ORGANIC BABY FOOD: AN ANALYSIS OF CONSUMER DEMAND

by

VICTORIA SAMANTHA LEBEAUX

(Under the Direction of Chung L. Huang)

ABSTRACT

In 2006, there were approximately 16.5 million children in the U.S. under the age of four, each needing food necessary for development and growth. By making products which satisfy these needs, the baby food industry achieves annual sales of almost $3.7 billion. Due to a stagnant birth rate, growth in the industry is slow, and niche markets are growing in importance. Organic baby food is one such market niche with $116 million in sales in 2006, an increase of 21.6% from the previous year. The purpose of this thesis has been to identify important consumer characteristics that are associated with organic baby food consumption and investigate their affects on consumption, using switching regression analysis. Price, choice of brand and store, and demographic characteristics such as age, race and education, have all been identified as factors influencing organic consumption.

INDEX WORDS: organic food, baby food, switching regression, consumer demand

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VICTORIA SAMANTHA LEBEAUX

B.A., University of Georgia, 2006

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2008

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VICTORIA SAMANTHA LEBEAUX

Major Professor: Chung L. Huang

Committee: Luanne Lohr
Michael E. Wet stein

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2008

DEDICATION

I dedicate this thesis to my family. The Barksdale/Dillard/Mills/LeBeaux clan which has supported me through many years of educational challenges. Without your love, support, and generosity, I could not have made this achievement. This thesis is also dedicated to my friends. To all of my friends in Conner Hall I will always remember the hours of endless companionship and encouragement you provided me with in these two years. To those friends may not live in Athens, in Georgia, or even in the U.S. I thank you for not letting time or distance deters you from supporting me through this endeavor.

ACKNOWLEDGEMENTS

Many thanks to my graduate committee for all of their help toward this research study. Dr. Chung L. Huang has my sincere gratitude for his unending patience in guiding me through this process. I have learned a lot from working with Dr. Huang, particularly in the area of data management, something which has terrified, annoyed, and aggravated me during many long hours in Conner Hall. Nevertheless thanks to Dr. Huang's unending patience, I learned and accomplished much more than I expected, and for this I am very thankful. Additionally I extend thanks to Dr. Luanne Lohr, who expertise in the field of organics was a tremendous asset during the completion of this project. Moreover, I thank Dr. Lohr for taking an interest in both my work and my life and her constant encouragement to reach for great opportunities. Finally, I must thank Dr. Michael E. Wetzstein. I am greatly appreciative of his open door policy and his sincere interest in my future success.

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CHAPTER 1

INTRODUCTION

1.1 Background

In 2006, there were approximately 16.5 million children in the U.S. under the age of four. This age group represents a very profitable market segment of the food industry. According to figures from the Neilson Company the baby food industry achieves annual sales of almost $3.7 billion (Lempert 2007).This report will investigate this market which includes canned and jarred baby food, cereal, snacks, and juice. Not included are other foods that babies consume such as fresh or frozen fruit, non-baby-specific juice, or non-baby-specific canned or jarred products that are targeted to consumers of all ages (e.g. 'regular' applesauce or 'regular' juice).

Baby food has a longer history than many other nondurable consumer goods. An environment favorable to the adoption of commercially canned baby food had already arisen by the start of the 20th century. Industrialization led to innovations in the mass production and distribution of canned goods, an increasing number of women were entering the work force, and nutrition experts were recommending the addition of fruits and vegetables to the infant diet. By the late 1920s, advertising had become widespread and the cost of canned foods had fallen, creating a ripe environment for the widespread distribution of canned baby food at the national level. By 1931 there were three major players in the baby food industry: Gerber, Beech-Nut, and Heinz, with Gerber selling over two million cans by 1932. Today, the scope of the baby food industry has expanded so much so that multinational corporations have purchased the three

largest baby food brands. Heinz sold its U.S. baby food businesses to Del Monte Food Company in 2002 (Weiner 2004) while Nestle purchased Beech-Nut in 1979 and acquired Gerber for $5.5 billion in 2007 (Biotech Business Week, 2007).

Despite sales totaling over $3 billion per year, the U.S. baby food industry has not experienced much growth in recent years. Statistics from the Nielsen Company, as reported by Phil Lempert of Progressive Grocer, indicate a gain of only 3.1% during 2006 (Lempert 2007). Thus, producers and retailers of baby food have created products which meet the preferences of a changing ethnic composition and the effects of an increase in births to older mothers. A prominent example of this trend has been the development of healthier foods. During the 1980s and 1990s, for example, manufacturers altered baby foods by removing refined sugar, added salt, and chemically modified starch (Weiner 2004). Consumer concerns regarding, nutrition, health, and safety have also led to the growth production of organic baby food.

In 1990 Congress passed the Organic Foods Production Act (OFPA). This piece of legislation required the United States Department of Agriculture (USDA) to develop national standards for organically produced agricultural products. Following this mandate, the USDA created the National Organic Program (NOP) to ensure that agricultural products marketed as organic, meet uniform, consistent standards. To be eligible for certification under the NOP organic food must be produced without using bioengineering, ionizing radiation, or sewage sludge. Organic food is also produced without the use of many conventional pesticides and without fertilizers made with synthetic ingredients. Organic meat, poultry, eggs, and dairy products come from animals raised without the use of growth hormones or antibiotics. The standards require every aspect of organic production and handling to comply with the provisions

of the OFPA. Handling of organic products includes the following activities: cooking, baking, curing, heating, drying, mixing, grinding, churning, separating, distilling, extracting, slaughtering, cutting, fermenting, eviscerating, preserving, dehydrating, freezing, chilling, or otherwise manufacturing, and the packaging, canning, jarring, or otherwise enclosing food in a container that may be used to process an organically produced agricultural product (Dimitri and Oberholtzer 2008).

The number of studies comparing the nutritional content of organic vs. conventionally grown foods has steadily increased since the early 1980s, with an average of six studies per year being published since 2000. New evidence in support of organic foods superior nutritional content emerges each year. A March 2008 study by the Organic Center reviewed the literature and concluded that for several main nutritional compounds including vitamins A and E, phosphorus and several antioxidants, organically grown plant based material was more nutrient dense (Benbrook et al. 2008). Thus it is perhaps not surprising that the organic segment of the food industry had sales of $16 billion in 2006, with an annual growth rate of 20% (Organic Consumers Association 2007). Moreover, the growth in organic baby food has paralleled the overall growth in organic foods. In 2006, $116 million were spent on organic baby food, an increase of 21.6% from the previous year (Lempert 2007).

For baby food processors and retailers the organic niche may be a window of opportunity for increasing sales in an otherwise stagnant industry. The baby food industry is faced with a situation in which there are few options to increase sales, so targeted marketing is an important development. In order to take advantage of this opportunity, information is needed regarding consumer demand. Methods to understand organic consumers will lead to ways to decompose

demand into target groups upon which marketing dollars can be focused. Examining the socio-demographic characteristics of the organic baby food consumer relative to the consumer who does not purchase organic baby food would yield such useful information. This study will utilize a switching regression model to examine both the consumer choice to purchase organic or conventional baby food, and subsequent organic and conventional baby food consumption.

1.2 Problem Statement

Organic baby food is a segment of the baby food market that is expanding rapidly. Previous studies of organic baby food have focused on determining the consumer's willingness to pay for organic versus conventional baby food. Additional work has been done which calculates demand elasticity estimates for various categories of organic baby food. There is, however, a lack of information relating consumer characteristics with organic baby food expenditures. This study will contribute to the literature by examining the demographic characteristics associated with the likelihood of the consumer to purchase organic, and analyzing the affect these characteristics have on quantity of organic baby food consumed.

1.3 Objectives

The overall objective of this research is to identify important consumer characteristics that are associated with organic baby food consumption and investigate their effects on consumption. The research results should have important implications for retailers and producers in the organic baby food market, enabling them to identify market opportunities and formulate effective marketing and supply decisions.

1.4 Organization

This thesis consists of six chapters. The next chapter is a literature review of consumer demand for organic baby food and organic foods in general. Chapter 3 presents the theoretical framework and the model used for estimation, and chapter 4 presents a descriptive analysis of the data used in this study. The estimation results are given in chapter 5. The final chapter, chapter 6, summarizes the study, points out limitations of the study, and gives recommendations for further research.

CHAPTER 2

LITERATURE REVIEW

2.1. Organic Food

Recent studies of the organic food market have focused on investigating consumer demographics, attitudes, tastes, and preferences which affect organic food purchase decisions. Zhang, Huang, and Lin (2006) conducted research on organic food consumption with the goal of identifying consumer characteristics associated with fresh produce consumption and investigating the affect these characteristics have on consumption. Nielsen Homescan data for 2003 was used in this study, with a sample size of 7,052 households. Expenditures on organic produce were modeled as a function of various social economic variables including age, education, race, location, household size and household composition.

Household size was not found to be a significant factor in the choice nor the consumption decision. Age of household head was only significant in the market participation decision with older decision groups more likely to buy organic produce than other age groups. Households with higher education levels and households living in urban areas were found to be more likely to participate in the market, and to have higher levels of consumption. Regionally, households in the West had the highest probability and level of consumption followed by the Eastern region. This result is not surprising considering that these areas have the highest levels of organic production in the U.S. Finally, the race variables indicated the tendency of Hispanics to be more likely to consume organic produce, and to consume at significantly higher levels, than white,

non-Hispanic households. Produce has always represented the majority of organic purchases. As other foods, such as organic baby food, begin to increase in popularity, it raises interesting questions as to whether or not these same socio-economic factors will come to play in the consumer's decision to purchase organic. This study will attempt to address this issue by analyzing the household characteristics of the organic baby food consumer.

Concerning, consumers' knowledge and attitudes, Rimal, Moon and Balasubramanian (2006), consider the relationship between the frequency of organic food purchases and consumer attitudes about agro-biotechnology. A survey of over 3,000 U.S. consumers was used to examine consumer perceptions of agro-biotechnology, namely genetically modified (GM) foods. The study found that a majority of consumers believe that there are economic consequences of agro-biotechnology. These consequences include the increasing control large corporations have over the food supply, as small-scale family farms, with less access to agro-biotechnology disappear. Additionally, there were more consumers who felt GM foods are an environmental risk, than consumers who did not associate GM food to environmental risk, and 25.6% felt that GM foods are a potential health hazard. Benefits of agro-biotechnology cited in the article include the reduced use of pesticides and herbicides in GM crop production, and the possibility for GM foods to reduce food shortages in developing countries via high crop yields.

To analyze what effect agro-biotechnology has on organic food purchases, the authors employed an ordered probit regression model. The dependent variable was the frequency of the consumers' organic purchases. Explanatory variables included socio-economic and behavioral variables, as well as the variables representing consumer perceptions of agro-biotechnology. Results indicated that when consumers perceived agro-biotechnology to be a risky crop

production method, they purchased organic food more frequently. Additionally, consumers who (according to results from survey) had a higher level of awareness about genetically modified organism (GMO) were more frequent purchasers of organic foods, than those consumers who had not heard or read much about agro biotechnology. Prices of food products did not have a significant effect on purchase patterns. The authors concluded that growth in the organic good market depends on the continued perception by consumers that organic products are safer food choices than other alternatives found in the grocery store. This may point to an underlying motivator for organic baby food purchases as well, as parents' undertake lengthy examination of organic and conventionally prepared foods, to determine whether or not their health and safety concerns are being addressed by both products.

Despite recent growth in the industry, much of the recent research on organics reveals that consumers are unclear about the meaning of the organic label. Conner and Christy (2004) researched the effectiveness of the USDA Organic label. The research objectives were to examine how effective the label is at reflecting the traits consumers want from organic food, and to determine how well consumers understand the label's meaning. Both a survey and an experimental auction were employed to meet these objectives. The survey took place at a local farmer's market and at a cooperative "health food" market in Ithaca, NY. The survey responses showed that consumers agree with the restrictions of the organic food label. Consumers opposed the use of GMOs, biosolids, and irradiation in organic production, all of which are prohibited by the USDA's National Organic Program. Results from the experimental auction show that consumers are willing to pay to avoid GMOs in organic food. However, the auction also demonstrated a lack of consumer understanding of what the organic label means. Almost half of the auction participants were unaware that foods with the organic label are free of GMOs. This

finding supports the practice of ‘double labeling’ by some manufacturers, who have both the organic label and an additional GMO-free label on their products.

There were also instances of consumers believing the organic label stands for more attributes than stipulated by the USDA NOP. When asked why they buy organic, survey respondents often stated that they want to support local and sustainable agriculture. Neither of these characteristics is guaranteed by the organic label, signifying a need for better information regarding the organic labeling system. The authors suggest that more emphasis be put on the lack of GMOs, biosolids, and irradiation in organically labeled food. Regarding the social values that consumers want from organic food, firms which meet these standards are encouraged to use other labels to inform consumers of their contributions to sustainable and local food production systems. These practices will help consumers be better informed about what the organic label does and does not represent.

Wolf et al. (2002) examined the demographics of organic lettuce purchasers and the reasons behind the choice to purchase organic. The primary purchasers of organic lettuce in California, where the survey took place, were more often college educated, single females, between the ages of 22 and 39, with a mid-range household income. In addition to identifying the target consumer group of organic lettuce, the study revealed further evidence that consumers lack a clear understanding of what the organic label represents. Although consumers identified the production characteristics of “environmentally friendly” as somewhat to very desirable, the organically grown characteristic was rated only slightly to somewhat desirable, signaling the lack of consumer understanding of the “environmentally friendly” characteristics of organic production (production without pesticides, bio-solids, or irradiation).

Despite the apparent confusion over the true meaning of organic, consumers have demonstrated both a stated and revealed preference for organic foods. This is perhaps an indication that consumers are inclined to purchase those products which come closest to their ideal attribute set. Studies which have considered the impacts of quality and reputation variables on consumer decisions have found that that reputation has a large impact on the willingness to pay of consumers. Moreover, it has been found that long term reputation is more important than short term quality movements, and that consumers react slowly to changes in product quality (Landon and Smith 1997). This information coupled with the increasing number of scientific studies which find higher nutritive content in organic foods than in conventional foods (Benbrook et al. 2008), may explain the increasing growth in the organic industry despite misconceptions as to the meaning of organic.

2.2 Organic Baby Food

There are several notable studies specifically concerned with organic baby food. An examination of the price differences between conventional and organic baby foods was undertaken by Harris in 1997. The purpose of the study was to examine the degree to which consumers of baby food value specific characteristics of the food product. These characteristics include fat-level, amount of added fillers, and the organic quality of baby food. Price of baby food was modeled as a function of organic, levels of protein, iron, fat, the existence of added starch or sugar, and other nutrition related factors. Scanner data from U.S. supermarkets was used for the analysis.

The lack of added fillers (added sugar, starches, or salt) was a significant factor in the price differences among baby food products. Consumers paid up to 2.7 cents more per jar for strained baby foods which were produced without the addition of processed sugars and starches.

Iron, protein, and reduced fat were also valued by consumers, with customers paying 0.7 cents per jar for an additional gram of protein in baby food. Consumers were also willing to pay 0.1 cent per jar for an additional percentage of the Recommended Daily Allowance (RDA) of iron in baby food. Each additional gram of fat in a serving of strained baby food was discounted 0.7 cent by consumers.

The organic component of baby food was found to have the greatest impact. The organic characteristic of baby food was found to cost consumers an additional 21 cents per jar over conventional baby food. Harris suggests that consumers are willing to pay such a premium for the organic component of baby food in exchange for what they perceive to be healthier, better tasting, and more nutritious baby food.

Harris (1999) examined the relationship between baby food consumption, attitudes about food safety, and socioeconomic characteristics of consumers. The objective of the study was to generate important information regarding factors that explain food demand, determinants of purchase behavior, and the relationship between dietary/health information, and food demand. Demand for baby food was modeled as a function of food prices, income, knowledge of the relationship between diet, health, and food safety, and demographic variables. Two sources of data from the USDA were used: 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and 1994-96 Diet and Health Knowledge survey (DHKS).

In terms of socioeconomic variables, income and education were both found to have a significant effect on baby food consumption. Education, measured in total years of formal education with a sample average of 13, had a negative impact on consumption. For each year of additional education, meal planner's purchases of baby food decreased by 19.52 grams per day.

For each additional dollar of weekly income, on the other hand, consumption increased 0.39 grams per day. This conflicts with recent studies on other organic foods (Lin, Zepeda, and Gould 2007; Storstad and Bjørkhaug 2003) which have not found income to have an effect on organic purchases. This could be due to real differences in the way consumers make choices for themselves versus for their baby's diet, or it could simply be an indication of outdated research. This study will attempt to discover which of these reasons is more plausible by investigating the relationship between education/income and organic baby food purchases using recent data.

Unemployed meal planners were found to purchase 162.08 fewer grams of baby food, on a daily basis, than those who were employed. Inner city, white, Women, Infants and Children (WIC) program participating meal planners purchased less baby food than their counterparts (suburban/rural, non-white, not a participant in the WIC program). Food safety concern also had a significant impact. Of the 91 households analyzed 87% of the household meal planners felt that the safety of the food they purchased was very important. As concern for safety increased, purchases of baby food decreased. Consumers who decreased consumption may have done so in favor of preparing their own. The concern for safety is also said to have had a positive impact on organic baby food purchases. Indicative perhaps, of the impact consumer beliefs play in food demand, and interesting considering that at this time organic foods were not regulated by USDA.

Thompson and Glaser (2001) researched national consumer demand for organic and conventional baby food. The objective of the research was to analyze trends in baby food consumption during the 1990s. Consumer responsiveness to changes in prices and expenditure was estimated using the Quadratic Almost Ideal Demand System (QUAIDS) model. Scanner data from ACNielsen and Information Resources, Inc (IRI) was used for empirical estimation.

Two separate samples were employed; Monthly ACNielsen data from April 1988 to December 1996 and data from IRI reported at four week intervals from August 1996 through December 1999. ACNielsen data were divided into four categories according to type of baby food. Organic and conventional dinners and organic and conventional fruits/desserts: IRI data were divided into eight categories: organic and conventional juice, cereal, fruits, and vegetables. The scanner data utilized by both sources came only from grocery stores with annual sales of $2 million or more.

A descriptive analysis of the sample data revealed that from 1988 to 1999 market shares of organic baby food rose and price premiums fell. By 1999, organic baby food dinners had captured 13% of the total baby food market (measured in volume). Organic vegetables and fruits accounted for 6.7% and 4.5% of the market respectively, while organic baby juices accounted for 2.3%. Prices for all categories of organic baby food declined during the study period. In 1988, most organic baby food was said to be twice as expensive as conventional baby food. By the end of the study period, 1999, some categories of organic baby food such as dinners and fruits were found to be cheaper than their conventional counterparts. While advertising and packaging costs contribute to price differences, this drop in the price premium may have also resulted from the increased availability of inputs due to expanded organic crop production.

In 1997, cropland in the U.S. devoted to organic vegetables was 48,227 acres. In 2002, the year of passage for the national organic standards, organic vegetables were grown on 69,887 acres. By 2005, this number had risen to 98,525 acres. For organic fruits, 49,414 acres were utilized in 1997 rising only 23% to 60,693 acres in 2002. By 2005, however, the amount of cropland devoted to growing organic vegetables increased by 60% to total 97,277 acres. This raises questions as to the effect of increased availability of organic crops on organic price

premiums for many types of fresh and processed organic foods, including organic baby food (USDA 2008).

Results from Thompson and Glaser's (2001) empirical estimation indicate that organic baby food purchasers are highly sensitive to the price of organic baby food. Organic dinners had an own price elasticity of -2.489 and the own price elasticity of organic fruits/desserts was -3.110. Own price elasticities for organic vegetables and juices were -1.584 and -5.161 respectively. Own price elasticities of conventional baby food, on the other hand, indicate no such sensitivity, with no significant own price response found for several categories of conventional baby food.

Maguire, Owens, and Simon (2004) undertook a hedonic analysis of the price premium for organic baby food. The authors hypothesized that the rising sales of organic baby food may represent parents' desires to reduce their babies' dietary exposure to pesticide residues. Thus, the price premiums calculated in this study could be used to infer consumer willingness to pay for reduced lifetime cancer risk to babies. A total of 1,689 observations were used in empirical estimation, with information on price, type, and brand of organic and conventional baby food collected from a variety of stores in Raleigh, North Carolina and San Jose, CA in February and August of 2001. A linear model is estimated using ordinary least squares such that price is a function of several explanatory variables. These variables include whether the baby food is organic or conventional, and indicator variables for product and store characteristics (brand, type of packaging, size of store, etc.)

Results from the model indicate that the price of organic baby food is 16 to 27% higher than conventional baby food. More specifically organic baby food was found to cost 3¢ to 4¢

more per ounce, or 10¢ to 15¢ more per jar than conventional baby food. These estimates can not be interpreted as purchaser's maximum willingness to pay to reduce health risk to babies. Instead the authors suggest that the premiums for purchasers of organic baby food, be considered a lower bound willingness to pay to reduce babies dietary exposure to pesticide residues.

Maguire, Owens, and Simon (2006) collected information about the motivation behind organic baby food purchases in a series of focus group discussions with parents of young children. Between August 2001 and February 2002 ten focus groups were conducted in five U.S. cities: San Jose, CA, Baltimore, MD, Philadelphia, PA, Richmond, VA, and Washington, DC. Each focus group consisted of six to nine participants, and two focus groups were held in each city. There were several different types of questions asked during focus group sessions. Participants were asked about the safety of the food supply, how they would define 'organic' and if organic foods were healthier than conventional foods. The majority of participants felt that the food supply in the U.S. was very safe. For those who declared the food supply unsafe, they felt this way because of pesticide application, and unsafe handling/packaging. Participant descriptions of organic food included such phrases as 'chemical-free', 'all natural', 'healthier' 'more nutrients', and 'more expensive'. Regarding the meaning of the USDA organic labels, participants were generally unclear as to exactly what the label stood for, and were skeptical about the diligence of the USDA in monitoring organic farming practices.

Other questions posed during focus group sessions concentrated specifically on baby food. Over 80% of focus group participants had fed their children jarred baby food. When asked about the safety of conventional baby food, some participants did not believe that their children faced any significant health risk by consuming conventional food products. Others felt that

pesticides used to grow conventional foods could harm babies, because children's digestive systems are so fragile during the primary stages of growth. Regarding organic baby food, many of the participants, who had previously purchased organic baby food, had done so inconsistently (choosing organic so that they could take advantage of a coupon or try a new flavor). However, even for these participants, who were only experimenting with organic baby food, safety was an important part of the purchase decision. For those who exclusively purchased organic, health risk reduction was their primary motivation.

2.3 Purpose of Study

This thesis can make several contributions to the current literature. The Harris (1999) study which examines the impact of consumer preference on baby food consumption does so through the use of survey data, while the Maguire, Simons, and Owens (2006) study used focus groups. Neither of these studies takes into account actual purchase choices, information retailers need when making inventory decisions. The Harris (1997) and Thompson and Glaser (2001) studies which took into account previous purchase decisions through the use of scanner data, used data from the 1980s and 1990s, and thus is quite outdated. Not only does this time frame predate recent expansions in the market (20% annual market growth between 2005 and 2006), but the data consist only of sales without household characteristics. The Maguire, Owens, and Simon (2004) research, while recent is limited to a single cross-section from only two U.S. cities, representing less than 1% of the U.S. population of children under one year of age.

The research undertaken in this thesis, on the other hand, is not restricted by any of the aforementioned limitations of time, type of data, or location. Descriptive and empirical analysis thus presented is drawn from nationally collected scanner data, with observations as recent as

2005, and will be useful in identifying the current status of the market. This is quite significant as four out of five of the aforementioned studies use data which precedes the implementation of the USDA National Organic Program. The affect of this program on the availability of organic food, consumer perceptions of organic and even on the very definition of organic should not be overlooked. Thus this study plays a major role in bringing to light recent changes in the market of organic baby food.

CHAPTER 3

THEORETICAL MODEL AND DESCRIPTION OF DATA

3.1 Literature Review of Switching Regression Analysis

This analysis will utilize a two-stage, switching regression estimation method. The first stage employs a probit procedure to estimate the probability of an individual purchasing organic rather than conventional baby food. For stage two, a least squares method is used to evaluate organic baby food expenditures.

This technique is often utilized in empirical estimation to correct for selectivity bias. Kim, Nayga, and Capps (2000), for example, used an endogenous switching regression model to analyze the effect of food labeling on nutrient intakes. In 1994, the Nutrition Labeling and Education Act (NLEA) was implemented to address concerns about the effect of diet on health. As a result of the NLEA most food products now have information about saturated fat, cholesterol and other nutrients included on the label. The intent of the study was to determine the effectiveness of the NLEA in improving the diet of American consumers. The endogenous switching regression model was used to control for sub-sample heterogeneity which can occur if label users have systematically different characteristics than non-label users. The model consisted of a single equation for the label use decision, and two equations to account for subsequent nutrient intake; one for label users and one for non-label users. In addition to the binary variables used to account for the decision to use labels, nutrient intakes including calories, total fat, cholesterol, fiber and sodium, were utilized as dependent variables. Independent variables consisted of knowledge about the linkage between diet and healthy problems,

participation in government programs relating to nutrition, demographic factors and household characteristics. The nutrient intake data from the 1994-96 CSFII and the 1994-96 DHKS data were used in the study with 5,203 total observations. Results from the study indicated that the probability of using nutrition information on product labels increased with income and education and decreased with age. Females were more likely to use labels than males, and individuals living in suburban areas were more likely to use labels than those residing in non-metro areas. Non-smokers and those who exercised regularly were more likely to use labels than smokers and individuals who did not exercise regularly. These results were yielded by the first stage of the switching regression equations, the probit model. From the second stage OLS estimates, the authors concluded that nutritional label use improves diet. Cholesterol, sodium, saturated fat, and calories from fat all decreased with the use of labels, while fiber intakes increased.

Switching regression analysis has also been used in consumer demand research. Lee, Brown, and Schwartz (1986) used a switching regression model to study the impact of Florida Department of Citrus (FDOC) coupon promotion programs on the demand for frozen concentrated orange juice (FCOJ). The objective of the study was to examine both the influence of household characteristics on coupon redemption and the relationship between household consumption behavior and coupon redemptions. From July 1981 to June 1982 the FDOC administered two coupon promotional programs in which approximately 136 million coupons were distributed via newspapers and magazines. Panel data for 9,552 households was used to estimate the model with two separate regimes identified: coupon users and non-coupon users. Explanatory variables included price paid for FCOJ, value of coupons redeemed, race, household composition, income, age, and size of market where household resided. Results from the first stage probit estimation reveled that households with children were less likely to redeem coupons,

while white, female headed household were more likely to use coupons. OLS estimation results indicated that coupons were effective in increasing demand for FCOJ, and that coupon users were less responsive to price changes than non users. These results were said to have important implications on product pricing strategies.

Switching regression analysis was also used to examine food expenditures at home and away from home (Lee and Brown 1986). Using data from the USDA 1977-78 Nationwide Food Consumption Survey, household income was found to increase the chances of a household eating away from home. Additionally, research results indicated that once a household decided to eat away from home income only had a significant effect on food expenditure if household income was greater than $20,000 per year.

3.2 Theoretical Model

These studies confirm the proficiency of the switching technique in accounting for selectivity bias. That is, the bias of sample data which occurs when empirical analysis only takes into account market participants. Switching regression analysis accounts for this bias by considering both market participants and non-participants. By starting from the point of a household's decision to participate in a market (in the present case, the decision to buy organic instead of conventional baby food), the existence of systematic differences between groups can be determined, and the OLS estimates can be adjusted accordingly.

The data used for this analysis is scanner data. One benefit of this type of data is that, each item purchased by a household is uniquely identifiable. Organic baby food observations can be distinguished from purchases of conventional baby food and the data can be categorized into

two separate groups, organic user and conventional user. This type of grouping is referred to as sample separation, and can be denoted by a binary dependent variable I_i in the model that equals one if organic baby food is purchased (organic user) and equals zero if only conventional baby food is purchased. BF_{i1} and BF_{i0} represent expenditures for organic and conventional baby food respectively. I_i* is a latent variable that determines the baby food purchase decision. The γ, β_1, and β_0, are vectors of unknown parameters to be estimated. Z_i, X_{i1}, and X_{i0}, are vectors of independent variables, and ε, μ_{i1}, and μ_{i0}, are error terms.

(3.1) $I_i = 1, \text{if } I_i^* = \gamma Z_i - \varepsilon_i \geq 0$ (when organic baby food is purchased)

$I_i = 0, \text{if } I_i^* = \gamma Z_i - \varepsilon_i < 0$ (otherwise)

(3.2) $BF_{i1} = \beta_1 X_{i1} + \mu_{i1}$

(3.3) $BF_{i0} = \beta_0 X_{i0} + \mu_{i0}$

The error terms in equations (3.1), (3.2), and (3.3), are assumed to have a trivariate normal distribution with mean vector zero and a covariance matrix:

$$Cov(\mu_{i1}, \mu_{i0}, \varepsilon) = \begin{bmatrix} \sigma_1^2 & \sigma_{1,0} & \sigma_{1,\varepsilon} \\ \sigma_{0,1} & \sigma_0^2 & \sigma_{0,\varepsilon} \\ \sigma_{\varepsilon,1} & \sigma_{\varepsilon,0} & 1 \end{bmatrix}.$$

Where σ^2_1, σ^2_0, and 1 are the variances of μ_{i1}, μ_{i0}, and ε, respectively. The off-diagonal elements of the matrix are covariances. Since the choice to purchase organic baby food or not is endogenous, the error terms in equations (3.2) and (3.3) have non-zero expected values. When this occurs and the equations are estimated using OLS the estimates of β are biased (Maddala

1983). Thus, the equations for expenditures on baby food are corrected as shown in equations (3.4) and (3.5).

(3.4) $$BF_{i1} = \beta_1 X_{i1} + \sigma_{1\varepsilon} W_{i1} + \xi_1, \text{ if } I_i = 1$$

and

(3.5) $$BF_{i0} = \beta_0 X_{i0} + \sigma_{0\varepsilon} W_{i0} + \xi_0, \text{ if } I_i = 0$$

where

(3.6) $$W_{i1} = \frac{\varphi(\gamma' Z_i)}{\Phi(\gamma' Z_i)}$$

and

(3.7) $$W_{i0} = \frac{-\varphi(\gamma' Z_i)}{1-\Phi(\gamma' Z_i)}$$

The new residuals, ξ_1 and ξ_0, are uncorrelated with zero conditional means (Lee and Trost 1978). The standard density function and cumulative distribution function are represented in equations (3.6) and (3.7) by $\varphi(\gamma' Z_i)$ and $\Phi(\gamma' Z_i)$, respectively. This procedure will yield consistent estimates of β_1, β_0, $\sigma_{1\varepsilon}$, and $\sigma_{0\varepsilon}$.

The probit equation (3.8) is defined such that the choice to purchase organic baby food is a function of two continuous variables, price and income, and fourteen dichotomous variables representing brand, type of store, regional location of the household, race, education, and age of the house-head.

(3.8)

$$\begin{aligned} Organic \; &= \beta_0 + \beta_1 Price + \beta_2 Income + \beta_3 Brand2 + \beta_4 Brand3 + \beta_5 Store2 + \beta_6 Central \\ &+ \beta_7 East + \beta_8 West + \beta_9 Black + \beta_{10} Hispanic + \beta_{11} Others + \beta_{12} Education1 \\ &+ \beta_{13} Education2 + \beta_{14} Education3 + \beta_{15} Age1 + \beta_{16} Age2 + \beta_{17} Age3 \end{aligned}$$

The second step, OLS equations (3.9) of the switching regression model are defined such that quantity of baby food purchased is a function of the same set of independent variables as included in equation (3.8). Thus, the quantity of baby food purchased (demanded) by either organic or conventional user can be expressed as:

(3.9)

$$\begin{aligned} Quantity_{(\text{Organic or Conventional})} &= \beta_0 + \beta_1 Price + \beta_2 Income + \beta_3 Brand2 + \beta_4 Brand3 + \beta_5 Store2 \\ &+ \beta_6 Central + \beta_7 East + \beta_8 West + \beta_9 Black + \beta_{10} Hispanic + \beta_{11} Others \\ &+ \beta_{12} Education1 + \beta_{13} Education2 + \beta_{14} Education3 + \beta_{15} Age1 + \beta_{16} Age2 \\ &+ \beta_{17} Age3 + \beta_{18} (W_{1(Organic)} \text{ or } W_{0(Conventional)}) \end{aligned}$$

An explanation of exogenous variables used in the discrete-choice and OLS stages of the model is provided in Table 3.1.

Table 3.1. Definition of Variables used in Probit and Regression Analyses

Variable	Definition
Organic	= 1 if household made any organic purchases, 0 otherwise
Purchase Record:	
Brand1	= 1 if brand of baby food is national brand A, 0 otherwise
Brand2	= 1 if brand of baby food is national brand B, 0 otherwise
Brand3	= 1 if brand of baby food is not national brand A or national brand B, 0 otherwise
Store1	= 1 if baby food was purchased in grocery store, 0 otherwise
Store2	= 1 if baby food was not purchased in a grocery store, 0 otherwise
Price	Unit price paid per ounce of baby food, calculated from: total annual expenditure per household divided by total annual quantity purchased
Quantity	Total annual quantity purchased, in ounces
Social, Economic, Demographic:	
White	= 1 if respondent is non-Hispanic white, 0 otherwise
Black	= 1 if respondent is African American, 0 otherwise
Hispanic	= 1 if respondent's race is of Hispanic origin, 0 otherwise
Other	= 1 if respondent's race is not non-Hispanic white, African American or Hispanic, 0 otherwise
Income	Annual household income
Age1	The higher age of either female or male head is between 25 - 34
Age2	The higher age of either female or male head is between 35 - 44
Age3	The higher age of either female or male head is between 45 - 54
Age4	The higher age of either female or male head is 55 or above
Education1	= 1 if "grade school" or "some high school" is the highest level of education attained by heads of household, 0 otherwise
Education2	= 1 if "graduated high school" is the highest level of education attained by heads of household, 0 otherwise
Education3	= 1 if "some college" is the highest level of education attained by heads of household, 0 otherwise

Education4	= 1 if "graduated college" or "graduate education" is the highest level of education attained by heads of household, 0 otherwise	
Central[a]	= 1 if household resides in the north central region, 0 otherwise	
South	= 1 if household resides in the southern region, 0 otherwise	
West	= 1 if household resides in the western region, 0 otherwise	
East	= 1 if household resides in the eastern region, 0 otherwise	
Sample size		1,432

[a] Regions are defined according to U.S. census regions.

Source: Compiled from Nielsen Homescan data 2005.

CHAPTER 4

DESCRIPTIVE ANALYSIS

4.1 Structure of Data

Nielsen Homescan is the data source of this study. The data are unique in that each panelist was supplied with a scanner device that he/she used at home to record grocery items purchased at any type of store throughout the study period. Purchase information used for this study is from the period of 1998-2005. The organic baby food purchases made from 2002 – 2005 are identified utilizing the certification classifications of the National Organic Program (NOP). Prior to that date, there was no national certification system for organic foods, thus identification of organic foods for the former years is done using the Universal Product Code (UPC). Baby food purchases made prior to 2002 which had the exact same UPC as purchases known to be organic according to the NOP, were classified as organic. Quantities are expressed in ounces; expenditures and prices were expressed in terms of cents paid per ounce. The price is derived as the unit value (defined as the expenditure divided by the corresponding quantity).

There are four different categories of baby food available in the dataset: strained baby food (jarred food, primarily vegetables, fruits, or meat, puréed or minced), junior baby food, cereals/biscuits, and juices. Only strained baby food observations were utilized for empirical estimation as this category represents more than half of the total sample of baby food.

4.2 Sample Shares and Price Premiums

During the eight year study period no significant changes occurred in the category offerings of conventional baby food. Strained baby food was the top seller during the entire period, comprising, on average, 57% of all conventional baby foods, as illustrated in Figure 4.1. Junior baby foods rank second, with an average 25% share of conventional offerings, followed by cereals/biscuits with 11%. Organic food offerings also exhibited few changes during the eight years. Strained organic baby food composed on average 97% of all organic baby food 1998 to 2005.

Within the category of strained baby food, purchases can be further divided according to type: fruits, vegetables, dinners, and other which includes dessert, meat, soup, breakfast, yogurt dessert, and assorted varieties. An average of 37% of strained baby food purchases in this study were fruit products, followed by vegetables, with an average of 26%. The third biggest seller was the dinner group, comprising on average 23% of the total strained baby food purchases over the eight year study period. Together these three types represent over 85% of the total sample of strained baby food purchases from 1998 – 2005.

If comparing organic to conventional, organic fruits were sold in higher proportion, with an average of 41% of sales, compared with 34% for conventional fruits. Conventional vegetables were sold in a slightly higher proportion at 28% than organic vegetables which contributed on average, 24% to total organic purchases. On average, 21% of conventional purchases were dinners, compared with 23% for organic dinners. While sample share of conventional fruits stays relatively flat during the eight years, the sample share of organic yogurt desserts virtually mirror

that of organic fruits. The same can be said for organic dinners, and organic vegetables as can be seen in Figures (4.1) and (4.2).

An examination of price reveals that between 1998 and 2005 organic fruits were on average 33% more expensive than conventional fruits, with an eight year average premium of 3.8¢. Beginning in 1998 at 3.9¢, the price premium for fruits peaked in 2004 at 4.4¢ before dropping back down to 3.9¢ in 2005. Organic vegetables were 36% more expensive than conventional vegetables with an average premium of 4.4¢. The highest ever average price premium for organic vegetables came in 2005 at nearly 5¢. Organic dinners were 40% more expensive than conventional dinners with a premium of 4.2¢. In 2005, the premium for organic dinners held at the mean of 4.4¢, down from the 2000 peak of 4.9¢. While the difference in prices for organic and conventional fruits was not shown to be significant, both vegetables and fruits were significance at $\alpha = 0.01$. A comparison of dinner, fruit, and vegetable price premiums is illustrated in Figure 4.4.

4.4 Purchase Channel

Regarding the purchase channel, the majority of both organic and conventional baby food purchases were made in a traditional grocery store. Throughout the eight year study period an average of 88% of organic and 99% of conventional purchases were made in traditional grocery stores. However, there was a decline in this figure over time as the trend toward shopping in super centers increased. As illustrated by Figure 4.5 an increasing percentage of both organic and conventional purchases took place in super centers with conventional outpacing organic in each of the eight years. Starting in 1998 at only 5% the percentage of conventional baby food

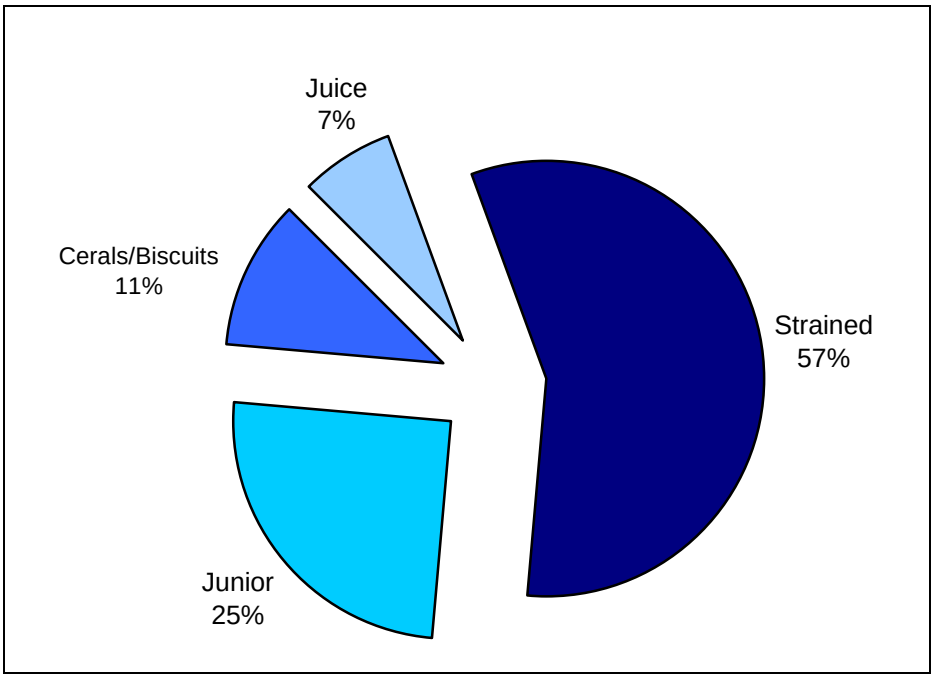
purchases made in super centers rose to 15% by 2005. Although slower than that of conventional baby food, the percentage of organic baby food purchases made in super centers also exhibited a fairly steady increase. Beginning at only 1% in 1998, by 2005 8.4% of all organic baby food purchases were made in super centers.

4.5 Discounts

In a previous study, parents who have bought organic food reported doing so for the purpose of taking advantage of a sale or coupon (Maguire, Owens, and Simon 2006). An inspection of actual household purchases enables a comparison of conventional and organic baby food purchased with a discount, and an identification of the prevalence of this trend. Sale for the purpose of this analysis is any purchase made at a discount, utilizing either coupons or in-store promotions.

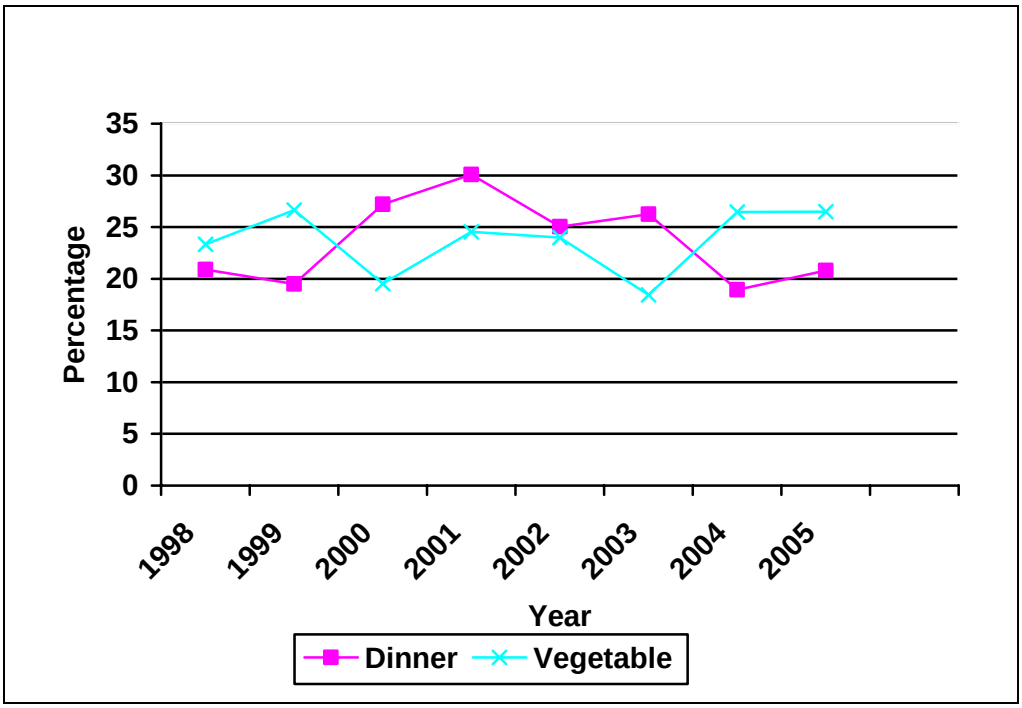
The average percentage of conventional purchases made on sale, 1998 - 2005 is 27.5%. Only 24.5% of organic purchases were made on sale, despite having the highest yearly average four times during the eight year observation period, Figure 4.4. Additional review of the data reveals varying trends according to type of baby food, Figures 4.5-4.7. The percentage of conventional dinners purchased on sale exhibited little changed over the eight years. No single year boasted a percentage of sale purchases more than 4% above or below the mean of 29%. The eight year average for organic dinners was barely higher than that of conventional at 30%; however this number varied widely throughout the period. The peak came in 2002 at 46%, which was the highest recorded average percentage of sale purchases made for any type of baby food, organic or conventional during any of the eight years.

There was little variation for either organic or conventional fruits, both with eight year averages of approximately 30% for conventional and 28% for organic. For vegetables on the other hand, the average percentage of organic purchases made on sale was lower than that of conventional for five out of the eight years, with a difference as large as 19% in 2001.This difference in the use of promotions or coupons, could represent a window of opportunity for manufactures and retailers of organic foods. Encouraging households to try organic products via discount promotions may be a tool for bringing new consumers into the market.



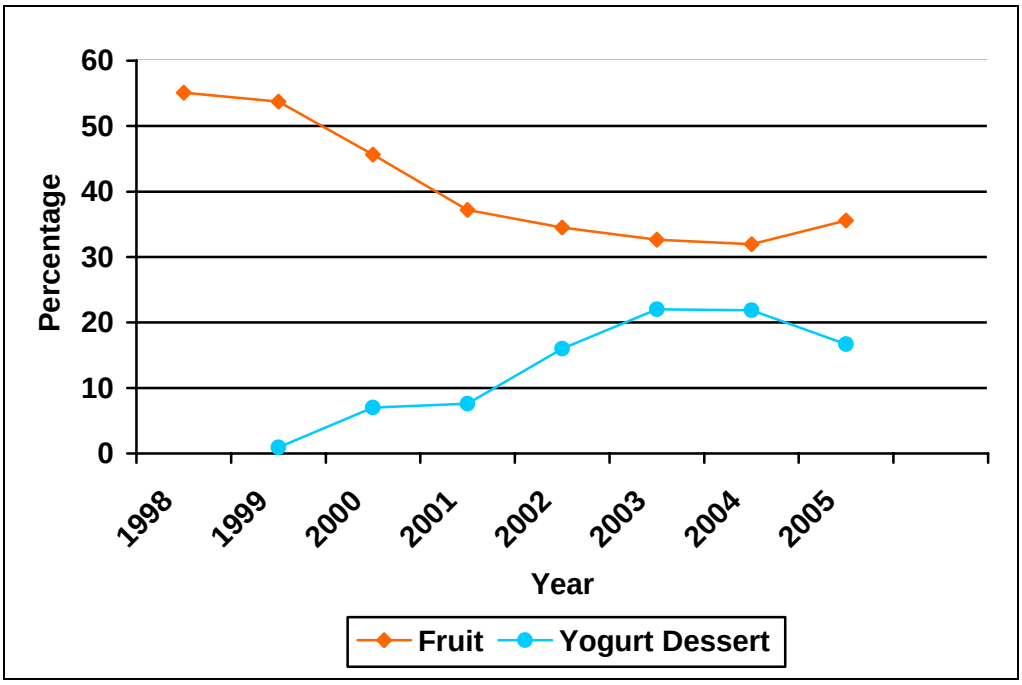
Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.1: Average Sample Share of Conventional Baby Food Categories, 1998-2005



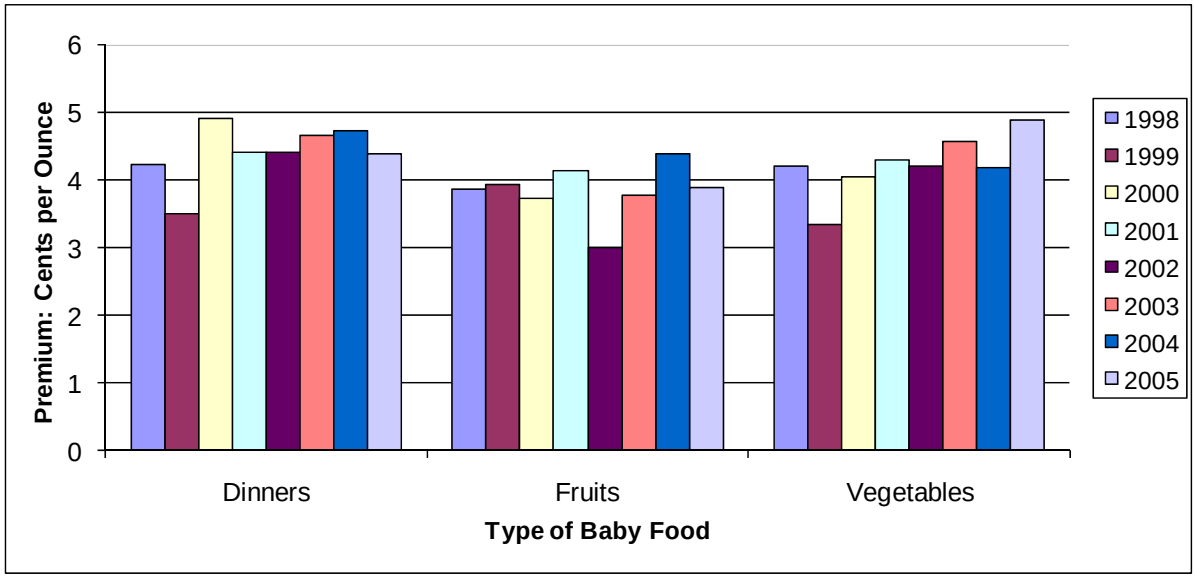
Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.2: Sample Share of Organic Dinners and Vegetables, 1998-2005



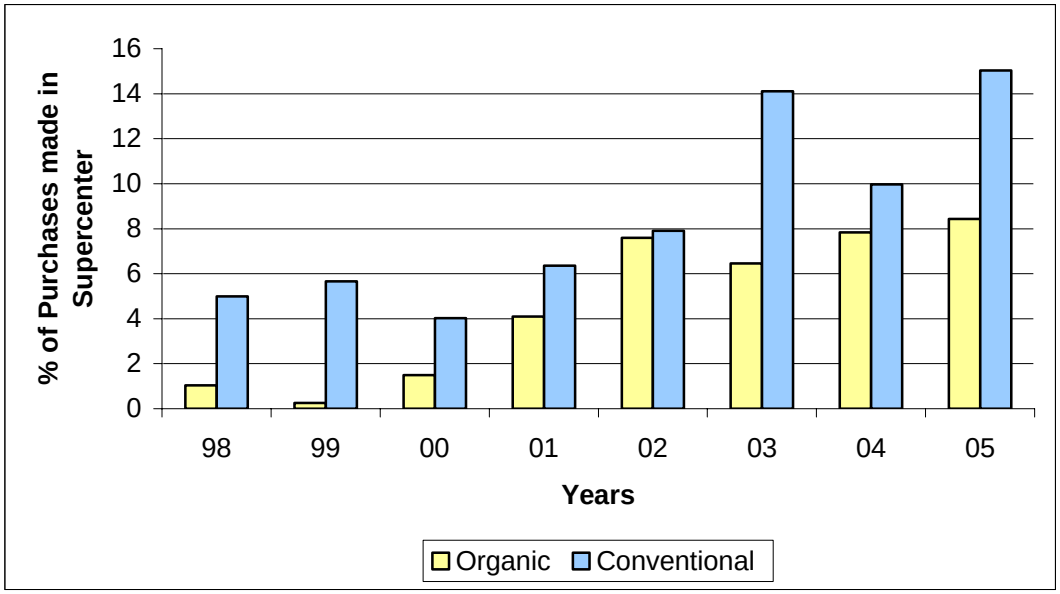
Source: Compiled from Nielsen Homescan data 1998 - 2005

Figure 4.3: Sample Share of Organic Fruits and Yogurt Desserts, 1998-2005



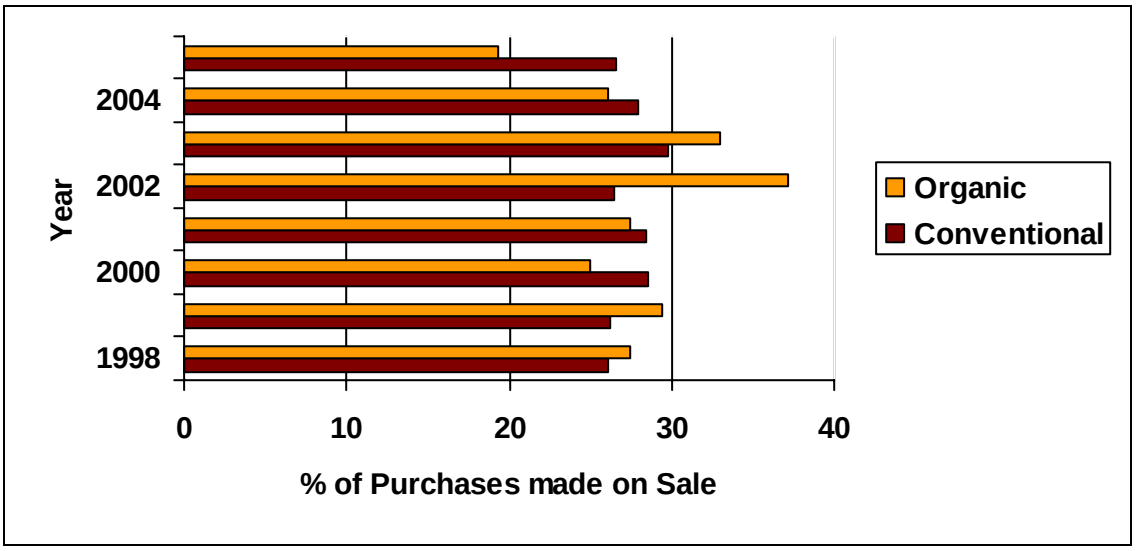
Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.4: Average Organic Premiums, 1998-2005



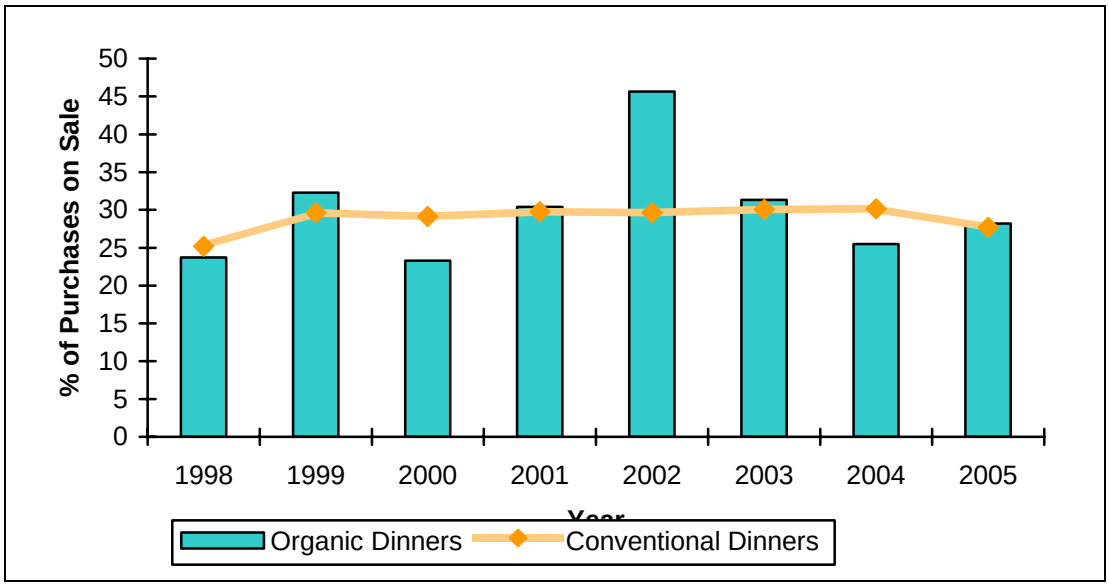
Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.5: Percent of Purchases made in Super centers, Organic vs. Conventional, 1998-2005



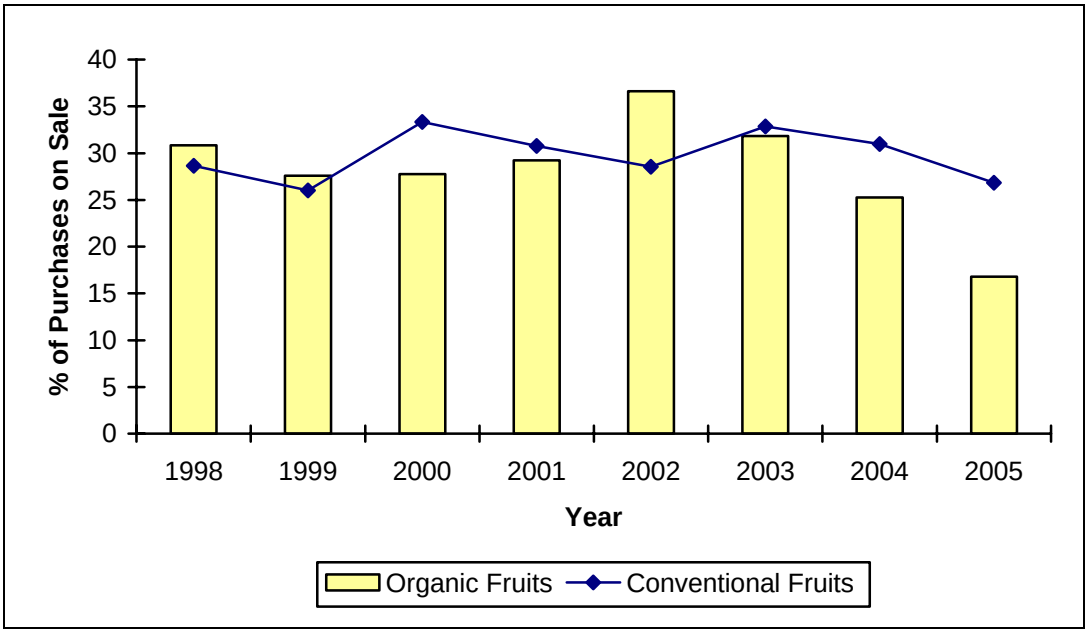
Source: Compiled from Nielsen Homescan data 1998 - 2005

Figure 4.6: Percent of Purchases made on Sale, Organic vs. Conventional, 1998-2005



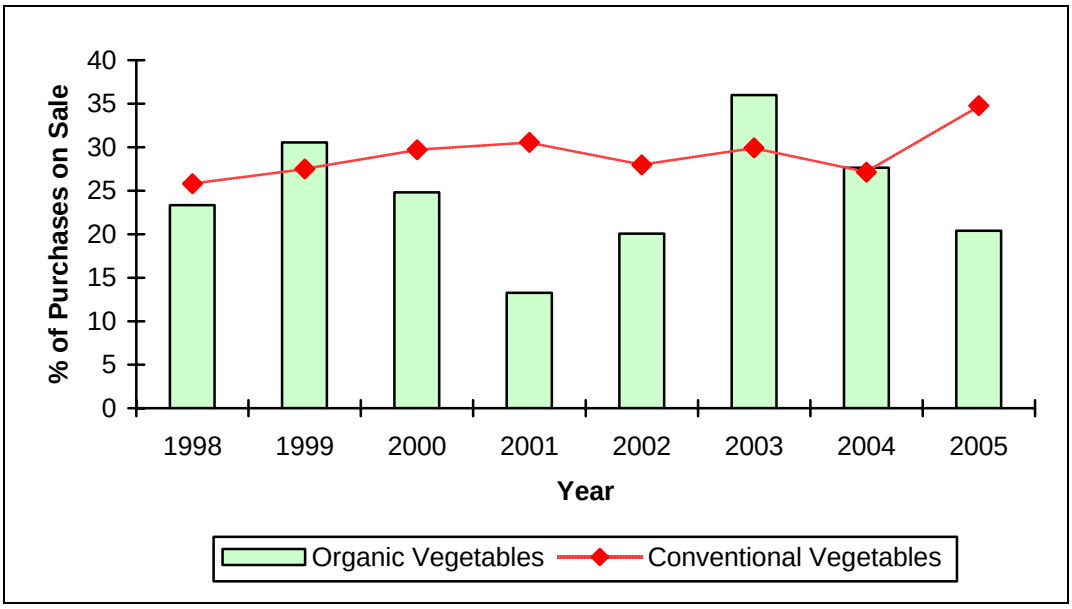
Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.7: Percent of Dinner Purchases on Sale, Organic vs. Conventional, 1998-2005



Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.8: Percent of Fruit Purchases on Sale, Organic vs. Conventional, 1998-2005



Source: Compiled from Nielsen Homescan data 1998 – 2005

Figure 4.9: Percent of Vegetable Purchases on Sale, Organic vs. Conventional, 1998-2005

CHAPTER 5

RESULTS AND IMPLICATIONS

5.1 Structure of Data: Empirical Analysis

Switching regression analysis is undertaken with data from 2005 with 1, 432 observations. Of households purchasing baby food in 2005, 69% were white compared with 80% in the U.S. population (U.S. Census Bureau 2005). 14% of participants in the sample were Hispanic, compared with a U.S. population of 14.8% while 10% of the sample was composed of African-American participants, (which is lightly less than the 12.8% found in the U.S. population). Only 27.2% of the U.S. population in 2005 had attained a bachelor's degree or higher, compared with 53% of participants in the sample. Sample statistics are shown in Table 5.1.

5.2 Probit Results

Table 5.2 shows the estimated coefficients and marginal effects of the exogenous variables on the probability of the household purchasing organic baby food. The estimated coefficients in the probit equation do not have any economic interpretation per se other than serving as an indication how they would affect the probability that an event will occur. Thus, it is more meaningful to interpret and discuss the probit results in terms of the marginal effects, which measure the changes in predicted probability associated with changes in the explanatory variables (Greene, 1997). More specifically, the marginal effect for the probit equation is defined in as the partial derivative of the predicted probability that an event will occur with respect to a given independent variable while holding other things constant:

(5.1) $$\text{Marginal Effect} = \frac{\partial \Pr(y = 1 \mid x)}{\partial x_k}$$

Results from the probit analysis revels that PRICE has a significant and inverse impact on the likelihood of the household to purchase organic, as expected. An increase by one percent in the price decreases the probability of the household purchasing organic by an average of 1.2%. Contrarily, income was not found to be a significant factor in the choice to purchase organic baby food. Two variables to identify shopping behavior were included in the model, brand of baby food, and store where item was purchased. Compared with BRAND1 (national brand A) households were 10% less likely to purchase organic if baby food purchases were BRAND2 (national brand B). Purchases of BRAND3 (all brands other than national brands A or B) were 22% less likely to be organic compared with BRAND1. Shopping venue did not have a significant effect on the decision to purchase organic. Perhaps this is an indication that as organic foods become more available, the search costs of purchasing these items is reduced, leading to an indiscernible impact on purchase decisions.

In terms of region, the benchmark for comparison is SOUTH which accounts for 43% of households in the sample. Households located in the EAST and WEST were 15% and 12% less likely to purchase organic than those in the SOUTH. While initially this may appear to be contradictory to productions patterns of organic food, with organic food are more readily available in the East and West, it is likely that production location of raw material does not affect availability of processed organic foods. The distribution systems of major baby food manufacturers should enable a consistent supply of both organic and conventional baby foods to be delivered to retail outlets regardless of regional location.

Of the socioeconomic variables included in the model, race, age, and level of education all have an effect on organic purchase decisions. The race variable OTHER is significant at the 1% level. Households in this category were approximately 16% more likely to purchase organic than white households. Significant at the 5% level, the variable HISPANIC increases the probability of a household buying organic by approximately 9%. Compared with households which have attained at least a college degree, households whose highest level of education is 'some college' (EDUCATION3), are 6% more likely to purchase organic than those with at least a college degree (EDUCATION4). Households with either an older female or male household head [within the 25-34 years age group (AGE1)], were about 10% more likely to purchase organic than those 55 years old or older. (The age groups are compared to households grouped in the 55 years or above category (AGE4), as this higher age bracket represents the majority of households in the sample).

5.3 OLS Results

Table 5.3 presents estimates of model parameters of the rate of baby food consumption conditional on the decision to purchase organic. The dummy variables in the OLS equation are intercept shifters and represent the marginal effects of changing from one state to another. Thus, the estimated coefficients directly reflect the discrete change effects.

The first variable of note, PRICE was not shown to have a significant effect on conventional purchases. For organic purchases however, every additional cent in cost translated to an average 4 ounce decrease in purchased organic baby food. The calculated own price elasticity for organic baby food was -3.732. This result corroborates that of Thompson and Glaser (2001) whose results from an empirical estimation of price elasticities indicated the

tendency of organic baby food purchasers to be highly sensitive to the price of organic baby food, with own price elasticities of organic dinners and organic fruits/desserts found to be -2.489 and -3.110 respectively. They found no such indication from elasticities of conventional baby food, on the other hand, with no significant own price response found for several categories of conventional baby food. The lack of price significance on conventional baby foods could be caused from a lack of viable substitutes for this product. Likely, the alternative to purchasing conventional baby food is to prepare food at home, which may be more expensive or inconvenient. The household does not achieve economies of scale savings, and they allocate other resources, primarily time for preparation, cooking, and cleanup of homemade baby food which may exceed the costs of purchasing manufactured baby food. Thus, with no cheaper alternative available, it is not surprising that price impacts on purchases of conventional baby food are indistinguishable from zero.

Income was not found to have a significant impact on the quantity purchased of either organic or conventional baby food. While contrary to the findings of Zhang, Huang, and Lin (2006) and of Lin, Zepeda, and Gould (2007), this result matches that of Harris (1999). This is perhaps, an indication of the differences between shopping for organic foods at large and shopping specifically for organic baby food. As noted by Thompson and Glaser (2001) baby food is only likely to account for a very small portion of a household's food expenditures, and explains perhaps, the reason behind no discernable income affect in empirical estimation.

Concerning the behavioral variables, for those households who purchased organic, quantity of baby food purchased decreased by an average of 94 ounces when buying BRAND3. This finding is significant at the 1% level. Due to data limitations, this result may not be

illustrative of the true trends in the market, as many new choices are becoming available in the market for organic baby foods. Many of these new products have made innovations in packaging with the goal of preserving the nutrients, colors, and tastes of fruits and vegetables better than traditional jars, however, the data included in this analysis only included jarred, strained, baby food. Recent innovations include frozen baby food cubes made by freezing 100% certified organic fruit and vegetable purees into small cubes, which can then be heated in the microwave or on the stove for easy preparation. Other new entries into the market include varieties of organic baby food meals which are flash-frozen 'to lock in freshness' or food prepared for sale as fresh and homemade from the grocery store's refrigerator section. More innovations come from new brands which incorporate a broad variety of herbs and spices into the baby food dish, again using USDA certified organic (Mintel 2008).

While not including these types of food items specifically, the results found in this study (parents are less likely to purchase organic when choosing a brand outside of national brands A or B) indicate that parents of young children are highly brand loyal. A motivation, perhaps, for organic baby food producers, and manufacturers of other products aimed at new parents, to make substantial efforts to build trust with new parents. Moreover, as noted previously jarred baby food represents over 57% of baby food purchases made in this sample. Thus, newer products which are located in the freezer or refrigerated sections of retail outlets may need to make extra efforts to breach a shopper's consciousness as parents are likely unaccustomed to shopping for baby food outside of the dry goods aisles.

The other variable included to identify shopping behaviors was the purchase channel, (type of store visited). For those households purchasing organic, an average of 44 fewer ounces

were purchased when shopping in channel STORE2, compared to the traditional grocery store. This result is perhaps not surprising given the results of Oberholtzer, Dimitri, and Greene (2005) who found that nearly half of all organic food sales occur in conventional grocery stores. However, results do somewhat contradict the findings of Lin, Zepeda, and Gould (2007), who found that shopping at a food cooperative or a health food store increased the probability that a household purchased organic. Unfortunately, Homescan data do not identify food purchased from food cooperative or health food stores separately. However, it is important to note that nearly 70% of purchases made in this sample took place at conventional grocery stores. Perhaps this illustrates the move major retail outlets are making to include organics in their inventory (Oberholtzer, Dimitri, and Greene 2005). Regionally, for those households purchasing organic, those in the WEST purchased an average of 48 fewer ounces of baby food than those in the SOUTH. This represents a reduction of 42% when comparing with the average amount of organic baby food purchased by households in the SOUTH (113 ounces). For those households purchasing only conventional, EAST was associated with an average 90 ounces more purchased baby food than SOUTH. This is nearly double the average amount of 58 ounces purchased by households in the SOUTH.

For those households purchasing organic, those classified as HISPANIC purchased an average of 32 more ounces of baby food than WHITE households. This represents an increase of 28% when compared with the mean quantity of organic baby food purchased by WHITE households. This result is consistent with Zhang, Huang, and Lin (2006) who also reported Hispanics more likely to purchase organic. A 2003 study by the Natural Marketing Institute also found Hispanic consumers to be significantly more interested in natural and organic products than the general population, and more likely to want their stores to carry natural and organic

products. Thus product development and marketing strategies should focus on creation of products which appeal to the varied taste of these cultural groups. Examples include producing products with unique combinations of fruits and vegetables more common in Latin and South American diets, and marketing products through culture specific channels such as Spanish or bilingual media outlets.

There was no corresponding education affect on the quantity of organic food purchased. In terms of conventional consumption however, households purchased an average of 130 more ounces of baby food if they were classified within EDUCATION1, did not complete high school, compared with those with at least a college degree (EDUCATION4). This represents a twofold increase over the mean quantity of conventional baby food (71 ounces) purchased by households within the classification of EDUCATION4. This finding is consistent with the work of Harris (1999), which is the only other organic baby food study accounting for both consumer characteristics and actual purchases. Harris (1999) found that for each year of additional education, meal planner's purchases of baby food decreased by 19.52 grams per day. Alternatives to commercially jarred baby food, such as preparing homemade baby food from fresh produce, may not be feasible for households with lower education that may have fewer resources, such as time or money, to devote to creating such substitutes.

Age also had a significant affect in the consumptions equations. AGE1 and AGE2 were both significant factors of increased organic consumption. Fifty three more ounces of organic baby food were consumed by households in the category of AGE1 than those with household head aged 55 and over, and 61 more ounces were consumed by those in the AGE2 bracket. This result is consistent with Lin, Zepeda, and Gould (2007) who found that age significantly affected

per-capita food expenditure levels for organic shoppers, while having no significant impact on per-capita food expenditures for conventional shoppers.

Table 5.1 Descriptive Statistics

	Non-Organic User		Organic User		Total	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
QUANTITY	64.253	141.113	107.576	207.768	79.531	168.873
PRICE	15.291	6.891	13.759	4.298	14.751	6.146
INCOME	3.895	1.991	3.770	1.991	3.851	1.991
BRAND1	0.370	0.483	0.507	0.500	0.418	0.493
BRAND2	0.229	0.420	0.244	0.430	0.234	0.423
BRAND3	0.401	0.490	0.250	0.433	0.348	0.476
STORE1	0.688	0.463	0.665	0.472	0.680	0.467
STORE2	0.312	0.463	0.335	0.472	0.320	0.467
EAST	0.263	0.441	0.164	0.371	0.228	0.420
CENTRAL	0.134	0.341	0.168	0.375	0.146	0.353
SOUTH	0.388	0.488	0.491	0.500	0.425	0.494
WEST	0.215	0.411	0.176	0.381	0.201	0.401
WHITE	0.714	0.452	0.634	0.482	0.686	0.464
BLACK	0.091	0.287	0.107	0.309	0.096	0.295
HISPANIC	0.137	0.344	0.176	0.381	0.151	0.358
OTHERS	0.058	0.234	0.083	0.276	0.067	0.250
EDUCATION1	0.015	0.122	0.010	0.099	0.013	0.114
EDUCATION2	0.179	0.384	0.172	0.378	0.177	0.382
EDUCATION3	0.260	0.439	0.307	0.462	0.277	0.447
EDUCATION4	0.546	0.498	0.511	0.500	0.534	0.499
AGE1	0.160	0.366	0.190	0.393	0.170	0.376
AGE2	0.224	0.417	0.248	0.432	0.233	0.423
AGE3	0.231	0.422	0.236	0.425	0.233	0.423
AGE4	0.384	0.487	0.327	0.469	0.364	0.481
Number of Observations	927		505		1,432	

Source: Compiled from Nielsen Homescan data 2005

Table 5.2 Probit Estimation Results

Variable	Estimated Coefficient (Standard Error)	Marginal Effect (Standard Error)
CONSTANT	0.276 (0.172)	0.101 (0.063)
PRICE	-0.032*** (0.007)	-0.012*** (0.002)
INCOME	0.012 (0.020)	0.004 (0.007)
BRAND2	-0.273*** (0.093)	-0.097*** (0.031)
BRAND3	-0.639*** (0.084)	-0.221*** (0.027)
STORE2	-0.087 (0.077)	-0.032 (0.028)
CENTRAL	-0.011 (0.105)	-0.004 (0.038)
EAST	-0.445*** (0.097)	-0.153*** (0.031)
WEST	-0.332*** (0.102)	-0.116*** (0.034)
BLACK	0.018 (0.122)	0.007 (0.045)
HISPANIC	0.246** (0.103)	0.093** (0.040)
OTHERS	0.403*** (0.147)	0.155*** (0.058)
EDUCATION1	-0.097 (0.328)	-0.035 (0.115)
EDUCATION2	0.041 (0.109)	0.015 (0.040)
EDUCATION3	0.153* (0.090)	0.057* (0.034)
AGE1	0.261** (0.109)	0.099** (0.042)
AGE2	0.151 (0.010)	0.056 (0.038)
AGE3	0.105 (0.095)	0.039 (0.035)
Number of Observations: 1,432 Pseudo-R^2: 0.081 Log Likelihood: -869.046		

Note: Triple, double, and single asterisks denote significance at 1%, 5% and 10%, respectively.

Source: Compiled from Nielsen Homescan data 2005

Table 5.3 Regression Estimation Results

Variable	Non-Organic User Estimated Coefficient (Standard Error)	Organic User Estimated Coefficient (Standard Error)
CONSTANT	257.508*** (46.829)	249.154*** (30.397)
PRICE	2.589 (1.873)	-3.864*** (1.125)
INCOME	-5.632 (5.549)	-0.758 (4.145)
BRAND2	19.071 (23.340)	-25.341 (17.005)
BRAND3	32.380 (24.081)	-93.829*** (18.719)
STORE2	-33.256 (23.365)	-44.122** (-17.691)
CENTRAL	-27.294 (33.914)	-16.804 (-25.197)
EAST	90.463*** (25.474)	-28.922 (17.797)
WEST	27.737 (28.564)	-47.584** (21.365)
BLACK	-62.614 (51.403)	-41.101 (-40.769)
HISPANIC	-34.776 (26.758)	31.554* (-18.985)
OTHER	-67.307 (42.533)	37.933 (-31.707)
EDUCATION1	129.987* (77.57)	19.829 (41.866)
EDUCATION2	-38.212 (32.67)	-20.853 (25.510)
EDUCATION3	-13.329 (24.034)	12.498 (16.684)
AGE1	-11.332 (30.397)	52.856** (-22.270)
AGE2	34.325 (26.949)	61.144*** (18.894)
AGE3	-5.500 (27.024)	18.229 (-20.277)
W_0	242.91*** (16.248)	
W_1		199.015*** (8.413)

Number of Observations	927	505
Log Likelihood	-10322.60	

Note: Triple, double, and single asterisks denote significance at 1%, 5% and 10%, respectively.

Source: Compiled from Nielsen Homescan data 2005.

CHAPTER 6

CONCLUSION

6.1 Summary

In 2006, there were approximately 16.5 million children in the U.S. under the age of four, each needing food necessary for development and growth. By making products which satisfy these needs, the baby food industry achieves annual sales of almost $3.7 billion. Due to a stagnant birth rate, growth in the industry is slow, and niche markets are growing in importance. Organic baby food is one such market niche with $116 million in sales in 2006, an increase of 21.6% from the previous year. The purpose of this thesis is been to identify important consumer characteristics that are associated with organic baby food consumption and investigate their affects on consumption.

A descriptive analysis of baby food purchase data revealed that, on average, organic baby foods are still more expensive than conventional baby foods. An analysis of price trends revels that from 1998 to 2005, strained organic baby food offerings, which represents the principle type of baby food sold during the study period, cost on average 2.1¢ more than conventional strained baby food. Within the category of strained baby food, organic price premiums were found for fruits, dinners, and vegetables. The eight year average premium for fruits was 3.8¢. The eight year average premiums of dinners and vegetables were 4.4¢, and 4.2¢ respectively. The source of the data is Nielsen Homescan 1998 - 2005.

Empirical estimation was undertaken using a two-stage, switching regression method. The first step employed a probit procedure to estimate the probability of an individual purchasing organic rather than conventional baby food. Step two utilized OLS regression to evaluate organic baby food consumption. Data for use in estimation was drawn from Nielsen Homescan 2005, and 1, 432 observations were used in this stage of the analysis.

Variables related to shopping behavior were found to have a significant impact on both the consumer's decision to purchase organic and on subsequent quantity purchased. Consumers were less likely to buy organic if they shopped outside of a traditional grocery store, or purchased brands outside of the top two national brands of baby food. Significant socioeconomic variables included race, age, and education. Hispanics and Other racial groups were more likely to consume organic baby food than whites. More organic baby food was likely to be purchased in cases where the head of household's highest level of education attained was 'some college' than households wherein the highest level of education attained by the head of household was a college degree or higher. Household heads aged 25 – 44 purchased more organic baby food than those aged 55 years old or older. Households in the East and West regions were shown by the probit estimation to be less likely to purchase organic baby food than households in the South.

The estimated results indicate that marketing strategies should be aimed at increasing brand and store loyalty with consumers. Advertising strategies should be refined to consider cultural and lifestyle differences among organic baby food consumers. While price does seem to be a deterrent to consumers of organic baby food, a descriptive analysis of data reveals the tendency for consumers to substitute one organic product for another, instead of choosing a

conventional substitute. Sales of organic fruits mirrored those of organic yogurt desserts, and sales of organic vegetables those of organic dinners, more so than the conventional alternatives.

6.2 Limitations

A notable limitation in this study is the use of demographic variables as proxies for consumer attitudes and behaviors. Consumer attitudes and concerns have been found to be significant factors in organic food purchasing behavior (Harper and Makatouni 2002, Wier and Andersen 2003, Gifford and Bernard 2004). These studies demonstrate that as consumers' concerns about nutrition, health, and environmental protection increase, so does the likelihood of consumers to purchase organic. Additionally, both Wilkins and Hiller (1994) and Lin, Zepeda, and Gould (2007) found that people who enjoy cooking and shopping are more likely to purchase organic. Attitude and knowledge variables such as these may be better predictors of organic shopping behavior than demographic variables, and would be an asset to a study of this nature.

An additional limitation arrives is the specification of the model. A principle benefit of using a switching regression analysis is this model's ability to account for sample selection bias, a problem which can often be incurred in empirical analysis when attempting to examine a particular market participation group. However, in specification of the model for this study, the groups of market participants were not sharply defined. A household classified as an organic purchaser, may have purchased only organic baby food, or they may have purchased both organic and conventional baby food. It would be beneficial to separate these two groups so that three market participant entities can be identified: households who purchase solely organic, household who purchase solely conventional, and households who purchase both organic and conventional.

6.3 Future Research

As indicated in the literature review portion of this paper, many studies have indicated that consumers do not fully understand what the organic label represents. Despite this finding sales of organic food have continued to grow, raising question as to the efficiency of this marketing tool. As indicated in the literature review portion of this paper, many studies have indicated that consumers do not fully understand what the organic label represents, with consumer definitions of organic range from 'healthier' and 'environmentally friendly' to 'all natural' and 'locally grown'. While it has been shown that consumers appreciate the environmental benefits of growing organically, the technical aspects of this process are not part of the consumer's knowledge base (Wolf et al. 2002; Rimal, Moon and Balasubramanian 2006; Maguire, Owens, and Simon 2006). Despite these challenges, the organic market has continued to grow in recent years, raising interesting questions as the efficiency of this marketing tool and link between consumer attitudes and beliefs and actual purchase decisions. Studies which combined consumer attitudes and beliefs about organic food in combination with actual purchase data would be useful by accounting for a larger percentage of issues which affect consumer choices. Results from such a study would yield useful information for producers and retailers of baby food and of all organic food.

Future research should also be conducted which analyzing the affects of brand loyalty. The results from this study have indicated the tendency of parents to be highly brand loyal. Thus manufactures of baby food and other goods for consumption or use by children may need to refine their production and marketing strategies. Further expanding product offerings to include pre-natal and toddler stages of childhood in an effort to keep each customer for a longer period of time is one technique which has already been instituted. Pre-natal vitamins and information on

a ‘healthy pregnancy’ are marketed to mothers-to-be in an attempt to establish brand loyalty as early as possible. Toddler foods, small, bite-sized plus conveniently packaged, are aimed at ‘busy’ parents for whom it is much more convenient to buy these pre-packaged meals and snacks, than prepare and cut food for toddlers on their own (Mintel 2006).

Research could be undertaken which examines purchases of these products to answer such questions as: Are purchases of ‘pre-natal’ and ‘toddlers’ foods increasing? If so, what effect is this having on brand loyalty? Are parents indeed choosing a preferred baby food brand during pregnancy, and remaining loyal to the brand through the toddler stage of child growth? Such information would provide incentives for manufacturers to expand production and advertising in these areas, and increase revenues, from repeat customers. Such research could also be useful to manufactures of other products, as an indication of how importance convenience is to consumers and how effecting branding strategies are in establishing consumer loyalty.

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