Road side stand
- 7. Other (Please specify)
- 8. Ref/DK/NA
- 9. Exit

Q14. How often do you typically purchase pecans?

[INTERVIEWER NOTE: CHOOSE ALL THAT APPLY, PROMPT WITH, "ANY OTHER TIMES?"]

[PROGRAMMER NOTE: ORDERED]

- 1. On a regular basis
- 2. Only during harvest
- 3. Only during holidays (Which ones?)
- 4. On special occasions other than holiday (Which ones?)
- 5. Other (Please specify)
- 6. Ref/DK/NA
- 7. Exit

Q15 Have you ever purchased a single serving snack size bag of any of the following nuts?

[INTERVIEWER NOTE: READ RESPONSES, CHOOSE ALL THAT APPLY]

[PROGRAMMER NOTE: ORDERED]

- 1. Almonds
- 2. Brazil nuts
- 3. Cashews
- 4. Hazelnuts
- 5. Macadamia
- 6. Peanuts
- 7. Pecans
- 8. Pistachios
- 9. Walnuts
- 10. Other (please specify):_____
- 11. None purchased
- 12. Ref/DK/NA
- 13. Exit
- Q16. When you buy single serving size bags of snack nuts where do you typically buy them?

[INTERVIEWER NOTE: PROBE FOR ALL SOURCES]

- 1. Enter response _____
- 9. Ref/DK/NA

Q17. When you think about single serving snack food products such as chips or cookies, which one of the following closest describes how you feel about nuts? Would it be . . . ?

[INTERVIEWER NOTE: CHOOSE ONLY ONE]

- 1. Very Expensive
- 2. Expensive
- 3. Somewhat expensive
- 4. Inexpensive
- 5. Very Inexpensive
- 6. Don't know
- 9. Ref/NA

[PROGRAMMER NOTE: FORMER Q17 DELETED]

- Q18.1 Thinking about potential new flavored pecan snack products, how likely would you be to purchase flavored pecan snacks, such as chocolate or honey mustard?
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA
- Q18.2 How likely would you be to purchase salted pecan snacks?
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA
- Q18.3 How likely would you be to purchase spicy pecan snacks?
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA

Q18.4 How likely would you be to purchase roasted pecan snacks?

- 1. Very Likely
- 2. Somewhat Likely
- 3. Don't Know
- 4. Unlikely
- 5. Very unlikely
- 9. Ref/NA
- Q18.5 And how likely would you be to purchase glazed pecan snacks
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA
- Q18.6 How about sugar and spice pecan snacks?
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA
- Q18.7 How likely would you be to purchase raw pecan snacks?
 - 1. Very Likely
 - 2. Somewhat Likely
 - 3. Don't Know
 - 4. Unlikely
 - 5. Very unlikely
 - 9. Ref/NA
- Q18.8 Are there any other types of pecan snacks that you might consider buying?
 - 1. Yes (Specify)
 - 2. No
 - 9. Ref/DK/NA

Q19. Thinking about snack foods you may have purchased, what types of products do you purchase that contain pecans? Things such as pies, candy coated, other baked goods and anything else that you can think of?

[INTERVIEWER NOTE: CHOOSE ALL MENTIONED, PROMPT IF NECESSARY]

[PROGRAMMER NOTE: ORDERED]

- 1. Chocolate covered
- 2. Pecan Ice cream
- 3. Cookies with pecans
- 4. In mixed nuts
- 5. Pecan pies
- 6. Roasted and salted
- 7. Sticky buns (rolls)
- 8. Candies
- 9. Cakes
- 10. Other (please specify):_____
- 11. None
- 12. Ref/DK/NA
- 13. Exit

Q20. I am going to read you a list of pecan products and would like you to indicate how often if at all, you eat each product.

Q20.1 How often do you eat pecans as a snack?

- 1. Once a week
- 2. Once a month
- 3. Once a year
- 4. Never
- 9. Ref/DK/NA

Q20.2 How often do you eat pecans in salads?

- 1. Once a week
- 2. Once a month
- 3. Once a year
- 4. Never
- 9. Ref/DK/NA

Q20.3 How often do you eat pecans in cookies?

- 1. Once a week
- 2. Once a month
- 3. Once a year
- 4. Never
- 9. Ref/DK/NA
- Q20.4 How often do you eat pecans in chocolate candies?
 - 1. Once a week
 - 2. Once a month
 - 3. Once a year
 - 4. Never
 - 9. Ref/DK/NA

Q20.5 How often do you eat pecans with ice cream?

- 1. Once a week
- 2. Once a month
- 3. Once a year
- 4. Never
- 9. Ref/DK/NA
- Q20.6 How often do you eat pecans with meat dishes?
 - 1. Once a week
 - 2. Once a month
 - 3. Once a year
 - 4. Never
 - 9. Ref/DK/NA
- Q20.7 How often do you eat salted pecans?
 - 1. Once a week
 - 2. Once a month
 - 3. Once a year
 - 4. Never

9. Ref/DK/NA

Q20.8 How often do you eat unsalted pecans?

- 1. Once a week
- 2. Once a month
- 3. Once a year
- 4. Never
- 9. Ref/DK/NA

[PROGRAMMER NOTE: FORMER Q20.9 DELETED]

Q20.9 How much would you say you eat in one sitting?

- 1. Handful (1 oz)
- 2. ¹/₂ cup
- 3. 1 cup
- 4. $1\frac{1}{2}$ cups
- 5. 2 or more cups
- 6. Don't know
- 9. Ref/NA
- Q21. Do you use nuts in cooking/baking?
 - 1. Yes
 - 2. No [SKIP TO Q27]
 - 9. Ref/DK/NA [SKIP TO Q27]
- Q22. What type of nuts do you use most often in cooking and/or baking?
 - 1. Enter response _____
 - 9. Ref/DK/NA

Q23. How frequently do you use nuts in cooking and/or baking?

- 1. Enter response _____
- 9. Ref/DK/NA

Q24. Now thinking specifically about pecans, do you use PECANS in cooking and/or baking?

- 1. Yes
- 2. No [SKIP TO Q27]
- 9. Ref/DK/NA [SKIP TO Q27]

Q25. What form of pecans do you purchase for cooking?

[INTERVIEWER NOTE: CHOOSE ALL MENTIONED]

[PROGRAMMER NOTE: YES/NO TOGGLE]

- 1. In-shell
- 2. Halves
- 3. Chopped
- 4. Other (Specify)
- 5. Ref/DK/NA
- 6. Exit
- Q26. When baking with nuts, do you prefer to crush/chop nuts yourself or purchase bagged chopped nuts?
 - 1. Crush myself
 - 2. Purchase bagged chopped nuts
 - 9. Ref/DK/NA
- Q27 When thinking about the prices of pecans relative to other nuts do you consider them to be more or less expensive or similarly prices than other nuts?
 - 1. More
 - 2. Same
 - 3. Less
 - 4. Don't Know
 - 9. Ref/DK/NA
- Q28. The following statements are about PECANS. Please tell me if you strongly agree, agree, disagree or strongly disagree.
- Q28.1 Pecans are of high nutritional value.
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA

Q28.2 Pecans are a specialty item

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 9. Ref/DK/NA
- Q28.3 Pecans are for those of a higher income.
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA
- Q28.4 Pecans are for modern people
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA
- Q28.5 Pecans are for old-fashioned people,
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA
- Q28.6 Pecans have many uses in baking.
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA

Q28.7 Pecans are a well-known nut.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 9. Ref/DK/NA
- Q28.8 Pecans have a high fat content.
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA
- Q28.9 Pecans are a good-tasting nut.
 - 1. Strongly agree
 - 2. Agree
 - 3. Disagree
 - 4. Strongly disagree
 - 9. Ref/DK/NA

Q28.10 Pecans are a low-carb snack.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 9. Ref/DK/NA
- Q29. Have you had a bad experience with pecans?
 - 1. Yes
 - 2. No [SKIP TO Q31]
 - 9. Ref/DK/NA [SKIP TO Q31]

Q30 What was the nature of the problem? Was it . . .?

- 1. A piece of shell
- 2. Rancidity
- 3. Size smaller than I expected
- 4. Color was different than I expected
- 5. Flavor was different than I expected
- 6. Other
- 9. Ref/DK/NA

We're almost through now, and I want to thank you for your time and patience. I have just a few more questions to ask about you, only so we can compare your answers to others. I want to remind you of the confidentiality of the information you give me.

Q31 First, what is your age?

_____years

99 - Ref/DK/NA

[RANGE: 18 – 99]

Q32 Gender (Ask only if necessary)

1. Male

- 2. Female
- 9. Not ascertained
- Q33 What is the highest level of education you have completed?
 - 1. Less than high school degree
 - 2. High school diploma/GED
 - 3. Some college/technical school
 - 4. College graduate
 - 5. Post-graduate degree
 - 9. Ref/DK/NA

- Q34 What category best describes your annual HOUSEHOLD income before taxes?
 - 1. Less than \$15,000
 - 2. \$15,000 \$24,999
 - 3. \$25,000 \$34,999
 - 4. \$35,000 \$44,999
 - 5. \$45,000 \$54,999
 - 6. \$55,000 \$64,999
 - 7. \$65,000 \$74,999
 - 8. \$75,000 \$84,999
 - 9. \$85,000 \$94,999
 - 10. \$95,000 \$104,999
 - 11. \$105,000 or more
 - 12. Ref/DK/NA
- Q35 Are you of Hispanic origin?
 - 1. Yes
 - 2. No
 - 9. Ref/DK/NA
- Q36 What race do you consider yourself?
 - 1. White
 - 2. Black
 - 3. Asian
 - 4. American Indian
 - 5. Multi-racial [SPECIFY _____]
 - 9. Ref/DK/NA
- Q37 What is your 5-digit zip code?

_____ zip code

[RANGE: 00000 - 99999]

- Q38 And in what state do you live?
 - 1. Alabama
 - 2. Arizona
 - 3. Arkansas
 - 4. California
 - 5. Colorado
 - 6. Connecticut
 - 7. Delaware
 - 8. District of Columbia
 - 9. Florida
 - 10. Georgia
 - 11. Idaho

- 12. Illinois
- 13. Indiana
- 14. Iowa
- 15. Kansas
- 16. Kentucky
- 17. Louisiana
- 18. Maine
- 19. Maryland
- 20. Massachusetts
- 21. Michigan
- 22. Minnesota
- 23. Mississippi
- 24. Missouri
- 25. Montana
- 26. Nebraska
- 27. Nevada
- 28. New Hampshire
- 29. New Jersey
- 30. New Mexico
- 31. New York
- 32. North Carolina
- 33. North Dakota
- 34. Ohio
- 35. Oklahoma
- 36. Oregon
- 37. Pennsylvania
- 38. Rhode Island
- 39. South Carolina
- 40. South Dakota
- 41. Tennessee
- 42. Texas
- 43. Utah
- 44. Vermont
- 45. Virginia
- 46. Washington
- 47. West Virginia
- 48. Wisconsin
- 49. Wyoming

99. Ref/DK/NA

Q39 – What is your marital status? Are you . . . ?

- 1. Married
- 2. Divorced
- 3. Separated
- 4. Widowed
- 5. Single
- 9. Ref/DK/NA

Q40 – How many persons live in your household?

_____ people

99 - Ref/DK/NA

[RANGE: 1 – 99]

Q41 – How many children live in your household?

children

99 - Ref/DK/NA

[RANGE: 0 – 99]

Q42 – What is your employment status?

- 1. Employed full time
- 2. Employed part time
- 3. Retired
- 4. Full time student
- 5. Homemaker
- 6. Unemployed
- 9. Ref/DK/NA

Q43 – And finally, what do you spend, on average, per week for food?

- 1. \$1 \$25
- 2. \$26 50
- 3. \$51 75
- 4. \$76 \$100
- 5. \$101 \$125
- 6. \$126 \$150
- 7. \$151 \$175 8. \$176 - \$200
- 9. \$201 +
- 10. Ref/DK/NA

That's all the questions we have for you tonight. Thank you so much for completing our survey!

[PROGRAMMER NOTE: IMPORT MSA-NON-MSA IMPORT FIPS] Appendix B:

Homoscedastic and Heteroscedastic Tobit Model Comparison

Variable	Homoscedastic Model	Heteroscedastic Model
Constant	0.1261	0.2180
	$(0.342)^{a}$	(0.702)
Inc_000	0.00094	0.001248
	(0.692)	(0.864)
Age	00613	-0.00716
	(-1.838)*	(-2.114)**
Female	0.2040	0.1701
	(2.043)**	(1.757)*
Kids	-0.02049	-0.0346
	(-0.535)	(-0.856)
White	-0.05743	-0.0851
	(-0.524)	(-0.760)
Region	-0.02711	-0.1759
	(-0.594)	(-0.394)
Expensive	0.2529	0.2189
	(2.466)**	(2.281)**
High_Fat	-0.1787	-0.2067
	(-2.055)**	(-2.172)**
Taste	0.2901	0.2778
	(1.112)	(1.357)
Favenut	0.2224	0.2020
	(2.217)**	(1.832)*
LTP_Any	0.6506	0.6785
	(4.084)***	(4.774)***
Nutspast	-0.1632	-0.1466
	(-1.730)*	(-1.536)
	× /	

Table A.1 Regression Results for Homoscedastic and Heteroscedastic Tobit Models for a Single Serving Snack Size Bag of Pecans

^a Values in parentheses are the p-values for each coefficient *** Indicates significance at the 0.01 level

** Indicates significance at the 0.05 level

* Indicates significance at the 0.10 level