EVALUATING CONSUMER RESPONSE TO LABELS AND PACKAGING IN THE MARKET FOR BABY FOODS

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ABSTRACT

The landscape of the baby food industry in the United States has evolved significantly in recent years. Demand for organic baby food continues to grow rapidly, and in addition, non-GM labels, and the new packaging innovation, pouch, are very popular among baby food consumers. Previous studies on baby food have been focused on determining the consumers' willingness to pay for the organic and other nutrition attributes. This study firstly uses hedonic pricing model to investigate the premiums that purchasers are willing to pay for the organic label, the non-GM label, and the pouch packaging. Second, I use a Tobit regression to explore the relationships between the organic, non-GM, pouch baby food purchasing shares and household characteristics and purchasers' shopping behavior. The results from the hedonic pricing model show that baby food purchasers paid a premium of 2.6 cents per ounce for the organic label, and 2.9 cents per ounce for non-GM label. It is interesting to see that the price premium for the non-GM was higher than organic. And baby food purchasers paid a premium of 13.8 cents per ounce for the new pouch packaging compared with the plastic tub packaging. The results from the Tobit regression models show that younger purchasers, those with high incomes, those with fewer children, and those with more free time are more likely to purchase organic and non-GM baby food. Higher education would increase consumers' preference for organic baby food, but has no significant effects on consumers' preference for non-GM baby food. In terms of geographic factors, consumers from the Pacific region have strong preference for both organic and non-GM baby food.

BIOGRAPHICAL SKETCH

Peixun Fang was born in 1989 and grew up in Nanjing, China. In 2008, he joined Sino-American 1+2+1 Dual Degree Program, and earned bachelor's degrees in Economics both from George Mason University and Nanjing University of Information Science and Technology in 2012. Peixun really enjoyed his education experience in the United States and decided to continue his study in agriculture economics which is more practical. He attended a Master of Science program in agricultural economics in Cornell University. During the graduate study, Peixun felt very lucky and honored to work with Professor Bradley Rickard, Professor Edward McLaughlin and Mr. Rod Hawkes.

This is dedicated to my family and all mothers.

献给我的家人(当然包括唐果一家),以及献给天下所有可爱的妈妈们。

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CHAPTER 1

INTRODUCTION

1.1 Background

Children's brains and organs are developing, and they eat more on a pound-by-pound basis than adults. Because babies or children are more vulnerable to toxins in their diets, it makes baby food products a very special and important food category. In 2013, there were about 24.0 million children under the age of five in the United States, and they consumed $6.6 billion of baby food according to Euromonitor International. The consumption of baby food declined from 2008 to 2011 due to the decline in births during the recession. Americans appear more open to having more babies again after 2011, as the U.S. economy shows signs of improvement. Baby food consumption in the United States also increased by 4% after 2011 and is expected to continue to increase in the following years. Part of the reason is the increasing baby population, and the other important reason is the rapid development of baby food industry in recent years.

The market for baby food has a long history. The first mass-produced baby foods were infant formulas in the 19th century, but by the 1920s, baby food had grown

to encompass ready-made baby cereals, fruits and vegetables. Gerber, which is the largest company in the baby food industry today, launched its first baby food in 1928, followed by Beech-Nut, which entered the market in 1931. By 1996, the three largest baby food companies were Gerber (70%), Beech-Nut (15%), and Heinz (10%). Earth's Best, the largest brand of organic baby food, had about 2% of the American market share in 1996. Between 2000 and 2008, market concentration had further increased. Gerber increased its market share to 80% (excluding baby yogurt), Beech-Nut's market share slightly declined to 12%, while Heinz declined to only 2%. On the other hand, Earth's Best, which was still the largest organic baby food brands, increased its market share from 2% to 5% (Chen, 2009). Overall, this suggests that consumers became more interested in organic baby food from 2000 to 2008. Since 2008, the landscape of the baby food industry has further evolved. Several organic premium baby food brand, such as Happy Baby, and Plum Organics, arose in recent years. Even though Gerber was still the largest company in this industry, it has been losing market shares to these smaller organic baby food brands. And importantly, these organic baby food companies were all acquired by various large food companies: Danone purchased Happy Baby; the Hain Celestial Group acquired Earth's Best and

Ella's Kitchen; and Campbell Soup bought Plum Organics. After joining these big food companies, the organic baby food companies are likely to have higher value sales and win more market share from the big baby food companies such as Gerber. Given these recent changes in the organic baby food market, information regarding consumer response is needed by baby food producers and retailers, but there is no recent study investigating the demand for organic baby food products. This study will investigate consumer response to organic baby food at this crucial time, with particular emphasis on labeling attributes and packaging.

Most consumers recognize organic baby food by the organic labels. After the popularity of organic labels, another product-attribute label, non-GM, has gained popularity in recent years in accordance with the heated debate surrounding genetically modified (GM) foods. Several states held referendums on mandatory labeling of GM foods and many people feel strongly about both sides of the issue. Proponents of mandatory GM labeling cite the right to know what is in their food as an important consideration in a democratic society. Opponents countered that GM label will confuse consumers with no improvement in food safety and also increase the cost of food. The propositions of California, Washington, Colorado, and Oregon were

defeated between 2012 and 2014; Connecticut and Maine passed the laws in 2013 under a clause that their GM labeling law will go to effect only if four or five other states pass similar laws, including one that borders them; Vermont became the first state to pass a "clean" GM mandatory labeling law, which will go into effect in 2016. All these referendums have attracted consumers' attention to GMs. Then, many food companies started to use non-GM labels, which is a voluntary labeling, to attract consumers who are concerned about GMs. There are some non-GM labels sprinkled throughout the stores, but in baby food category the non-GM label is used in a relatively significant way. Non-GM labels are widely adopted in different brands, different packaging, and different categories of baby food. Earth's Best was the first brand that adopted non-GM labels. Happy Baby and Ella's Kitchen also used non-GM labels since their establishments. Plum Organics, at first, did not adopt the non-GM label, but finally adopted it in 2012. The interesting thing is that all the baby food brands that adopt non-GM labels already had an organic label. In other words, these baby food brands are "double labeled". If a product is organic, it is by default non-GM. However, evidence from the study by Hartman Group suggests that most consumers do not clearly understand the relationship between organic and non-GM. Therefore,

non-GM and organic label might be two independent labels for some consumers, and these "double labeled" baby food brands might create more incentives to buy among baby food consumers by including both organic and non-GM labels. It is interesting to see consumers' response to non-GM label, particularly when they lack understanding of GMOs. Besides the organic label and the non-GM label, another popular label on baby food packaging is the natural label. Some baby food producers used natural label as a substitute for the organic label. It is also interesting to see whether the natural label resonates with the baby food consumers.

One of the reasons that organic baby food has become more popular in recent years is that it has found the perfect partner: the food pouch. Food pouches are BPA-free plastic bags with little plastic spouts at the top from which baby food can be sucked. These pouches are shelf-stable, unbreakable, resealable and allow babies or toddlers to feed themselves through the spout. The pouch was introduced into the U.S. baby food market in 2008 by Neil Grimmer, who is the founder of Plum Organics baby food. This innovation has become very popular and helped fuel growth for all baby food companies. Plum Organics conservatively estimated that its sales of pouches for babies and toddlers reached $53 million in 2012 after introducing pouches

in 2008 (New York Times, 2012[1]). Recognizing the success of the food pouch innovation, other baby food companies have also jumped into the space. For example, Earth's Best reported its pouch sales a 372% jump in grocery store revenue in 2012; Gerber, the number one baby food company, also reported that its sales of new lines of pouches for babies and toddlers were growing at double-digit rates (New York Times, 2012). Although the pouch usually costs double the price of baby food in a traditional jar, consumers appear to prefer them and major retailers are increasingly placing them on their shelves. Because pouches are new, its effect on consumption has not been examined in baby food market or other food products. This study will investigate what premiums consumers are paying for pouches using a hedonic pricing model.

1.2 Problem Statement

The landscape of the baby food industry has evolved significantly in recent years. Demand for organic baby food continues to grow rapidly, and in addition, non-GM labels, and the new packaging innovation, pouch, are very popular among baby food consumers. Previous studies on baby food have been focused on determining the

[1] http://www.nytimes.com/2012/06/21/garden/food-pouches-let-little-ones-serve-themselves.html?pagewanted=2&_r=0

[2] http://www.hartman-group.com/publications/reports/organic-natural-2014

[3] New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont); Mid-Atlantic (New Jersey, New York, and Pennsylvania); East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin);

consumers' willingness to pay for the organic and other nutrition attributes. So far, consumer response to non-GM label and the pouch packaging has not been examined.

This study will contribute to the literature by examining the consumers' willingness to pay for the three attributes: the organic label, the non-GM label, and the pouch packaging. Additionally, in order to better understand baby food consumers, this study will further explore their demographic and socio-economic characteristics and purchasing behaviors by each of the three attributes. The research results should have important implications for retailers and producers in the baby food industry in the United States, as well as for emerging baby food markets in countries such as China.

1.3 Organization

This thesis proceeds as follows. Chapter 2 reviews literature about organic, GM, and packaging. Studies on organic baby food are emphasized. Chapter 3 describes and presents an initial analysis of the rich panel data used in this study. Models used for estimation are presented in Chapter 4. Chapter 5 presents the estimation result and discusses the implications of the results. Chapter 6 summarizes and gives recommendations for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 Consumer Demand for Food Attribute Labels

Driven by increasing consumer demand for healthier, safer, and more environmentally friendly food products, the use of food labels has become increasingly important in recent years. Mandatory labels such as nutrition labels have been investigated extensively. Previous studies (O'Sullivan, 1997; Wandel, 1997) show that nutrition labels have a positive impact on consumer purchase decision making. Wandel (1997) also pointed out that consumers were more content with the information they got about nutritional aspects, than with safety and environmental aspects of the food. The information about safety and environmental aspects of food can be provided by food quality or attribute labels such as organic label, and eco-labels. Unlike nutritional labels, which are mandatory, food attribute labels are voluntary, but they have been widely adopted in recent years. The food attribute labels allow firms to signal quality or the presence of specific desirable attributes, so that consumers might be willing to pay premiums for these labels (McCluskey and Loureiro, 2003). Brecard (2013) suggested that most consumers prefer a product with attribute labels over an unlabeled

one, but that consumers differ in their willingness to pay for attribute labels, mainly according to their socio-economics characteristics. Women, young people or parents are generally more interested in food attribute labels.

The proliferation of food attribute labels have induced consumer confusion and misperception about the real guarantees they provide (Brecard, 2013). Bonroy and Constantatos (2014) suggested that consumer misperception of the label's information may have three sources: complexity of the message, large number of closely-related labels, and potential misperception of the true risks/benefits related to the label-related product attribute. The information spillovers give firms an incentive to choose strategically among different labels, making learning about labeling more difficult for consumers (Harbaugh and Maxwell, 2011).

Labels are very important for baby food purchasers. Considering babies' fragile and developing digestive system, baby food purchasers usually pay careful attention on labels. Similar to other products, the proliferation of the labels on baby food has also brought consumer confusion and misperception. In this study, we will investigate consumers' response to different labels on baby food, such as non-GM label, organic label, and natural label.

2.2 Organic Labels

As consumers' interest in organic food has grown remarkably, consumers' response to organic food has been investigated extensively. Yiridow, et al. (2005) and Hughner, et al. (2007) separately provide excellent reviews of the previous studies on consumer preferences for, and attitudes toward organic food, relative to conventionally grown products.

Regarding the meaning of organic, both studies note that consumers interpret the term organic in a variety of ways and in a multitude of contexts. Because organic products are credence goods, consumers may not know whether a product is produced using organic methods, and perhaps not even after repeated purchase and consumption. Thus, consumer purchase decisions are based on subjective experiences and perceptions of organic foods, which makes consumer awareness and perception of organic foods very important.

Lack of consumer knowledge and awareness about organic products was considered the number one reason why consumers do not buy organic foods; 59% of respondents indicated that they never considered organic products because they did not know about them (Yiridow, et al., 2005). Previous studies showed that although

consumers typically understand the general issue associated with organic, many tend to be confused about the organic concept and even not recognize the symbol of the organic food standards regulatory body (Hill and Lynchehaun, 2002; Hutchins and Greenhalgh 1997; Wolf, 2002).

Consumer perceptions about organic food can influence their purchase decisions. In general, most studies reported that consumers purchase organic foods because of a perception that organic foods are safer, healthier and more environmentally friendly than conventionally produced alternatives. Food safety was reported as the number one quality attribute by consumers in some studies (Schifferstein and Oude-Ophuis, 1998; Goldman and Clancy, 1991), followed by concern for the environment (Gregory, 2000; Estes, et al., 1994).

Because some consumers generally perceive organic products to be superior to conventional products, they are willing to pay price premiums for organic products. There have been many studies examining organic consumers and about how the socio-economic and demographic factors influence their willingness-to-pay for organic products. Often the findings are contradictory, likely because the samples of the previous studies were generally limited to particular locations or food stores, but there

have been some generally consistent results across studies. Most studies report that income is not a significant variable or has small effect in explaining differences in the purchasing behavior of buyers and non-buyers of organic products. Most buyers of organic foods tend to be women, perhaps because they are usually the primary grocery shoppers in most households and consequently tend to be more informed about various labels used on food products (Yiridow, et al., 2005). Regarding age, most studies suggest a negative relationship between age and organic buying behavior. With respect to the presence of children/babies in households, Hill and Lynchehaun (2002) noted that families are often introduced to organic foods with the arrival of a baby.

All the findings from the previous studies on organic products can provide useful information for our study of organic baby food.

2.3 Non-GM Labels

One of the key areas of controversy related to genetically modified organism food (GM food) is whether these food products should be labeled. GM labeling is not required by the Food and Drug Administration in the United States, but there have been several efforts to pass GM labeling laws at the state level. Proponents of mandatory GM labeling cite the right to know what is in their food as an important

consideration in a democratic society. Opponents countered that GM labeling laws will confuse consumers with no improvement in food safety and also increase the cost of food (Alston and Sumner, 2012).

Many recent studies of GM labeling have been focused on the effects of mandatory GM labeling. Alston and Sumner (2012) explored the economic implications for the food industry if the proposed California GM food labeling initiative were adopted and found that mandated labeling would impose significant burdens on consumers, farmers, the food industry, and the environment, both inside and outside California. At the same time, the mandated label would not provide any meaningful information regarding human health and environmental safety, nor would it provide greater choice for consumers.

Mandatory labeling would increase costs for producers, which would then be passed along to consumers. Despite this potential for price increases, some consumer advocacy groups believe that providing information is a good thing and that consumers have a right to know about the food they buy. Consumers have developed misperceptions regarding the risks of biotechnology, according to the testimony of David Just (2014) before U.S. House of Representatives Committee on Agriculture.

The misperception is perhaps because industry has focused on marketing the benefits of growing these crops to farmers, leaving consumers with a latent understanding of why genetic modifications are introduced into the food supply to begin with. Without direct explanations of the benefits and risks (or lack thereof) of GM foods, people are uncomfortable with the technology and this feeds the controversy around labeling.

Many studies have examined consumers' attitudes towards GM foods and GM labels, and consumers' willingness to pay for non-GM foods. Banterle, Cavaliere, and Ricci (2012) analyzed which kinds of currently labeled information are of interest and actually used by consumers. Based on their results from focus groups and surveys involving 240 consumers, among the currently available labelled information on food products, consumers showed the highest interest towards origin of product and presence or absence of GMs. Li, McCluskey, and Wahl (2004) studied consumers' attitudes towards GM-corn-fed beef and found that 90% of consumers in the survey agreed that GM-corn-fed beef should be labeled. Their results also showed that GM labels could cause consumers to avoid GM products if stores do not offer a small discount. Lusk et al. (2005) conducted a meta-analysis using 25 studies which estimated consumer demand for genetically modified food. The results revealed that

consumers worldwide are averse to GM foods and are often willing to pay to have non-GM rather than GM food. Across all studies, consumers on average placed a 42% (unweighted average using all data) to a 23% (weighted average excluding one outlier) higher value for non-GM food relative to GM food.

These studies clearly show that consumers are concerned about the presence or absence of GM components in food. Likewise, food consumers in our study are expected to look for the information about GM on baby food packages. Considering that parents might be more cautious about what they feed their babies, they might be willing to pay higher premiums for non-GM labeled baby foods than other consumers. Therefore, it could be very interesting to investigate whether and how much the households in our study are paying a premium for non-GM labels.

Many consumers do not fully understand the meaning of non-GM and organic, and the relationships between them. Consumers interested in non-GM foods tend also to be interested in organic foods. Therefore, when studying consumers' willingness to pay for non-GM foods, presenting organic option simultaneously can accurately reflect market conditions. Many studies have been carried out on consumers' willingness to pay for non-GM and organic, and the relationships between them.

Loureiro and Hine (2002) used contingent valuation techniques to determine consumers' value for three attributes of potatoes: organic, GM-free, and Colorado-grown. Their findings showed that 47% of respondents were willing to pay higher price for GM-free, and 58% were willing to pay a premium for organic. Bernard and Gifford (2006) researched consumer willingness to pay for organic and non-GM foods relative to one another and to conventional foods through auction experiments involving the three versions (organic, non-GM, and conventional) of potato chips, tortilla chips, and milk chocolate with 79 subjects. Their results suggested that significant premiums exist for both non-GM and organic versions of foods compared to conventional, with the largest for the organic versions.

Non-GM is actually only one of the requirements of organic, and the other components of organic attributes include pesticide-free, and fertilizer free. The previous studies did not specifically treat non-GM as a component of organic. Bernard and Bernard (2010) examined the value of organic as a whole compared to the value of its component parts including non-GM and pesticide-free. Here they examined demand relationships and WTP for potatoes and sweet corn in four versions: conventional, organic, pesticide-free and non-GM, the latter two being individual

attributes of organic. The results suggested that consumers were willing to pay significant premiums for organic and its component attributes (pesticide-free and non-GM) over conventional versions for both potatoes and sweet corn. When comparing the organic with its component attributes, the sum of the premiums for the pesticide-free and non-GM was close to the premium for organic. This suggested that non-GM and pesticide-free together were the two most important attributes of organic in the respondents' eyes. Bernard and Bernard (2010) explained that while it cannot be said that the remaining parts of organic hold no value to consumers, their findings suggested that either the remaining parts' value within the bundle was limited or that substitution possibilities were very important in WTP estimates.

Despite the widespread controversy over GM foods, or perhaps because of it, a lot of consumers are still confused about their labels. Both GM/non-GM labels and organic labels have induced consumer confusion and misperception. Non-GM is one of the requirements of organic, so organic food is by default non-GM food. However, a lot of consumers actually do not understand the meaning of organic label and non-GM label, as well as the relationship between them. Conner and Christy (2004) conducted experiment auctions and surveys with 123 organic food consumers to see if

they were aware that GMs are not allowed in organic production. They found that only 53% of participants knew that organic already implies GM-free. The auction also demonstrated a WTP for the GM-free label on the organic foods among participants. A study by Hartman Group[2] (2014) also showed that very few of those they define as the Core Organic and GM-Averse consumers understand that USDA organic products do not contain GM ingredients. Specifically, only 9% of GM Averse consumers and 8% of Core Organic consumers correctly stated the relationship between organic and non-GM.

In the baby food industry, some companies, including Gerber, the largest baby food company, use only the organic label and not the non-GM label on its packages. On the other hand, other companies such as Earth's Best puts non-GM label along with the organic label on their packages. It raises interesting questions as how households value the two different labels, and whether they are clear about the meaning of them and the relationship between them. This study will attempt to address this issue by analyzing consumers' willingness to pay for different labels on baby food.

[2] http://www.hartman-group.com/publications/reports/organic-natural-2014

When investigating consumers' acceptance of GM foods and consumer willingness to pay for non-GM foods, previous studies generally examined the effects of socio-demographic variables (age, race, education, income, etc.) and cognitive variables (opinions, beliefs, knowledge).

Baker and Burnham (2001) demonstrated that gender, age, income, and high school education were not significant factors in explaining consumer purchasing decisions. However, the cognitive variables, including the respondents' level of risk aversion and opinions regarding GM foods, were strong indicators. Consumers with relatively high aversion to risk were dubbed "safety seekers" and rejected GM foods.

Loureiro and Hine (2002) suggested that age had a negative relationship with WTP for GM-free potatoes, which meant that elderly consumers placed greater trust in food safety and had lower WTP for GM-free potatoes. Subjects with high income and high education had and increasing WTP for GM-free potatoes.

Grimsrud et al. (2002) analyzed factors affecting consumers' willingness to accept discounts to purchase GM-foods. The results interestingly showed that people with high self-reported knowledge were less likely to purchase GM foods, but higher education may increase consumers' willingness to purchase GM foods. This may

indicate that the self-reported knowledge has been obtained from sources that are negative towards GM foods, but higher education level might increase consumers' understanding of biotechnology and GM foods.

Bernard and Gifford (2006) did not find that age, income, or gender affected WTP for non-GM food. However, education and the presence of children under 18 positively affected WTP for non-GM foods. Two education variables were included in the model and they had opposite effects on WTP. Specifically, college education increased WTP, but postgraduate education decreased WTP for non-GM over conventional. Consistent with Grimstrud et al (2002), Bernard and Gifford (2006) suggested that better educated consumers would be less concerned with GM foods. The other significant demographic variable, the presence of children under 18 in the household may increase consumers' willingness to pay for non-GM over conventional.

Meanwhile, other studies showed that consumers with a higher level of education might be willing to pay higher premium for non-GM foods. Kaneko and Chern (2005) investigated consumers' willingness to pay for non-GM foods using a U.S. national telephone survey. Their results demonstrated that higher education, the presence of children, the level of information, and the regional dummy for the

Northeast had a positive effect on the non-GM premium, contradicting results discussed previously.

It's equally plausible that consumers with higher education understand GM better and therefore accept it or that higher education increases their ability to afford to a "play it safe" strategy and avoid GM foods. The true relationship remains an empirical question.

All the previous studies on GM food used data from experiments, surveys, or focus groups. Our study differs in that actual purchase data is used, which may better reflect consumers' true willingness to pay for non-GM label. In addition, baby food products are one of the few food products in the United States that show relatively widespread adoption of non-GM labels, which makes baby food a great study subject. Therefore, our study will contribute to both non-GM labeling literature and the demand for baby food literature because no study has examined the effects of non-GM label on baby food purchases.

2.4 Organic Baby Food

Organic food has been investigated extensively, but there have been only a few studies specifically focused on organic baby food. Harris (1997) first studied the premiums

consumers paid for organic baby foods in 1997. There was no national definition of organic foods at that time, and Earth's Best was the only national brand of organic baby food sold in the United States, using its own certification program. Harris (1997) used a hedonic pricing model based on a characteristics demand model where the price of baby food can be decomposed by the food's different attributes such as organic, and content of protein, iron, fat, and fillers. Supermarkets were the primary retail outlet for baby foods in the United States, so scanner data were used for the study. Harris claimed that actual purchase data provide objective valuation of consumers' preferences, whereas focus groups or surveys provide subjective valuation of product attributes.

The results showed that consumers paid a premium of 21 cents per jar (the size of a jar of baby food normally ranges from 2.5 to 6 ounces) for the organic attribute, which was the most important one. There were also other significant attributes but these were associated with smaller premiums: consumers were willing to pay 0.7 cent per jar for an additional gram of protein and 0.1 cent per jar for an additional percentage of Recommended Daily Allowance (RDA) of iron in baby food. Consumers also would like to pay a 2.7 cents per jar for no fillers and 0.7 cent for 1

gram less fat. Harris (1997) suggested that the above attributes are the important ones that were relevant to consumers' purchase decisions. Consumers were willing to pay for organic products as they were interested in reducing potential health risks from exposure to pesticide residuals, or to have what they perceived to be a better taste and nutrition.

Harris (1999) examined the relationship between processed baby food consumption, awareness and attitudes concerning food safety and nutrition, and socioeconomic factors such as income, education, race, and whether the household was participating in the Women, Infants and Children (WIC) program. Parents were cautious about the food for babies, so their attitudes and awareness concerning the baby foods would play important roles in processed baby food consumption. The data that make the study possible are the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and the 1994-96 Diet and Health Knowledge Survey (DHKS), both of which were conducted by USDA. They provided information about food and nutrient intakes for individuals in the U.S. households, and information about consumers' attitudes and knowledge concerning nutrition, diet and health.

The results indicated that households that were most concerned about food safety consumed less processed baby food. More highly educated meal planners purchased 19.52 grams per day less baby food for each additional year of education. This was probably because higher educated meal planners might be more aware of publicized safety concerns regarding baby food and might have a higher propensity to translate negative health and safety information into reduced consumption. All the significant socioeconomic factors affected the processed baby food consumption as hypothesized: Unemployed meal planners were found to purchase 162.08 grams per day less baby food; higher income households consumed more processed baby food; households in the WIC program also consumed 230.57 grams less baby food per capita than other households because they may be using more infant formula and are restricted of which types of baby food they can consume under the program.

Thompson and Glaser (2001) analyzed the trends in consumption of organic and conventional baby food during the 1990's by estimating key price elasticities using two national scanner data sets: ACNeilsen from 1988 to 1996 and Information Resources, Inc. from 1996 to 1999. The own-elasticities of organic baby foods were large in absolute value, suggesting that decreases in price of organic baby foods could

result in large increase in organic baby food purchases. These absolute value of own-elasticities of organic baby foods declined over the years, which emphasized the fact that as market shares of organic baby foods increase, any reductions in price would have relatively less effect on aggregate purchases. By contrast, price changes in conventional baby food would have little effect on conventional baby food purchases. On the other hand, cross-price elasticities estimates indicated that any price increase for organic baby foods would no largely affect current purchasers while increases in the prices of conventional baby foods had significant effects in spurring consumers to purchase organic baby foods. The reason might be the small minority who were repeat purchasers of organic baby foods had viewed organic prices as high and had decided to purchase organic baby foods despite their relative high prices. These purchasers probably face less constraining budgets or have strong preferences for organic baby foods relative to conventional baby food products.

Maguire, Owens, and Simon (2004) used a hedonic model to estimate the price premium associated with organic baby food. Unlike the previous studies using only scanner data from the large grocery store chains, they collected data from two cities (Raleigh, North Carolina, and San Jose, California) which included all sales venues—

from upscale markets to convenience stores—thus providing a more complete representation of the market for baby food.

Regarding the variable of ultimate interest, the organic attribute, the results indicated that consumers were willing to pay a price premium of 3 cents to 4 cents per ounce more, or 10 cents to 15 cents per jar (approximately 16 to 27%) for organic baby food as opposed to conventional baby food. The other characteristics were also found to be significant factors in determining the prices consumers paid. Among the three primary brands of baby food, Gerber prices were consistently the highest, ranging from 1 cent to 10 cents more than Beechnut. Heinz products had varying prices across the samples. The multi-pack result was contrary to the expectation that multi-pack jars would be consistently priced lower than single jars to reflect volume discounts. Instead, jars sold in multi-packs were priced differently depending on the store type and location. As for the store type, prices were higher in small grocery stores and convenience markets, as expected, given that these stores do not enjoy economies of scale. Prices were lower in ethnic markets in San Jose, where these types of markets tend to be large stores catering to a particular ethnic population, and affording them the economies of scale.

In Maguire, Owens, and Simon (2004), baby food is categorized into three stages: stage 1, 2, and 3, which are made with different textures and different ingredients, in different sizes, for babies from 4 months to 12 months. The result indicated that the prices were 5 cents to 18 cents per jar higher for stage 1, and 4 cents and 8 cents per jar higher for stage 2, compared to stage 3, which were likely to have the most substitutes. The primary reason was that the cost per jar of producing a lower stage baby food was higher.

There have been several studies confirming the presence of considerable price premiums for organic baby food. However, Maguire, Owens, and Simon (2006) note that few analyses have explicitly examined the motivation behind these purchases. They explored perceptions and attitudes toward organic baby food through focus group discussion with parents of young children. 10 focus groups discussions were conducted in five cities (San Jose, CA, Baltimore, MD, Philadelphia, PA, Richmond, VA, and Washington, DC); each group comprised of six to nine participants. Participants were asked their opinions about the meaning of an organic label, health risks from the food supply and baby food, and for those who chose organic baby food, the questions related to the reasons behind the purchase decisions were asked.

Approximately 83% of participants fed their babies jarred baby food, and most of them used jarred baby food as the primary means of feeding their babies solid foods during the first year of life. They felt the risks posed by jarred baby food were negligible. Some of them perceived jarred baby food to be safer than the general food supply because they trusted the use of special processing techniques to manage the risk of bacteria, reduce preservatives, and an overall greater level of monitoring. Those who chose not to use jarred baby food reported doing so to avoid chemicals, preservatives, and fillers, or because of cost and convenience. Regarding organic baby food, for those participants who chose organic baby food for their babies, pesticide-free farming methods were an important part of their purchasing decisions. They were more concerned about the food safety consideration given that the food-to-consumer weight ratio in babies is relatively high. The other reasons for purchasing organic baby food were that parents thought the flavors of organic baby food were interesting, or they had a coupon to try a particular brand. For participants who chose organic baby food exclusively, their choice was motivated by the health risk reductions.

LeBeaux (2008) investigated the important consumer characteristics that are associated with organic baby food consumption and their effects on consumption of

organic baby food. A two-stage switching regression method was undertaken: the first step employed a probit procedure to estimate the probability of an individual purchasing organic rather than conventional baby food; and step two utilized OLS regression to evaluate organic baby food consumption. The data used in estimation was Nielsen Homescan 2005 which contained both baby food purchasing information and the information about the household characteristics.

Results from the probit analysis revealed that price had a significant and inverse impact on the likelihood of the household to purchase organic, as expected. The OLS results showed that price had a significant and inverse effect on the quantity of organic baby food consumption, but it did not have a significant effect on conventional purchases. This result matched that of Thompson and Glaser (2001) which showed that organic baby food purchases were highly sensitive to the price of organic baby food, but conventional baby food purchases were found not price sensitive. Income was not found to be a significant factor both in the likelihood of purchasing organic baby food and in the quantity of baby food purchased. LeBeaux (2008) stated that it is because baby food is only likely to account for a very small portion of a household's food expenditures. The other socioeconomic variables

included race, age, and education. Regarding race, Hispanics were most likely to consume organic baby food. With regard to education, if the household head had attained 'some college' education, the households was more likely to purchase organic baby food than households with a head that attained a college degree or higher. Household heads aged 25 to 44 purchased more organic baby food than those aged 55 year old or older.

Smith, Huang, and Lin (2009) estimated a hedonic pricing model to investigate price premium and discounts associated with household characteristics, market factors, and product attributes for baby food. The data source of the study was also Nielsen Homescan data. The years 2004 and 2006 were analyzed to test for significant price movements among each characteristic. The results indicated that household characteristics exert little influence on the price of baby food relative to market factors and product attributes. The price of baby food was generally at its lowest in the Southern region of the United States, and at its highest in the West and Northeast. Because baby food products were mostly jarred in this sample, the prices were quite stable across time and geographical regions. Therefore, the estimated price differences were small – less than one cent per ounce. Regarding store format and promotional

offerings, baby food tended to be priced higher in a convenience store and lower at a discount store (supercenter or club warehouse). Baby food under a promotion (store promotion or coupon use) was discounted substantially below the regular price. All of the product attributes were significant at the 1-percent significance level. Vegetable baby food maintained the lowest price, while baby food sold as dinners commanded the highest price. The results suggest that the organic premium was 1.64 cents per ounce in 2004 and 3.49 cents per ounce in 2006. The interaction variables of organic and product category enable us to test for significant price differences among the organic products. The result shows that organic fruit baby food receive the highest price and organic vegetable baby food was the second highest priced baby food product.

2.5 Packaging

There have been many studies investigating the effects of a package shape (Raghubir and Krishna 1999), size (Coehlo do Vale, Pieters, and Zeelenberg 2008; Argo and White 2011), image (Madzharov and Block 2010), and packaging transparency (Deng and Srinivasan 2013) on food consumption or sales. Few studies investigated the factor of the convenience of packages.

Raghubir and Krishna (1999) examined biases in the perception of volume due to container shape. Through a series of laboratory experiments at Hong Kong University, the results revealed that generally participants perceive more elongated packages to be larger. Specifically, they demonstrated that the elongation of an empty glass positively influences the perceived capacity of that glass; the elongation of the prepoured drink inside glasses positively influences the perceived volume of that prepoured drink.

Package's size can affect the food consumption. Coehlo do Vale, Pieters, and Zeelenberg (2008) investigated the effect of package's size on consumption of hedonic tempting products. Unlike utilitarian products, hedonic products trigger an urge for immediate consumption that needs to be restrained. The results demonstrated that when consumers have self-regulatory concerns and products are tempting, small packages can paradoxically increase consumption, and large packages can lead to lower rather than higher quantities consumed. The reason is when self-regulatory concerns were activated, consumers deliberated the most before deciding to consume, were least likely to consume, and consumed the least of tempting products from large package formats. Argo and White (2011) further explored the conditions under which people overconsume when they have access to multiple small packages. The results

suggested that people low in appearance self-esteem (ASE) are particularly sensitive to external control properties (e.g. packaging-related factors that signal the ability of packaging to regulate food intake such as visibility of the product quantity, location of the caloric content, and communicated caloric content). Specifically, low-ASE people consume the most when making the product quantity visible (as opposed to not visible), or when caloric information is on the front compared with on the back or not available.

Madzharov and Block (2010) examined how the number of product units displayed on packaging affected consumer perceptions of product quantity and consumption. They demonstrated an anchoring bias such that more product units on the package lead consumers to believe that there is more of the product inside the package and to find the product more attractive.

Deng and Srinivasan (2013) examined the effects of transparent packaging on food consumption or consumers' perception. They proposed that transparent packaging has two opposing effects on food consumption as it enhances food salience, which increases consumption (salience effect), and facilitates consumption monitoring, which decreases consumption (monitoring effect). The net effect is moderated by food

characteristics such as size, and appearance. Deng and Srinivasan (2013) suggested that for small, visually attractive food, the monitoring effect is low, so the salience effect dominates and people prefer transparent packaging over opaque packaging. For larger food items, the monitoring effect dominates and people prefer opaque packaging.

New technology has brought consumers new packages. Nanotechnology was one of the latest controversial and new innovations working its way into the food system. Katare, Yue, and Hurley (2013) examined how nano packaging designed to enhance shelf-life for food affected consumer willingness to pay for perishable products. Their results suggested that most participants of the experiments perceived nano-packaging as adding value to the product, and consumer preference and WTP for nano-packaged food products varied by products. Consumers were more willing to pay a premium for the shorter shelf-life products such as salad and fresh produce in nano packages. It was also worth noting that participants were willing to pay a premium for organic nano-packaged food products compared to the conventional, which suggested that many consumers would still value organic products more even if they were packaged using nanotechnology.

Few studies have examined how the convenience of packages affected the consumption and sales. Silayoi and Speece (2004) discussed how consumers responded to convenience products in two focus groups. When asked about convenience products such as quick meal or microwave food, respondents that did not work mostly avoided them, perceiving them to be less healthy. On the other hand, respondents that work often purchased microwave food, which they found convenient and reliable. They indicated that those brands were well known.

As more new packaging innovations emerge in baby food industry, they will influence consumers' purchase decisions. Traditionally, baby food was packaged in glass jars, and then rigid plastic tubs became popular because of the reduced weight and lower cost. These two packaging methods made up the vast major of all baby food sales. However, after the invention of the stand-up pouch several years ago, the landscape of baby food market has dramatically changed. This study will contribute to the literature that studies the demand for baby food by examining consumers' willingness to pay for the new convenient portable pouch.

2.6 Purpose of Study

This thesis makes several contributions to the literature. First, many previous studies used samples from particular locations or stores, which generate results which may not apply to the entire baby food market. This study uses 2011 Nielsen Homescan data which are provided by 60,000 panelists. Because the panel is geographically and demographically balanced, we can treat it as representative of the U.S. population. Second, the demand for the non-GM label has not been investigated in previous studies of baby food. Currently more than half of the baby food brands use non-GM label and it might significantly influence consumers' purchasing behavior. Third, no previous work in this area has studied the effect of packaging, which is a crucial factor. The introduction of the conveniently packaged pouch in 2011 has transformed the landscape of the baby food market. This study will investigate the effect of the pouch. In addition, in order to better understand baby food consumers, this study will further explore the characteristics of consumers of organic baby food, non-GM baby food, and pouches by looking at their demographic and socio-economic characteristics, and purchasing behavior.

CHAPTER 3

DATA AND DESCRIPTIVE ANALYSIS

3.1 Data Source and Structure of Data

The primary data used in this study are the Nielsen Homescan (NH) data, collected from 2008 to 2011 in approximately 60,000 households using in-home scanners to record all purchases from any channel, including grocery stores and online shopping. The Nielsen sample includes respondents in all states and major markets. Panelists are geographically dispersed and demographically balanced. Each panelist is assigned a projection factor, which enables purchases to be projectable to the entire United States, however I do not use the projection factors in my analysis. In addition to the product attributes, NH data also provide the purchasing information, retailers' information, and demographic and socio-economic information about the households. In this study, there were 4448 households that purchased baby food in 2011.

There are five different categories of baby food in the NH dataset: strained baby food (primarily pureed fruits, vegetables, and meat for babies from about 4 to 9 months), junior baby food, baby cereal/biscuits/snacks, baby juice, and baby milk and milk formula. The shares (unit sales) of the five categories of baby food did not change significantly from 2008 to 2011. As shown in Figure 3.1, strained baby food

was the top seller, and on average represent about 60% of all baby food sales. Junior baby food and Baby Cereal & Biscuit comprised 18% and 11% of baby food sales respectively. Baby milk and milk formula, which were traditionally important baby food products, composed only 7% of baby food. The small share is due to the relatively large size of each milk formula product, wheras the other categories are smaller typically consumed in one meal. In this study, strained baby food, the top seller, is the focus of the research.

In addition to the interesting variables provided in the NH dataset, we also collected data on non-GM labels and natural labels on baby food packages. The methods of collecting these two variables was to request the information from the baby food companies and use Google to look up the pictures of the baby food packages between 2008 and 2011. Non-GM labels are usually on the back of packages. The examples of non-GM labels are: “No GM”, “No GEI”, “No Genetically Engineered Ingredients”, and “No Genetically Modified Objects”. Natural labels are usually on the front side of packages. The most common example is All Natural.

3.2 Market Size and Number of Births

Before using NH data, it is necessary to verify that it is a good dataset that can reflect the situation of the actual baby food market in the United States. One way we can verify this is to compare both the actual market size and the total number of births with the NH data to see if they are showing similar trends. According to National Vital Statistics Reports (2007 to 2011), the number of births reached to a peak in 2007 and started to drop in 2008 because of the recession, and the decline lasted to 2011. The number of households that purchased baby food in NH also decreased slightly from 2008 to 2011. Figure 3.2 shows that the actual number of births and the number of households that purchased baby food in NH have the similar declining trend from 2008 to 2011. Because of the declining baby population, the market size for baby food in the United States also dropped from $6.65 billion in 2008 to $6.13 billion in 2011, according to Euromonitor International database. In NH, the total dollar sales of baby food dropped from $729,808 in 2008 to $514,336 in 2011. Although the dollar sales of NH had a larger proportion decrease than the actual market, Figure 3.3 shows that the trend of the baby food sales from the NH data and the actual market are generally

similar. Therefore, the NH data provides a reasonably good representation of the situation of the actual baby food market in the United States.

3.3 Organic baby food

3.3.1 Shares of Organic

Organic baby food became more popular in recent years. As can be seen in Figure 3.4, organic baby food unit sales made up 13% of all baby food sales in 2008 and the share increased to 16% in 2011. The dollar sales of organic baby food also showed the same trend. The dollar sales of organic baby food in 2008 was about 6% of all baby food sales and this increased to about 10% of total sales of baby food in 2011. Within the organic baby food category, on average, 77% of total unit sales are strained baby food (Figure 3.5). This is another reason why strained baby food is the focus of this study.

Figure 3.6 shows the composition of different types of strained baby food from 2008 to 2011. Organic strained baby food are primarily yogurt, fruits, dinners (combinations of fruits, vegetables, and grains.), and vegetables. They together comprised more than 90% of organic strained baby food. Organic fruit baby food and organic dinner baby food became more popular compared to organic yogurt in recent years, and the market share of organic vegetable baby food was relatively stable.

3.3.2 Price Premiums of Organic Baby Food

Within strained baby food, fruit, vegetable, and dinner are the main categories which are all produced in both organic and conventional formats. Baby Food yogurt is produced often sold as organic, and other categories such as meat are produced mainly as conventional products. When comparing prices of organic and conventional strained baby food, it makes more sense to compare the categories that are both commonly produced in organic and conventional, which are fruit, vegetable, and dinner. As shown in Figure 3.7, the prices of these categories as organic products are all higher than $0.20 per ounce, and the prices of the conventional version are all lower than $0.15 per ounce. Therefore, the prices of organic strained baby foods are significantly higher than the conventional.

3.3.3 Organic and Purchasers' Age

Organic purchases might be affected by purchasers' characteristics such as age, education, and income. Organic is a relatively new concept especially for baby food. Young parents might be more likely to hear about organic food, and they are also more likely to try new products like organic baby food. Figure 3.8 provides data that

shows that the average age of individuals purchasing organic baby food were always lower than those purchasing conventional baby food products between 2008 to 2011.

3.3.4 Organic and Purchasers' Education Level

The education level of the primary shopper might affect organic baby food purchases. Consumers might develop stronger perceptions about the health benefits of organic food when they have higher education. Although the health benefits of organic food are still controversial, organic foods are perceived by most consumers as healthier than conventional foods, especially for babies who are more vulnerable to toxins in their diets. With higher education, consumers are also more likely to develop perceptions about the other positive benefits of organic food.

In Nielsen Homescan, 21.16% of primary shoppers received post-graduate education; 64.05% of primary shoppers received college/university education; and the remaining (14.80%) primary shoppers received high-school education or less. Consumers with different education levels were showing different levels of interest in organic baby food. As can be seen in Figure 3.9, baby food purchased by consumers with high-school education was nearly 10% organic.. For the consumers who received college education, 20% of their baby food purchases are organic, which is double that

of consumers with a high-school education. Consumers who received post-graduate education showed the strongest interest in organic baby food. Nearly a quarter of their purchases are organic baby food. It is not clear if this is solely an effect from education, or if it is also related to income as income and education are highly correlated.

3.3.5 Organic and shopping channels

The shopping channels that consumers primarily purchased baby food are grocery stores (58%), and discount stores (33%). Of baby food sold in grocery stores, 20% is organic, and 13% in discount stores is organic. Even though the other types of channels are not as important as grocery stores and discount stores, they should not be ignored. One reason is that consumers appear more likely to buy organic baby food in some of the specialty stores such as toy stores, and apparel stores. As shown in Figure 3.10, 78% of baby food sales in apparel stores are organic, and 82% of baby food sales in toy stores are organic. These percentages are dramatically higher than the other stores, including grocery stores and discount stores. One possible reason is that consumers shopping in apparel stores and toy stores have high income, which can be seen from Figure 3.11. It may also be possible that these retail outlets offer a greater

relative selection of organic baby food products as a way to send a status signal to their consumers.

3.4 Non-GM / "Double Label"

3.4.1 Sample Shares of Non-GM

The USDA organic seal verifies that irradiation, sewage sludge, synthetic fertilizers, prohibited pesticides, and genetically modified organisms were not used. So if a product is organic, it is by default non-GM. However, a lot of consumers do not clearly understand the relationship between organic and GM free, and some baby food brands include both the organic and non-GM label on their products. Such "double label" practices were adopted by more and more baby food brands in recent years. In the Nielsen Homescan data, the percentage of baby food labeled non-GM increased from 3% in 2008 to 6% in 2011. And for the three main categories (dinner, fruit, and vegetable), the share of non-GM baby food increased from 4% to 8%. Therefore, more consumers became interested in non-GM baby food. Larger companies do not do it perhaps because it would likely represent a large cost to them to procure non-GM ingredients.

3.4.2 Price Premiums of non-GM

Similar to organic, the main baby food categories labeled non-GM are dinner, fruit, and vegetable. Prices of conventional and non-GM baby food products are compared in Figure 3.12. It is obvious that non-GM baby food were much more expensive than the conventional from 2008 to 2011. The price premiums of non-GM label are all about $0.50 per ounce, or in the other word, non-GM baby food are 33% more expensive than conventional baby food products.

The interesting thing is that many of the non-GM baby food in the United States also have organic labels. Non-GM is one of the requirements of being organic, so these baby food brands are “double labeling” their products. On the other hand, there are some baby food brands that only have organic labels. Comparing the prices that consumers paid for non-GM and organic labelled baby food with the just organic labelled baby food would be very interesting. As shown in Figure 3.13, the price of the non-GM baby food was a little bit lower than baby food with only organic label in 2008 and 2009, but the non-GM baby food became more expensive than the organic baby food since 2010, and the price difference became larger in 2011. Given that more

baby food brands started to use the non-GM label after 2011, it is very likely that consumers become more interested in non-GM baby food also.

3.4.3 GM Free and Purchasers' Education Level

Unlike organic food, GM food has been rejected by some consumers because they worry that GM foods are unnatural and unsafe. On the other hand, many studies have been done to prove that GM food is safe and can lower the cost of food production. With higher education, consumers are likely to hear more about GM food. Some of these consumers might understand and accept GM food; some other consumers might remain opposed to the GM food to avoid any possible side effects. It is hard to tell the response to the GM-free label among consumers with different levels of education without looking at their actual purchases. It may also depend on the type of education that consumers have received (i.e. what subjects they studied in college)

In the Nielsen Homescan dataset, the percentages of non-GM labelled baby food purchased by consumers with different levels of education are shown in Figure 3.14. The percentages of consumers who have high-school, college, and post-graduate education are 21.16%, 64.05% and 14.80% respectively (averaged between 2008 and 2011). For consumers who have a high-school education, the share of their non-GM

baby food purchases increased steadily from 1.6 percent in 2008 to 3% in 2011. Compared to them, the consumers with college or post-graduate education showed stronger interest in baby food with non-GM label. The share of non-GM baby food purchases of consumers with a college education increased from 3.67% in 2008 to 6.11% in 2011. For consumers with post-graduate education, their non-GM baby food purchases increased from 4.82% in 2008 to 8.65% in 2011. Unlike the purchasing of organic baby food, of which consumers' interest did not significantly increase from 2008 to 2011, the shares of consumers purchasing non-GM baby food increased dramatically from 2008 to 2011, which can be seen in Figure 3.14. Thus, based on this trend, it is obvious that non-GM labels have become more popular among food retailers and baby food consumers.

3.5 Natural Label

Several baby food brands use a "natural" label on their products. Unlike organic and non-GM, the natural (except for meat category) is not defined by any U.S. government agency; instead, the meaning of natural is largely up to food manufacturers. Whether consumers in the baby food market understood and were willing to pay premiums for the natural attribute is an interesting question that can be assessed using the NH data.

Based on the Nielsen Homescan dataset, natural labels were primarily used among dinner, fruit, and vegetable of baby food. And unlike the relationships between non-GM and organic, the natural label is more likely a substitute for the organic label. Figure 3.15 compares the prices per ounce that consumers actually paid for the baby food products with different labels. The price consumers paid for the organic label was higher than baby food with the natural label and conventional, which is as expected. On the other hand, interestingly, the price consumers paid for baby food with a natural label was the lowest; it is even lower than the conventional baby food which has no special label at all. Even though the price consumers paid for baby food with a natural label is increasing slowly overtime and getting close to the conventional price, it appears that the natural label did not provide consumers in baby food market with adequate incentives to buy the product.

3.6 Pouch Packaging of Baby Food

3.6.1 Unit Sales of Pouches

Baby food packaging has experienced massive changes in the past several years in the United States. Historically, glass jars and rigid plastic tubs have made up the vast majority of overall unit sales of strained baby food. After the introduction of baby

food pouches around 2009, they instantly caught on in the United States and their market shares grew.. Figure 3.16 shows the unit sales of the three main types of packaging of prepared strained baby food in past several years. Glass jars and pouches are primarily only used in strained baby food, but rigid plastic tubs are also used in formula and baby juice, which is why their sales were much higher than the other two package types. Within prepared baby food, the market shares of tubs and glass jars were very similar before 2009. After 2009, the unit sales of pouches have been increasing exponentially, and the market share for pouches was close to that for glass jars in 2013.

In Nielsen Homescan dataset, there were four main types of baby food packaging: glass jar, tub (rigid plastic), pouch, and envelope. Envelope is actually one type of pouch where the packaging closure is a zip lock closure instead of plastic screw closure. The unit sales of pouches in the Nielsen Homescan data increased from 0 in 2008 to 1538 in 2010 and 4770 in 2011, which were 0.8% and 2.6 % of total unit sales of strained baby food in 2010 and 2011. The increase in sales was not as remarkable as what occurred in the actual market, but the general increasing trend is consistent with trends in the marketplace.

3.6.2 Price of Pouches

Figure 3.17 shows the price that consumers in the Nielsen Homescan data paid for per ounce of strained baby food in different packaging types. The price per ounce of baby food in pouches was the highest, which was about the double the price of baby food in rigid plastic tubs and glass jars. This is the same situation in today's supermarket. The price of baby food in envelopes ranked second after pouch packaged food, and the price decreased from 2010 to 2011. In 2012, the baby food company which used envelope packaging changed to pouches. Therefore, based on figure 3.17, it is obvious that consumers were willing to pay high premiums for pouches.

3.6.3 Pouch and Purchasers' Age

Pouch is a more convenient product to use, and regarded as safe (it uses BPA free materials compared with glass jars and rigid plastic tubs, but it is not recyclable). These attributes may influence the relationship between sales and purchasers' characteristics, such as age. Different ages of purchasers might have different recycling habits, and different interests in new products. As shown in Figure 3.18, the average age of consumers that purchased the pouch were relatively low compared to

consumers of glass jars and rigid plastic tubs. Therefore, pouches seemed more popular among young consumers.

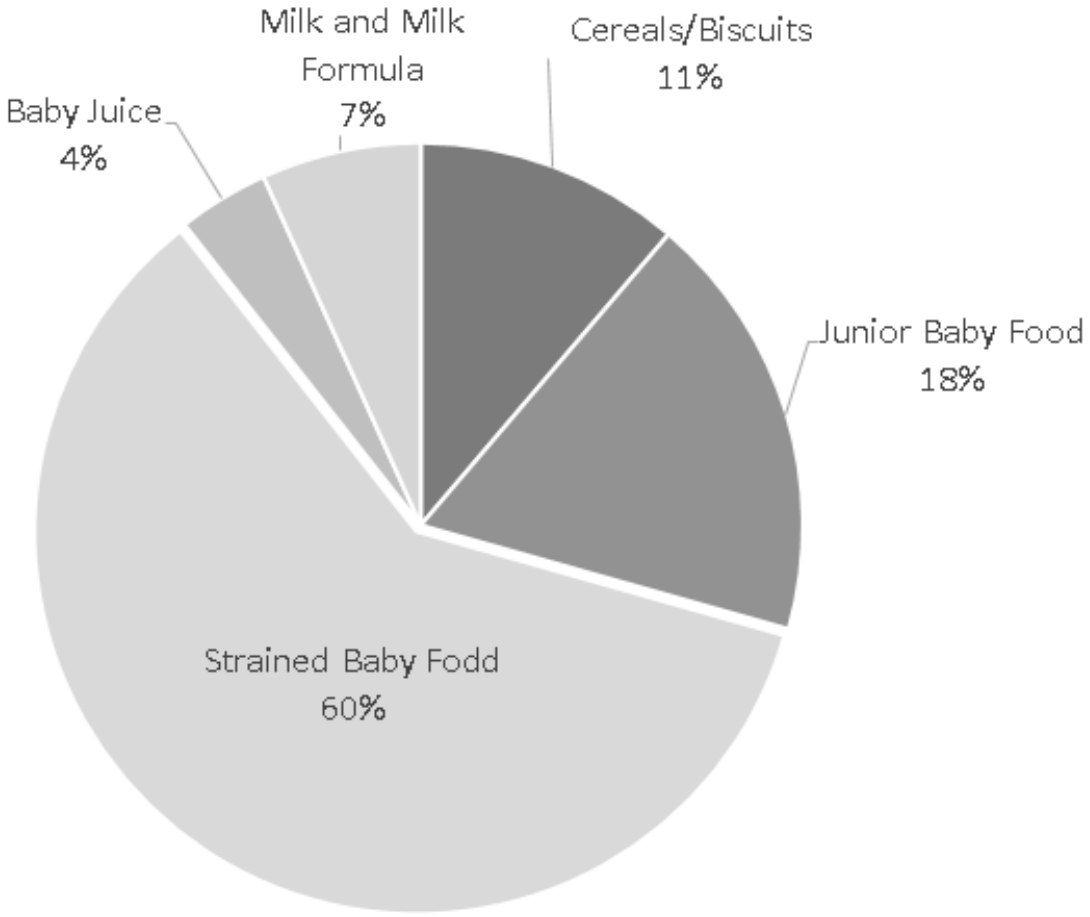


Figure 3.1: Average Sample Share of All Baby Food Categories, 2008-2011

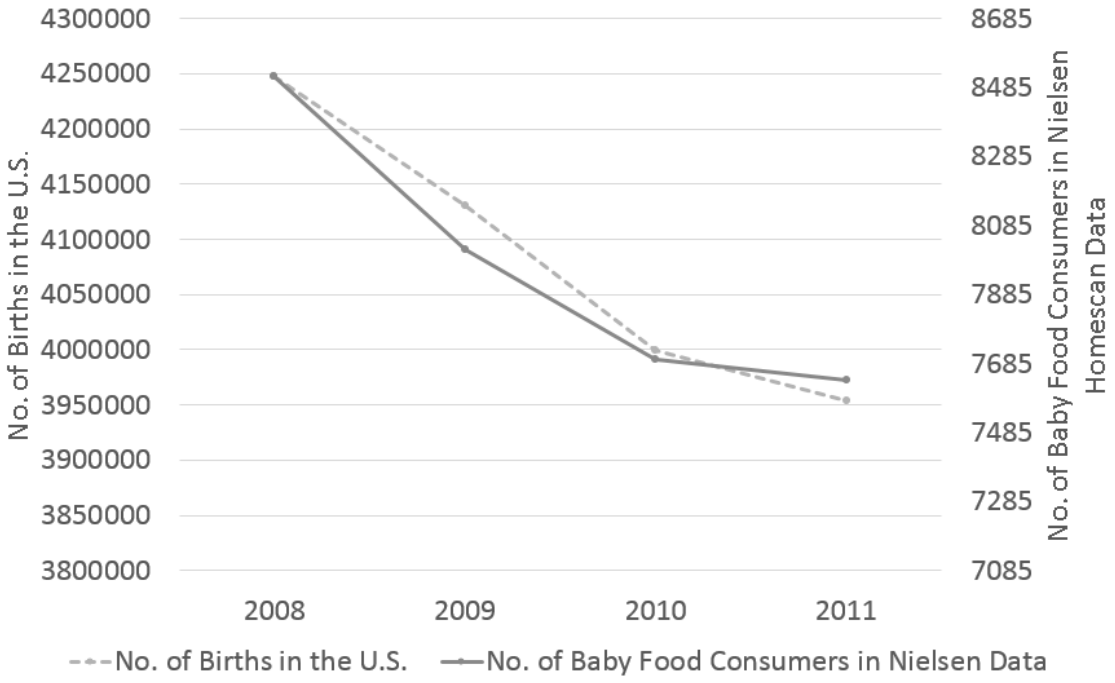


Figure 3.2: Number of Births in the United States and Number of Baby Food Consumers in Nielsen Data, 2008-2011

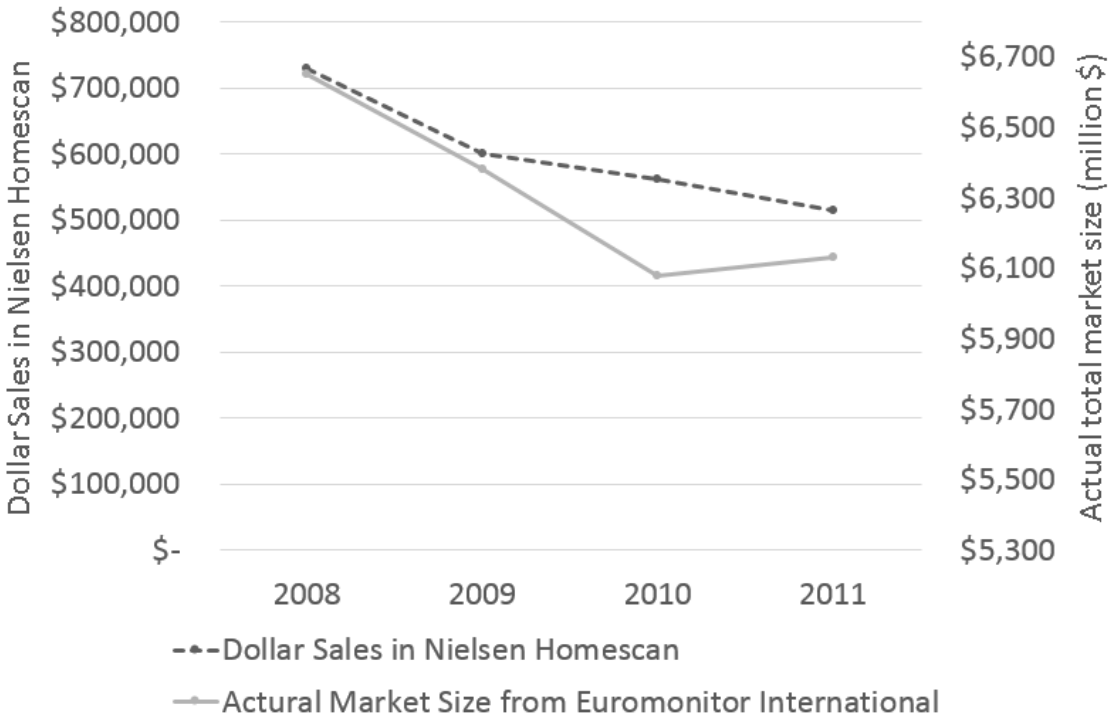


Figure 3.3: Dollar Sales of Baby Food of Nielsen Data and of the Actual Market, 2008-2011

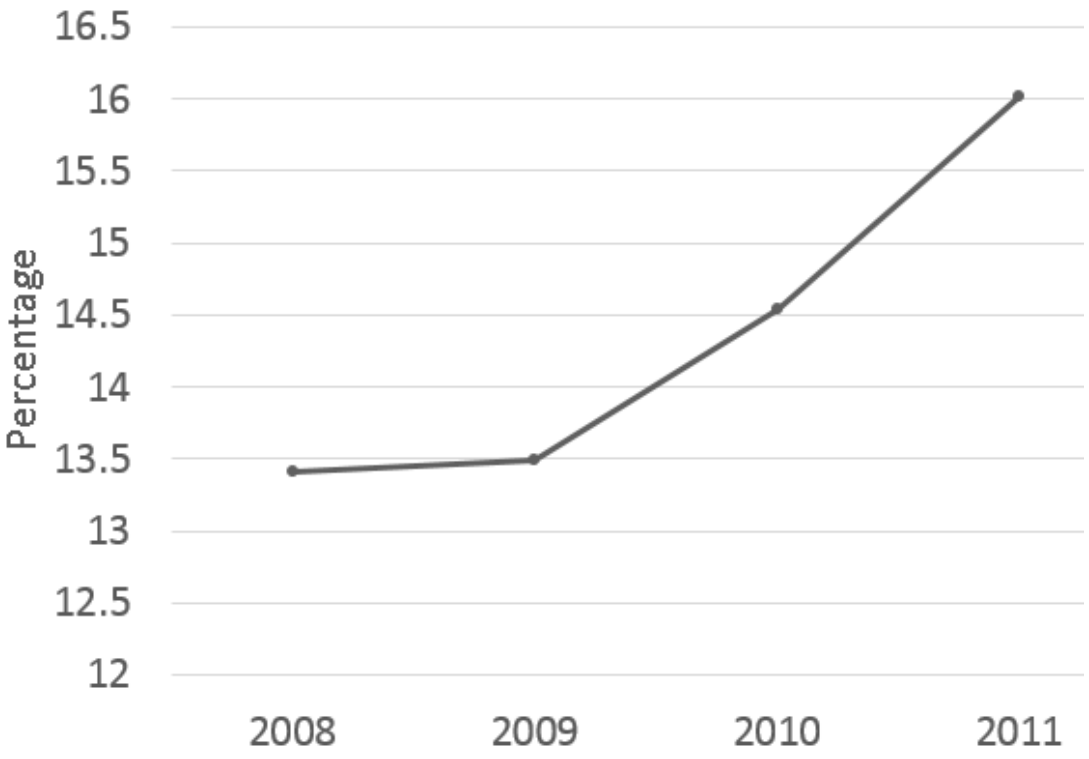


Figure 3.4: Sample Share of Organic Baby Food, 2008-2011

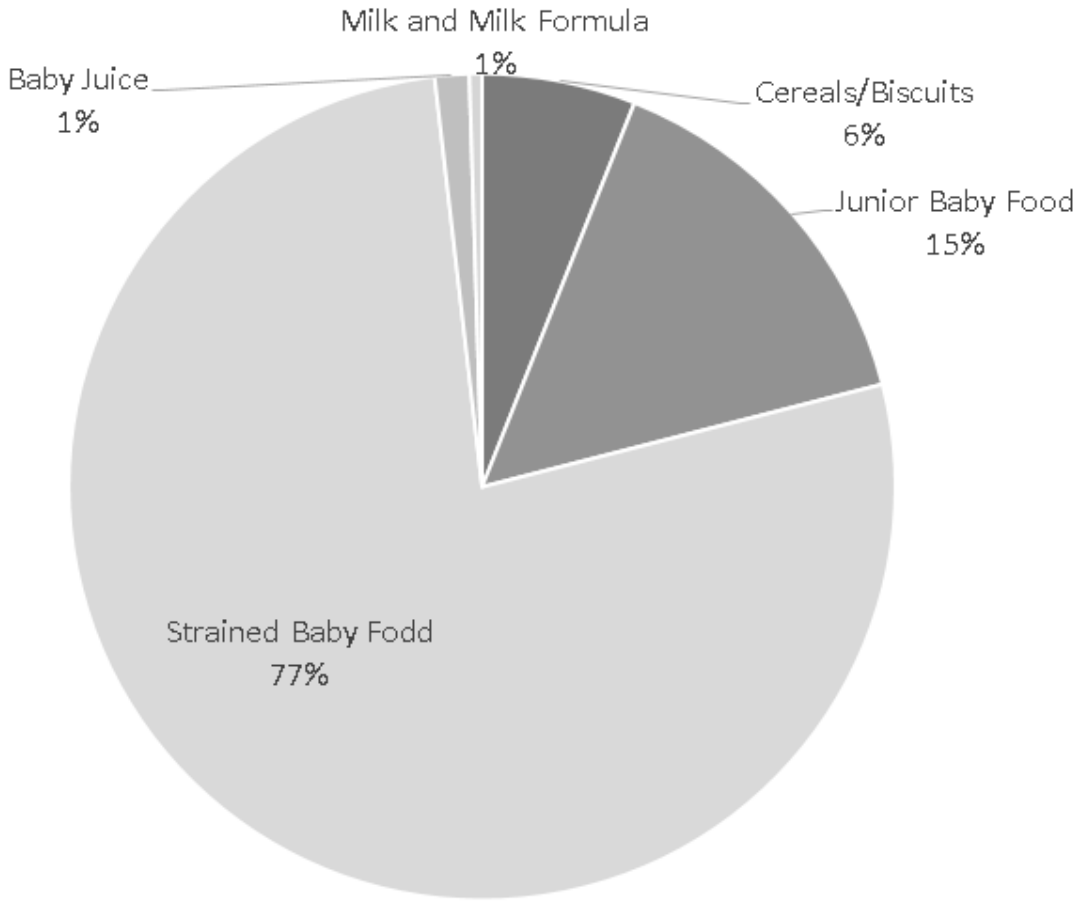


Figure 3.5: Average Sample Share of Organic Baby Food Categories, 2008-2011

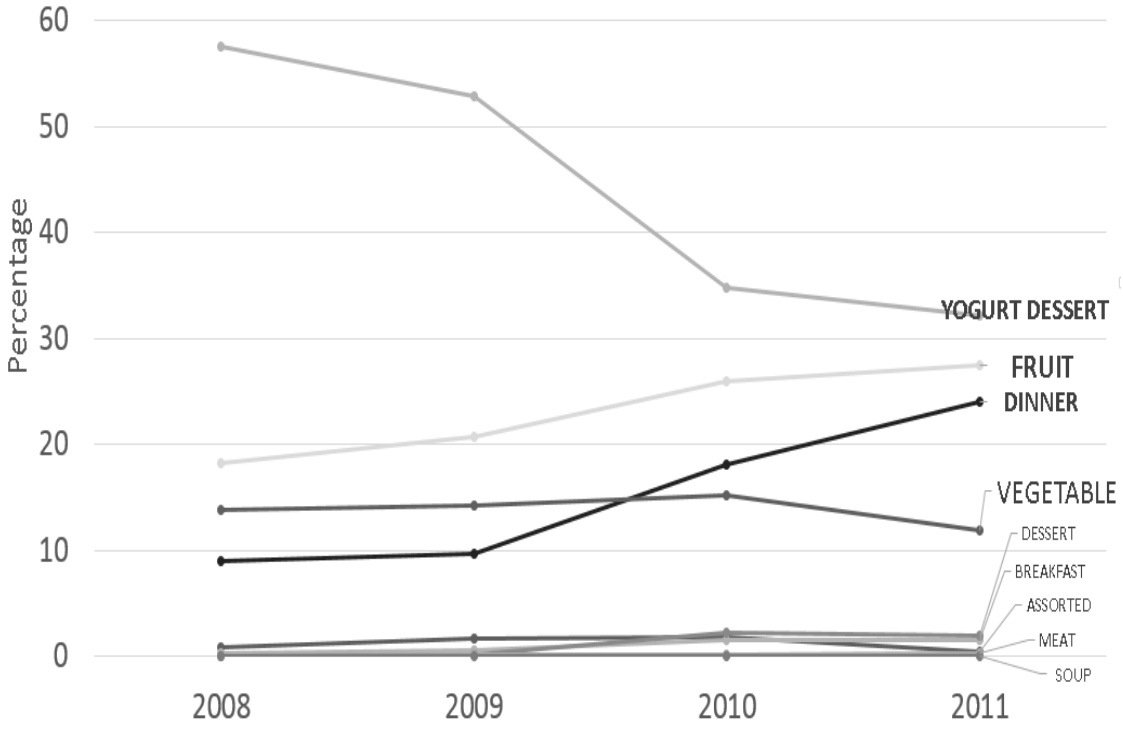


Figure 3.6: Sample Share of All Organic Baby Food Categories, 2008-2011

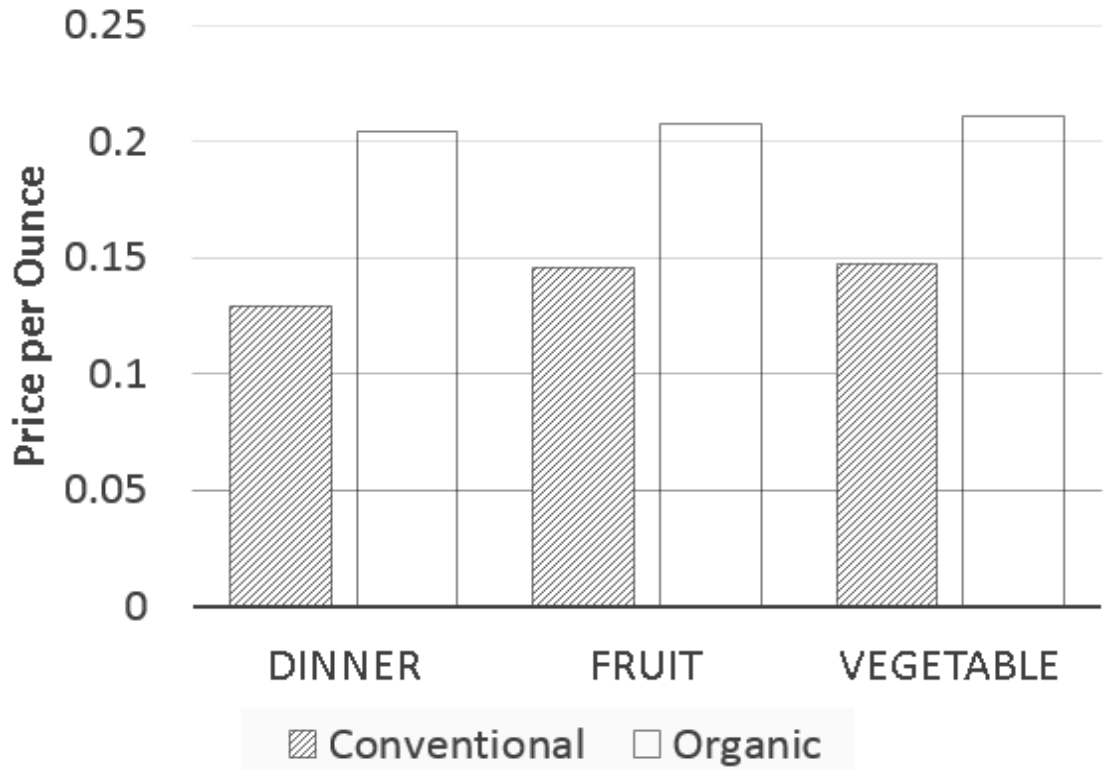
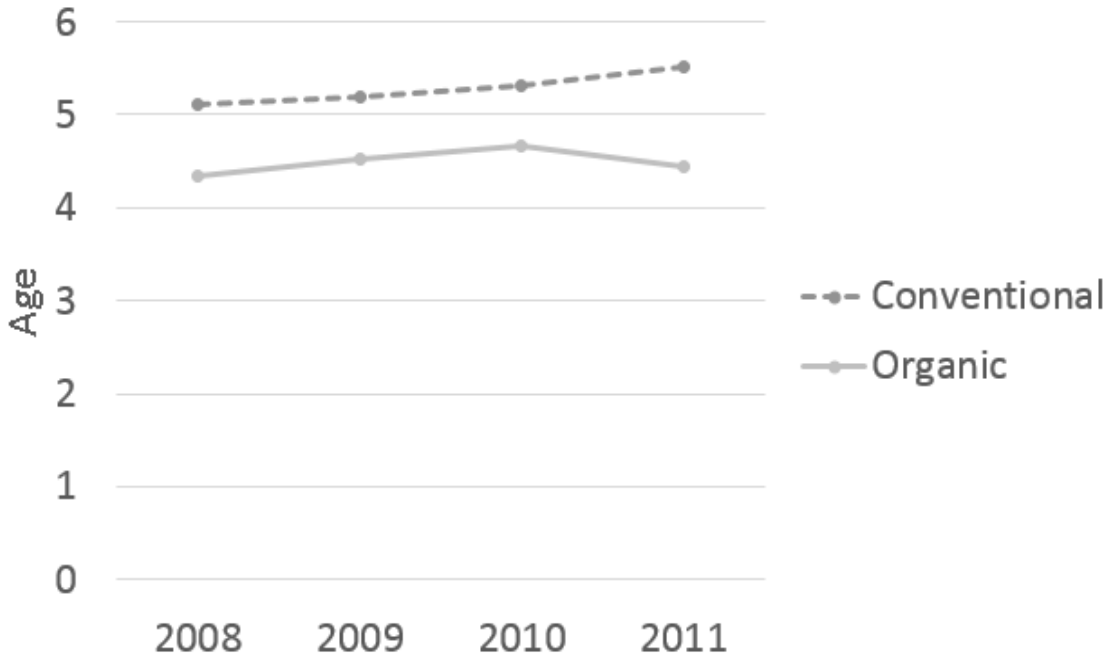


Figure 3.7: Average Price per Ounce of Conventional and Organic Baby Food, 2008-2011



(Note: Age 4 = 35-39 years, Age 5 = 40-44 years, Age 6 = 45-49 years)

Figure 3.8: Average Age of Conventional and Organic Baby Food Consumers, 2008-2011

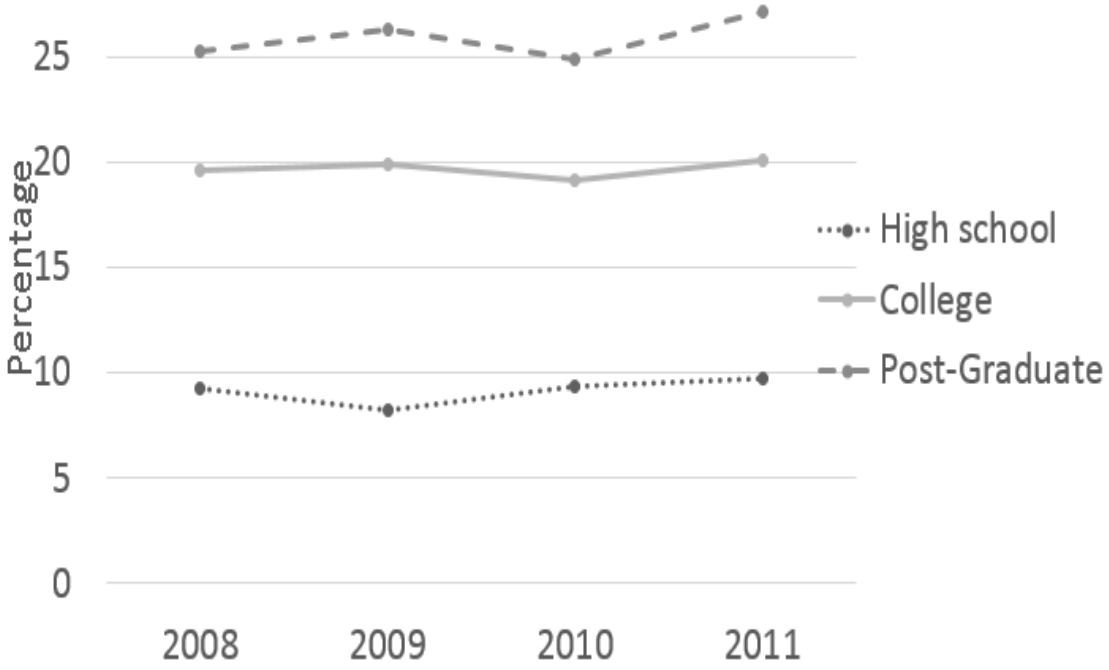


Figure 3.9: Shares of Organic Baby Food Purchasing of Consumers among Different Education Levels, 2008-2011

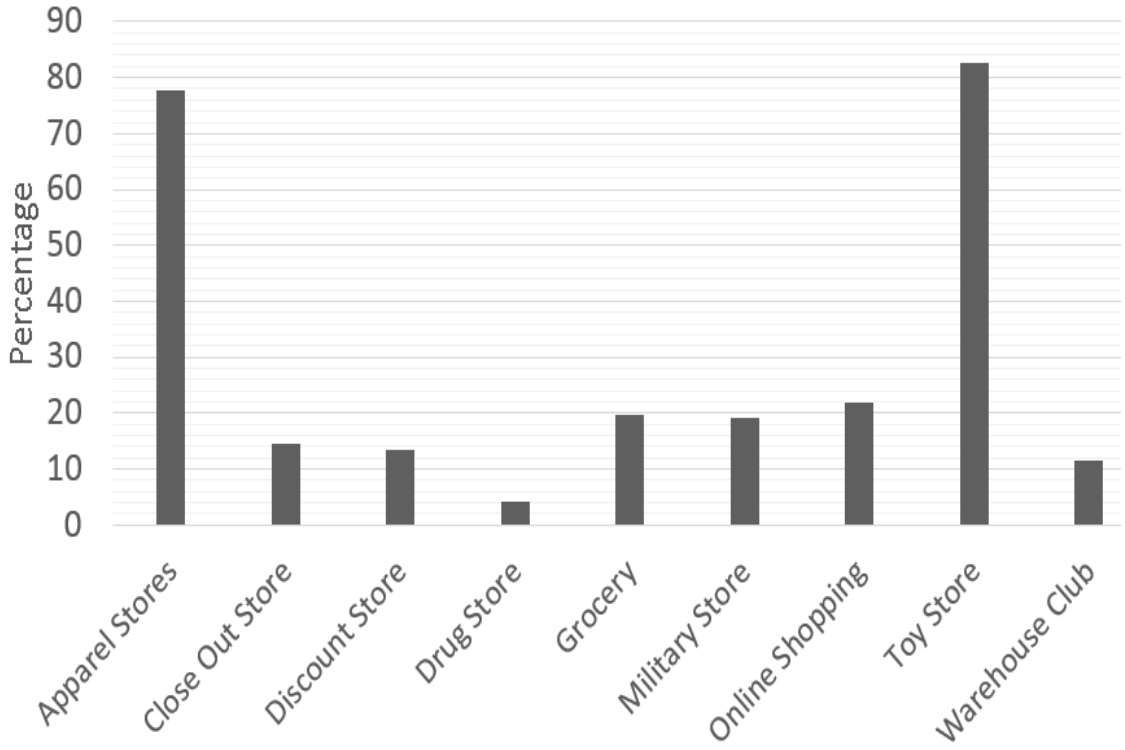
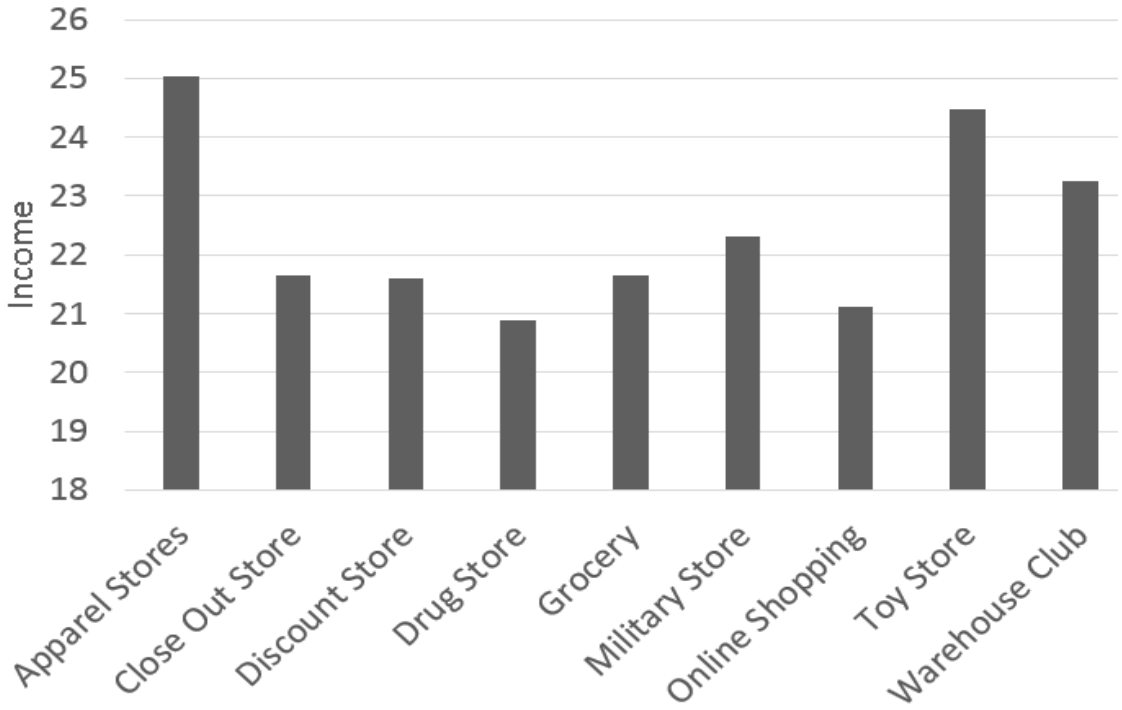


Figure 3.10: Average Shares of Organic Baby Food Purchasing among All Shopping Channels, 2008-2011



(Note: Income 19=$45K-50K, Income 21=$50K-60K, Income 23=$60K-70K, Income 26=$70K-100K)

Figure 3.11: Average Income of Baby Food Consumers in Different Shopping Channels

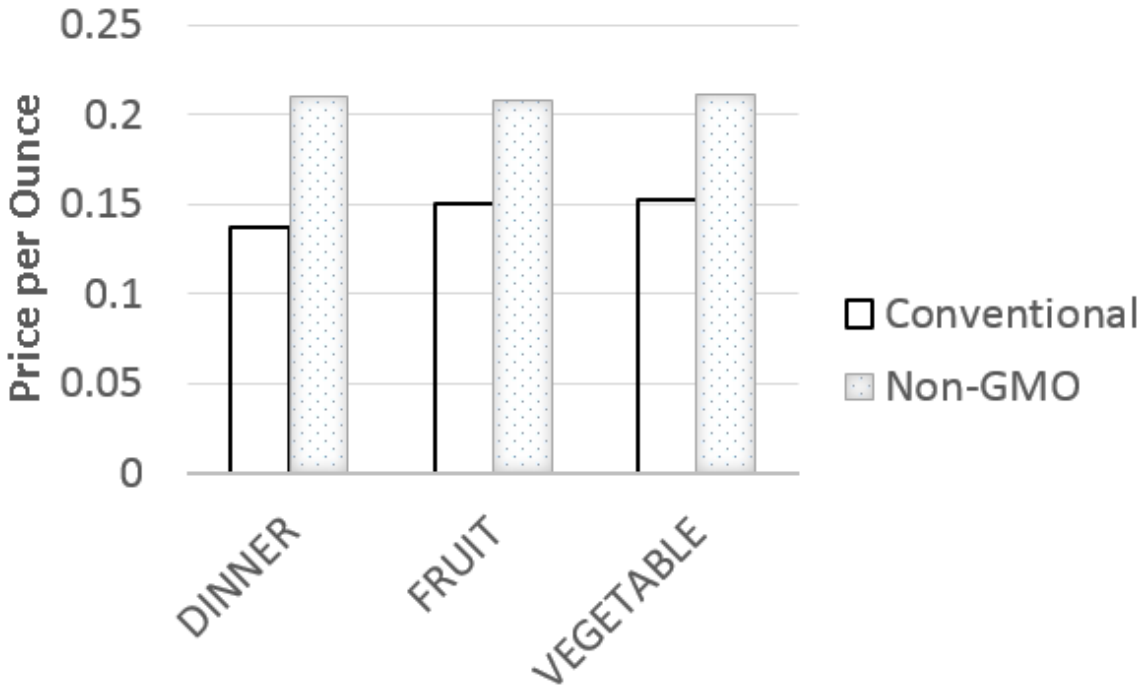


Figure 3.12: Average Price per Ounce of Conventional and Non-GM Baby Food

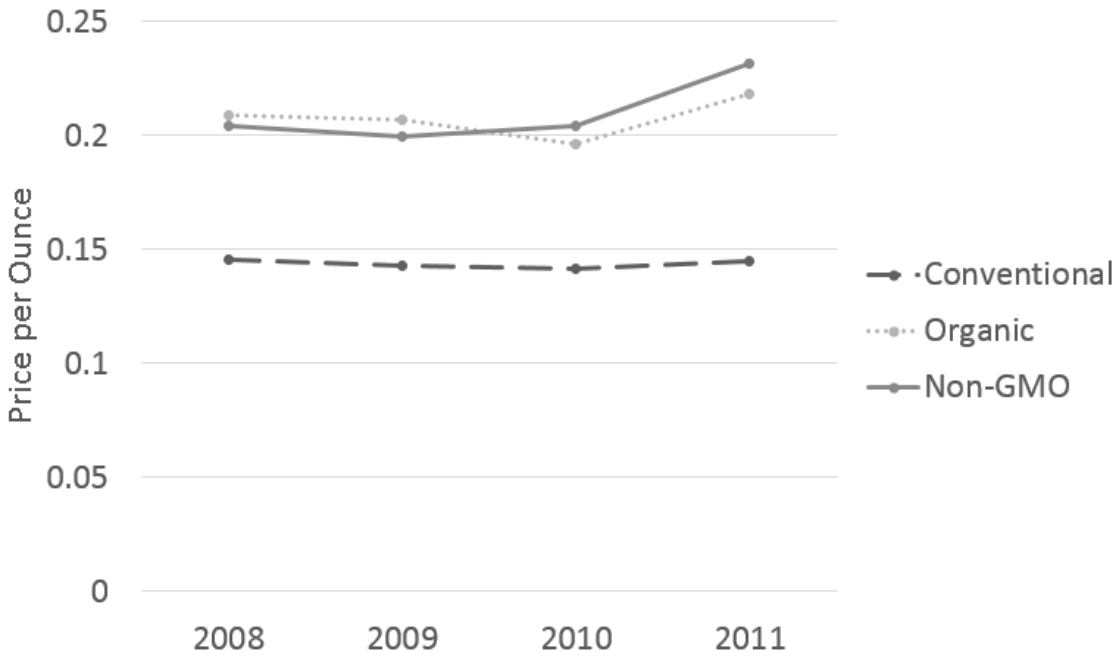


Figure 3.13: Price per Ounce of Conventional, Organic, and Non-GM Baby Food, 2008-2011

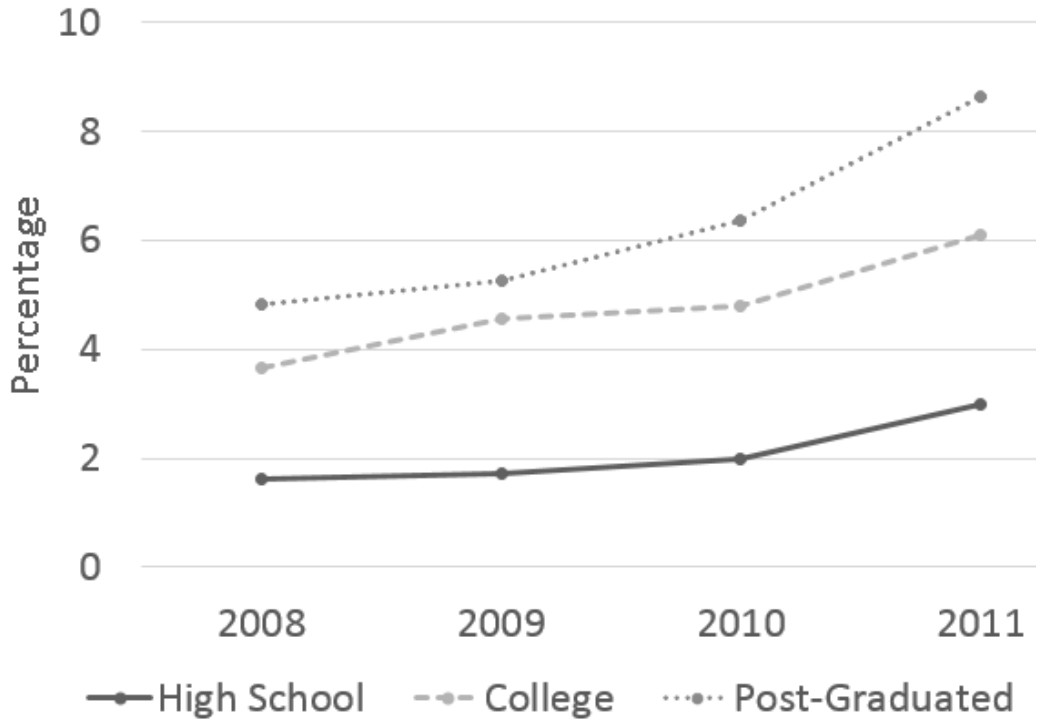


Figure 3.14: Shares of Non-GM Baby Food Purchases for Consumers accross Different Education Levels, 2008-2011

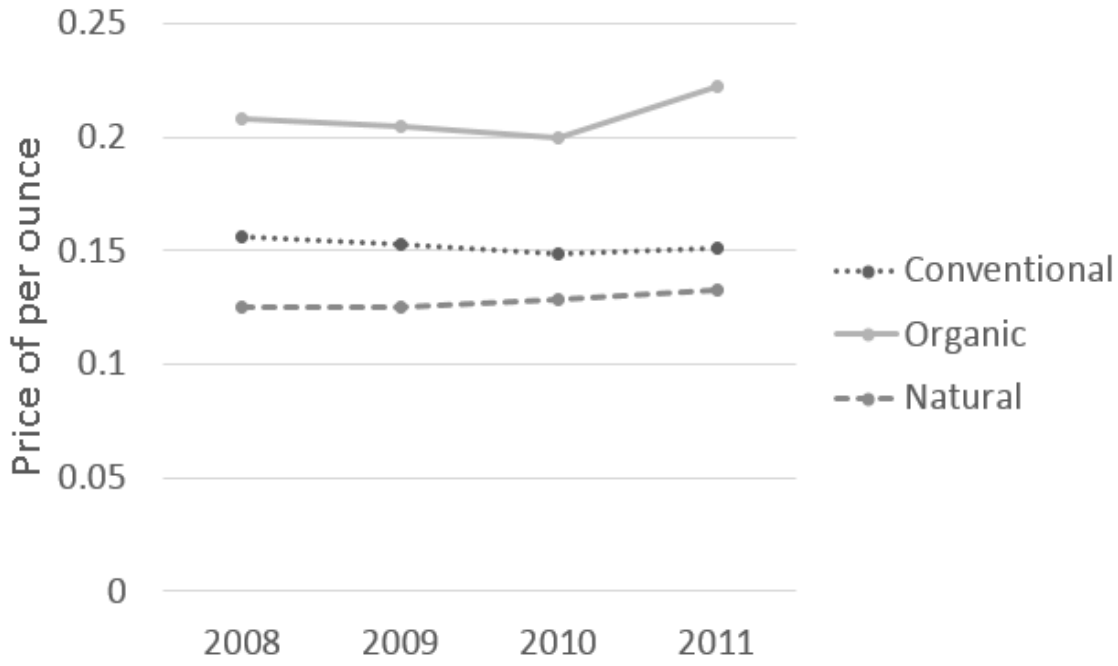


Figure 3.15: Price of Per Ounce Baby Food with Different Labels, 2008-2011

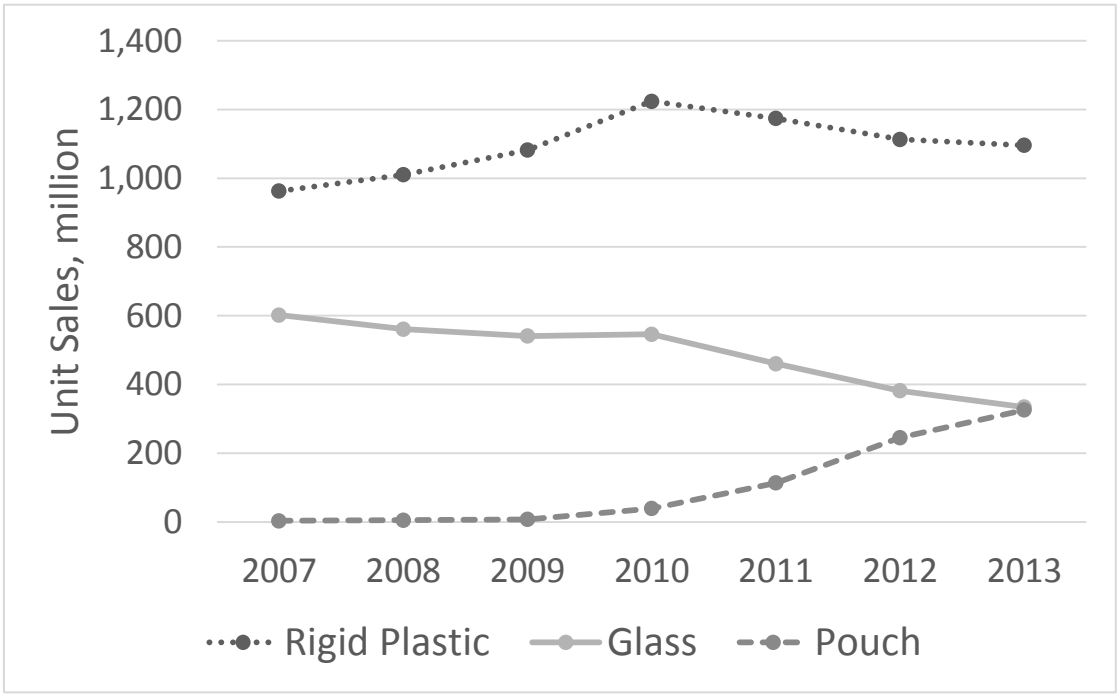


Figure 3.16: Unit Sales of Three Main Types of Baby Food Packaging, 2007-2013

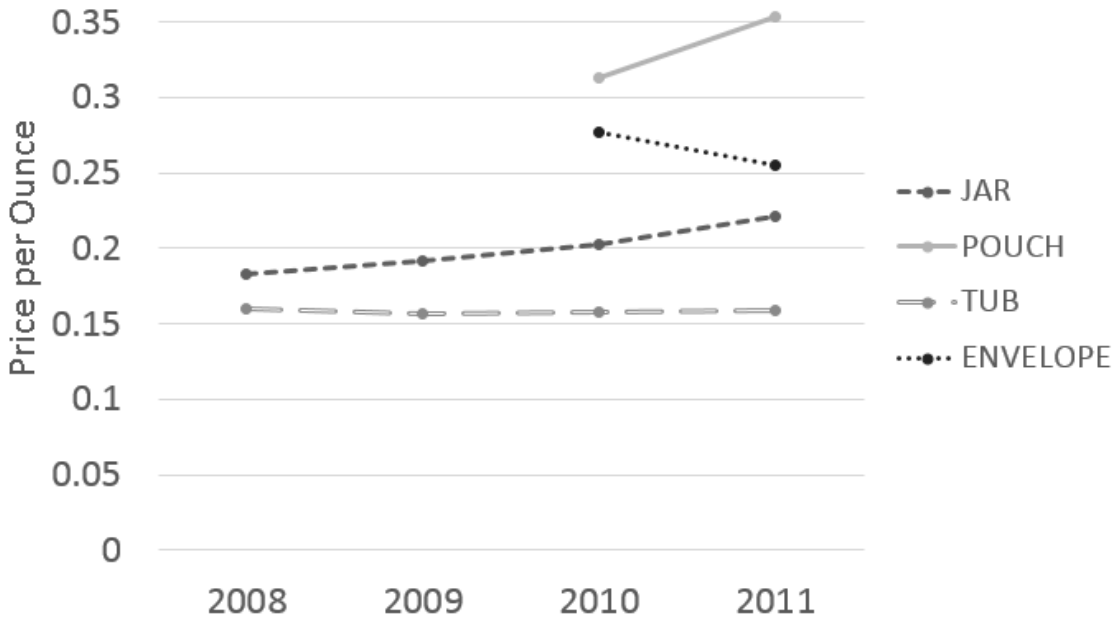
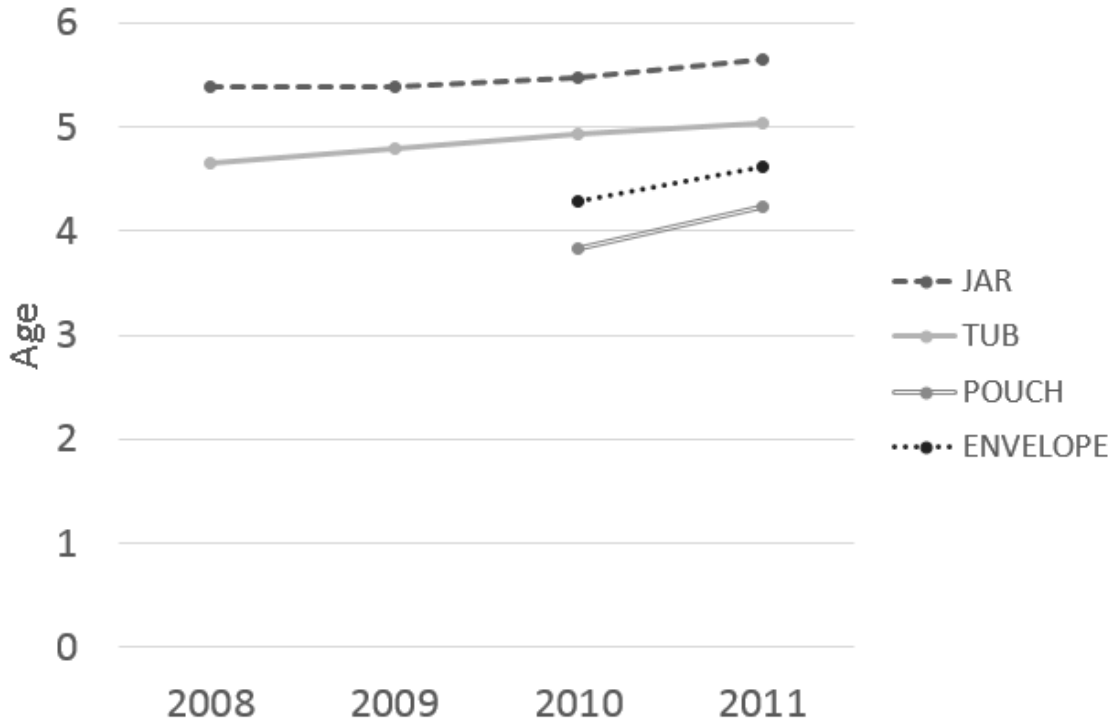


Figure 3.17: Unit Price of Baby Food in Four Types of Packaging, 2008-2011



(Note: Age 4 = 35-39 years, Age 5 = 40-44 years, Age 6 = 45-49 years)

Figure 3.18: Average Age of Baby Food Purchasers for Four Types of Packaging

CHAPTER 4

METHODOLOGY

4.1 Hedonic Pricing Model

Baby food is available in many brands, flavors, different packaging, with different labels, and is sold in different channels. Baby food consumers can derive utility from all these different attributes. The hedonic approach allows the estimation of the part worth for these different attributes of baby food. Individuals will consume a component attributes to the point where their willingness to pay is equal to the marginal price (Maguire, et al., 2004). Specifically for baby food, consumers will choose a baby food with a set of characteristics (e.g., Plum, organic, pouch, discount store) and a price which maximize their utility. Here I am interested in examining consumer response to the product attributes, such as organic, non-GM, and pouch packaging, so the hedonic approach or hedonic pricing model could be an appropriate model. Lancaster (1966) proposed the characteristics theory which assumes that consumers derive utility from the characteristics or attributes inherent in a good or service. It is not the good itself that gives utility to consumers, but the attributes within the good. Rosen (1974) expanded Lancaster's theory to develop hedonic approaches that model price as a function of quality attributes to estimate the implicit values of

product attributes. Hedonic pricing model is very popular among studies that investigating food products. Heiman (2004) used hedonic pricing model to analyze the prices of organic grains. Huang and Lin (2006) used hedonic pricing model to estimate the implicit values of fresh tomatoes. And in the studies of baby food, hedonic pricing model was also often used. Maguire, et al. (2004) and Huang, et al. (2009) both investigated the price premium for organic baby food using hedonic pricing model.

The hedonic pricing model for our study is shown in equation (1); is defined such that the price per ounce of baby food is a function of product attributes (*PRO*), market factors (*MKT*), geographic factors (*GEO*), and socio-demographic characteristics (*SOC*). Product attributes include the labels (organic, non-GM, and natural), product types, the interactions between organic and product types, packaging types, and size. Market factors include the promotion or coupon use, and the shopping channels. Geographic factors include whether the consumers are from metro area, and which region the consumers are from. Socio-demographic characteristics include the household income, age and education level of the primary shopper, marital status, number of children under 18, race, and the hours of household heads work. The complete specific estimation model is shown in equation (2). In this equation, each

baby food purchase in any shopping trip by a household is an observation. Because the same baby food consumer usually makes multiple purchases, the error terms are expected to be clustered-correlated and not independently distributed. We can control for this using the household code variable from Nielsen Homescan data in the estimation.

(1) $$Price = \beta_0 + \beta_1 PRO + \beta_2 MKT + \beta_3 GEO + \beta_4 SOC + \varepsilon$$

(2) $$Price = \alpha_0 + \alpha_1 Pouch + \alpha_2 Jar + \alpha_3 Non-GMO + \alpha_4 Natural + \alpha_5 Organic + \alpha_6 Dessert + \alpha_7 Dinner + \alpha_8 Fruit + \alpha_9 Meat + \alpha_{10} Organic * Dessert + \alpha_{11} Organic * Dinner + \alpha_{12} Organic * Fruit + \alpha_{13} Organic * Meat + \alpha_{14} Size + \alpha_{15} Promotion + \alpha_{16} Coupon + \alpha_{17} Apparel\ Store + \alpha_{18} Discount\ Store + \alpha_{19} Drug\ Store + \alpha_{20} Online\ Store + \alpha_{21} Toy\ Store + \alpha_{22} Other\ Store + \alpha_{23} Metro + \alpha_{24} New\ England + \alpha_{25} Mid-Atlantic + \alpha_{26} East\ North\ Central + \alpha_{27} West\ North\ Central + \alpha_{28} South\ Atlantic + \alpha_{29} West\ South\ Central + \alpha_{30} Mountain + \alpha_{31} Pacific + \alpha_{32} Household\ Income + \alpha_{33} Primary\ Shopper\ Education + \alpha_{34} Primary\ Shopper\ Age + \alpha_{35} Marital\ Status + \alpha_{36} No.\ of\ Children +$$

$$\alpha_{37} Avg.\ Work\ Hours + \alpha_{38} Black + \alpha_{3} Asian + \alpha_{40} Other\ Races +$$

$$\alpha_{41} Hispanic + \varepsilon$$

4.2 Tobit Model

Consumer response to organic label, non-GM label, and the new pouch packaging is of our most interest. Hedonic pricing model is our first step. In order to better understand baby food consumers who are interested in these product attributes, we will further explore the households who purchase organic baby food, non-GM baby food, and pouch baby food, respectively. One way to investigate consumers' interest in organic, non-GM or pouch baby food is to look at the share of a household purchasing these baby food products among their all baby food purchases in a year. Besides buying commercial baby food products, parents may also make baby food, so the total units of baby food purchases partly depend on whether parents are also making baby food. Compared with the total units of purchases, the shares of organic/non-GM/pouch baby food purchasing can better reflect consumer preference. Because some households purchase only conventional baby food, their organic, non-GM and pouch baby food shares would be zero. Therefore, I use a Tobit regression to explore the relationships between the organic, non-GM, pouch baby food shares and the household characteristics and their shopping behavior.

The Tobit regression models for this study, equation (3) (4) (5), are defined such that organic, non-GM, pouch baby food shares of households are functions of socio-demographic characteristics (*SOC*), geographic factors (*GEO*), and shopping behavior (*SPB*). Shopping behavior includes the variables showing consumers' expense shares on several food categories in supermarkets. In order to compare the pouch packaging with the traditional jar packaging, another Tobit regression, equation (6) is used to estimate jar baby food share. The complete equations for equations (3), (4), (5), and (6) are expressed in equation (7). In these equations, each household is an observation because the variables in equations (3), (4), (5), and (6) are invariable for a household in a year.

(3) $\textit{Organic Share} = \gamma_0 + \gamma_1 SOC + \gamma_2 GEO + \gamma_3 SPB + \varepsilon$

(4) $\textit{Non-GM Share} = \delta_0 + \delta_1 SOC + \delta_2 GEO + \delta_3 SPB + \varepsilon$

(5) $\textit{Pouch Share} = \mu_0 + \mu_1 SOC + \mu_2 GEO + \mu_3 SPB + \varepsilon$

(6) $\textit{Jar Share} = \rho_0 + \rho_1 SOC + \rho_2 GEO + \rho_3 SPB + \varepsilon$

(7) $$Org\quad ic/Non-GM/Pouch/Jar\ Share = \alpha_0 + \alpha_1 Household\ Income + \alpha_2 Primary\ Shopper\ Age + \alpha_3 Primary\ Shopper\ Education + \alpha_4 Marital\ Status + \alpha_5 No.of\ Children + \alpha_6 Avg.Work\ Hours + \alpha_7 Black +$$

$$\alpha_8 Asian + \alpha_9 Other\ Race + \alpha_{10} Hispanic + \alpha_{11} Metro + \alpha_{12} New\ England +$$

$$\alpha_{13} Mid - Atlantic + \alpha_{14} East\ North\ Central + \alpha_{15} West\ North\ Central +$$

$$\alpha_{16} South\ Atlantic + \alpha_{17} East\ South\ Central + \alpha_{18} Mountain + \alpha_{19} Pacific +$$

$$\alpha_{20} Dairy\ Expense\ Share + \alpha_{21} Grain\ Expense\ Share +$$

$$\alpha_{22} Fresh\ Produce\ Expense\ Share + \alpha_{23} Non -$$

$$Fresh\ Produce\ Expense\ Share + \alpha_{24} Protein\ Expense\ Share +$$

$$\alpha_{25} Snack\ Expense\ Share + \varepsilon$$

Explanations of the variables used in the Hedonic pricing model and the Tobit models are provided in Table 4.1 and Table 4.2.

Table 4.1: Definition of Variables Used in Hedonic Pricing Model

Variable	Definition
Dependent Variable	
Price	Unit price of per ounce baby food (expenditure net of any promotions divided by the quantity), dollars
Independent Variables	
Product Attributes	
Pouch	=1 if the baby food packaging is pouch, 0 otherwise
Jar	=1 if the baby food packaging is jar, 0 otherwise
Non-GM	=1 if the baby food contains non-GM label, 0 otherwise
Natural	=1 if the baby food contains natural label, 0 otherwise
Organic	=1 if the baby food contains organic label, 0 otherwise
Dessert/Fruit/Dinner/Meat /Vegetable	=1 if the type of baby food is a specific type (Dessert/Fruit/Dinner/Meat/Vegetable)
Size	Size of one unit of baby food
Market Factors	
Promotion	
Coupon	=1 if purchase made on sale or under promotion, = 0 otherwise
Store type	The value of coupon used
	=1 if baby food was purchased in a specific store (apparel store/discount store/drug store/online store/toy store/other store)
Geographic Factors	
Metro	
Region	=1 if the household resides in a county in metro area with more than 250,000 population
	=1 if the household resides in a specific region (New England/Mid-Atlantic/East North Central/West North Central/South Atlantic/East South Central/West South Central)/ Mountain/Pacific
Household Characteristics	
Household Income	
Primary Shopper Education	
	Annual household income
Primary Shopper Age	=1 if attained "high school", =2 if attained "undergraduate", =3 if attained "post-graduated"
	Age 1= under 25 years, 2=25-29 years, 3=30-34 years, 4=35-39 years, 5=40-44 years, 6=45-49 years, 7=50-54 years
Marital Status	=1 if married, 0 otherwise
No. of Children	
Avg. of Work Hours	

Race	Number of children under 18 in a household Average work hours of both household heads
Hispanic	=1 if the household head is a particular race (White, Black, Asian, other race), 0 otherwise = 1 if respondent's race is of Hispanic origin, 0 otherwise

Source: Nielsen Homescan Data, 2011.

Table 4.2: Definition of Variables Used in Tobit Regression Models

Variable	Definition
Dependent Variable	
Organic Share	Organic baby food volume divided by the total baby food volume in a year for a household
Non-GM Share	Non-GM baby food volume divided by the total baby food volume in a year for a household
Pouch Share	Pouch baby food volume divided by the total baby food volume in a year for a household
Jar Share	Jar baby food volume divided by the total baby food volume in a year for a household
Independent Variables	
Shopping Behavior	
Dairy Expense Share	Dairy products (e.g. cheese, and milk) expense divided by all food grocery expense in a year
Grain Expense Share	Grain products (e.g. bread, cereal, pasta) expense divided by all food grocery expense in a year
Fresh Produce Expense Share	Fresh produce products expense divided by all food grocery expense in a year
Non-Fresh Produce Expense Share	Non-Fresh produce products (e.g. canned produce, frozen produce) expense divided by all food grocery expense in a year
Protein Expense Share	Protein products (e.g. meat, seafood, eggs) expense divided by all food grocery expense in a year
Snack Expense Share	Snack products expense divided by all food grocery expense in a year

Note: The definition of the other independent variables in Tobit regressions are the same as in the Hedonic pricing model.

Source: Nielsen Homescan Data, 2011.

CHAPTER 5

RESULTS AND IMPLICATIONS

The results are presented first for the Hedonic pricing model to estimate the unit price of baby food as a function of product attributes, market factors, geographic factors, and household characteristics. The data source is Nielsen Homescan data of 2011. Nearly 170,000 observations of baby food purchase records are used in the regression. Next I presented results from the Tobit regressions that investigate consumer preference for organic/non-GM/pouch baby food. The dependent variable here is the organic/non-GM/pouch baby food purchasing share, which is a function of household characteristics, market factors, geographic factors, and consumers' shopping behavior. There are about 4480 households that purchased baby food in 2011 in the sample, and 2270 of them purchased baby food more than 10 times a year. These observations are the focus of my analysis.

5.1 Hedonic Pricing Model Results

Likelihood ratio tests are used to test the goodness-of-fit of the four hedonic pricing models (a full model and three reduced nested models) which include different numbers of variables. Product attributes are included in model A, as they are the most important variables. Then, we add the other three groups of variables one at a time into

the regression. According to the results of likelihood ratio test (Appendix 1), the full model (Model D) is the most appropriate model among the four models, so we will discuss the results of the full model (Model D). Table 5.1 shows the results from the Hedonic pricing models.

The premium consumers paid for organic baby food is 2.6 cents per ounce. It is consistently significant at the 1 percent level in all the four models. This price premium of organic is consistent with Maguire, Owen, and Simon (2004) who found that consumers were willing to pay 3 to 4 cents per ounce for organic, and also consistent with Huang, et al. (2009) who found that consumers were willing to pay 1.6 to 3.5 cents per ounce for organic. Considering that organic baby food is more available and the market becomes more competitive, the price premium of organic is expected to decrease overtime, so our result is reasonable.

Regarding product types, the price of vegetable baby food is the lowest. The prices of dinner baby food and fruit baby food are not significantly different from vegetable. Dessert baby food and meat baby food are more expensive than vegetable; this may be due to their higher cost. Allowing organic to interact with the product types enables us to test for significant price differences among the organic products.

The positive coefficient for the interaction term between organic & dinner and organic & meat implies that consumers are willing to pay a premium for organic dinner and meat based baby foods.

The organic label, the non-GM label and the natural label are also all significant at 1% level. The price premium consumers paid for the non-GM label is 2.9 cents, which is higher than the premium for the organic label. Although consumers' awareness of organic is probably higher than GM, the premium of organic might become lower because of the competitive organic baby food market. At the same time, it is possible that consumers are more aware of non-GM foods recently and are becoming interested in the non-GM label provided by selected baby food companies.

Surprisingly, the natural label has a significant and inverse impact on the price consumers paid for baby food. The results shows that the natural label actually decreases consumers' willingness to pay by 1.2 cents per ounce. Although natural is an attribute that might be expected to generate a premium, this might not happen because its definition is not as clear as the other labels. As there is no official definition of natural provided by any organization, the meaning of the natural label is largely up to producers, and consumers might be confused about its meaning. In a

shelf space where there are competing labels, consumers place greater value on organic and non-GM.

The results also show interesting implications for packaging types which has not been examined in previous studies. The jar is the traditional packaging type, but the plastic tub (similar to a yogurt cup) commands the lowest price because of its low cost. Compared to the tub, baby food in a jar is 1.3 cents per ounce more expensive, and pouch is 13.8 cents per ounce more expensive. The coefficients for jar and pouch are significant at the 1 percent level. The high premium that consumers were willing to pay for pouch packaging confirms its importance in consumers' purchasing decisions for baby food.

The size coefficient is significant and decreases the price consumers pay for baby food, which is as expected. It is mainly because the small packaging size (stage 1) for baby food for younger babies is more expensive than the large packaging size (stages 2 or 3) for baby food.

The promotion and coupon coefficients are each significant and have a negative impact on the price consumers' willingness to pay for baby food. Therefore, the promotion and the coupon marketing tools are useful among baby food consumers.

Regarding the effect of store types, consumers were paying more for baby food in drug stores (2.1 cents per ounce higher) and less in discount stores (1.4 cents per ounce lower), all relative to grocery stores. This result is consistent with Huang, et al. (2009) who found that baby food sold at a discount store was priced 1 cent per ounce lower than food sold through a grocery store, and baby food sold at a convenient store (e.g. drug store) was priced between 1.6 to 2.7 cents higher than food sold at a grocery store.

In terms of geographic factors, the metro coefficient is negative and significant at the 5 percent level. It implies that consumers in urban areas paid less for baby food. The reason might be that the baby food market in urban areas is more competitive, and that this decreases the price of baby food in urban areas. Consumers from New England, Mid-Atlantic, West North Central, South Atlantic, and Pacific regions all paid significantly more for baby food than their counterparts in the East South Central region.[3] Price premiums are the highest in the Mid-Atlantic and Pacific regions, where the major organic baby food companies are located, and where consumers are

[3] New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont); Mid-Atlantic (New Jersey, New York, and Pennsylvania); East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin); West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota); South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington D.C., and West Virginia); East South Central (Alabama, Kentucky, Mississippi, and Tennessee); West South Central (Arkansas, Louisiana, Oklahoma, and Texas); Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming); Pacific (Alaska, California, Hawaii, Oregon, and Washington)

relatively wealthier. So organic baby food, which is more expensive, might be more popular among consumers in these regions.

Household characteristics exert little influence on the price of baby food in terms of both statistical significance and magnitude relative to products attributes, market factors and regional factors, which is consistent with Huang, et al. (2009). Thus, prices paid for baby food are not largely affected by consumers with different household characteristics.

5.2 Tobit Regression Results

5.2.1 Tobit Regression Results: Organic and Non-GM Baby Food Shares

Two Tobit regressions were estimated on organic baby food volume share and non-GM baby food volume share. Again, likelihood ratio tests are also used to test the goodness-of-fit of the models (full model and reduced models) in these two Tobit regressions. Results (See Appendix 2 and 3) show that the full model, which is a function of household characteristics, geographic factors, and consumers' shopping behavior, is the most appropriate model. The results of organic and non-GM share regressions are compared in Table 5.2, because organic and non-GM are two similar and related labels.

The results show that household characteristics exert strong influence on consumers' purchase share at organic or non-GM baby foods. Income is significant at the 1% level and increases consumers' spending on both organic and non-GM baby food. As the organic and non-GM baby food are both more expensive than conventional baby foods, the households with higher income are expected to buy more of them. Part of the reason might be the correlation between income status and the shopping channels. Our results show that consumers shopping in apparel stores and toy stores have higher income than those shopping in the other store types, and the baby food sold in these two types of stores were mainly organic (apparel store 78%; toy store 82%). Our finding is also consistent with Thompson and Kidwell (1998) who found that higher household income increases the probability that a household will shop at a specialty store.

Education level has a significant and positive impact on consumers' purchase share of organic baby food, but no effect on non-GM baby food. Consumers with higher education levels, they are likely to be more aware of organic, and would choose organic when buying baby food. On the other hand, although consumers with higher education level might be more aware of and become interested in non-GM, they may

or may not have a better understanding of the GM technology. Therefore, it is reasonable that education does not impact non-GM sales as much as organic sales. Age is significant at the 1% level and has a negative impact on both organic and non-GM baby food shares. This is consistent with Loureiro and Hine (2002) who found that age has a negative relationship with willingness to pay for non-GM potatoes. Also, older purchases of baby food might place greater trust in food safety, so they might be less interested in organic and non-GM products compared with younger purchasers. Marital status has no significant effect on organic or non-GM baby food shares. Number of children has a significant and negative impact on organic and non-GM baby food purchases; this may be because more children increase expenditures on food and households with more children will be less interested in the expensive organic or non-GM baby food.

Average work hours per household head is a proxy for how much time parents have with their babies. The result shows a significant and negative coefficient on work hours implies that parents who work less might have more time for their babies, and they are more likely to be aware of organic and non-GM baby food. Asian consumers purchase more organic and non-GM baby food products.

The metro variable did affect the price of baby food, but it does not have a significant effect on consumers' purchase shares of organic or non-GM baby food. Compared with the West North Central region, consumers' preference for organic baby food is stronger in New England, Mid-Atlantic, and Pacific regions. The coefficient for the South Atlantic region is significant at the 10% level in the full model, but is insignificant in the reduced models. Compared with the West North Central region, consumers' purchase share for the non-GM baby food is significantly higher in the South Atlantic and Pacific regions. The Pacific region is the only region where consumers have both significantly higher purchase shares of organic and non-GM baby food. Consumers in the Pacific region are probably more aware of GM issues considering the GM mandatory labeling referendums that happened in California, Washington, and Oregon in recent years.

The coefficients of the shopping behavior variables show the effects of purchase patterns as they relate to other food product categories. In the organic share regression, the results show that consumers who spend more on fresh produce have higher shares of organic baby foods. Fresh produce is perceived as healthy food and often comes in organic versions, so consumers purchasing more fresh produce might

be more interested in healthy food products and organic products, and would choose organic when buying baby food. Non-fresh produce and protein product expense shares have significant negative impact on the share of organic baby food purchases. The possible reason is that some of the non-fresh produce (e.g., canned fruits) and protein products (e.g., pork, and beef) are not perceived to be fresh or not healthy by consumers, so organic baby food consumers will buy less of them. In the non-GM share regression, expenditures on fresh produce has a similar significant positive impact and protein products have a significant negative impact; this result implies that non-GM baby food consumers are likely to buy more fresh produce and fewer protein products. The reasons are probably similar to the reasons of their impact in the organic share model.

5.2.2 Tobit Regression Results: Pouch and Jar Baby Food Shares

Pouch is the packaging innovation that was introduced into the baby food market in 2009. Its impact on the market is of interest and has not been investigated in previous studies. The results of the Tobit regression on pouch baby food share are shown in Table 5.3. Based on the results of the likelihood ratio test (see Appendix 4), the shopping behavior variables should not be included in the pouch baby food share

regression, and we refer to the results in the second column of Table 5.3; here the pouch share is a function of household characteristics and geographic factors.

The results show that income has a significant positive impact on consumers' purchase share of pouch baby food. Since the pouch baby food is more expensive (almost double the price) than jar baby food, consumers with high income are likely to purchase more pouch baby food than consumers with lower income. Education has a significant and positive effect on consumers' purchase share of pouch baby food, so consumers with higher levels of education are more likely to buy more pouch baby food. Age has a significant (1 percent level) and negative effect on the pouch baby food share. It implies that younger consumers are more interested in this new packaging. Marital status and number of children have no significant effect on pouch purchases.

Average work hours of household heads could plausibly have mixed effects on pouch baby food purchasing. When the work hours are larger, the household heads are busier, so they might be more interested in pouch baby food, which is a very convenient packaging that allows babies to feed themselves. Moreover, busy parents have little time to shop and study baby food products, so they might be less likely to

be aware of the new pouch packaging. In our results, the variable of the average work hours of household heads has a significant negative effect on pouch baby food share. It implies that an increase in the number of work hours by the household head leads to less purchases of pouch baby food. Overall, the result indicates that the "awareness effect" outweights the "convenience effect". Race does not has any significant effect on pouch baby food purchasing.

Regarding the geographic factors, consumers purchased larger shares of pouch baby food in New England, Mid-Atlantic, and Pacific regions, when compared with the Mountain region. This may be related to income levels in the various regions, but also are home to some of the premium baby food companies, which sell a lot of pouch baby food and might have more regional advertising. For example, Plum organics introduced pouch baby food into the U.S. market and is located in California. The metro variable does not have significant effect in these regressions.

Jar baby food is a substitute of pouch baby food. Jar is the traditional baby food packaging and pouch is the new invention in recent years, so it is interesting to compare them. Based on the results of the likelihood ratio test, the full model is the most appropriate model, which is a function of household characteristics, geographic

factors, and consumers' shopping behavior. Since jar baby food is not our primary interest, we will focus on the most important and significant variables. Household income has a significant negative impact on jar baby food purchasing, and while the number of children has significant positive impact. The jar baby food is cheaper and is packaged in larger sizes, so it is good for the household with low income and with more babies or toddlers. Age has a positive impact on purchase share of jar baby food, which implies that older baby food purchasers prefer jars. This is probably because older purchasers have a stronger preference for recyclable packaging.

Table 5.1: Results from the Hedonic Pricing Models

	Model A1	Model B1	Model C1	Model D1
Pouch	0.139***	0.138***	0.138***	0.138***
	(0.0130)	(0.0128)	(0.0131)	(0.0126)
Jar	0.014***	0.013***	0.013***	0.0130***
	(0.0023)	(0.0023)	(0.0023)	(0.0022)
Non-GM	0.024***	0.029***	0.029***	0.029***
	(0.006)	(0.0058)	(0.0059)	(0.0057)
Natural	-0.016***	-0.013***	-0.013***	-0.012***
	(0.0022)	(0.0021)	(0.002)	(0.0019)
Size	-0.045***	-0.047***	-0.046***	-0.046***
	(0.0015)	(0.0014)	(0.0014)	(0.0014)
Dessert	0.017***	0.020***	0.020***	0.019***
	(0.0025)	(0.0025)	(0.0023)	(0.0023)
Dinner	-0.002	0.000	0.000	0.000
	(0.0015)	(0.0013)	(0.0013)	(0.0013)
Fruit	-0.0009	0.0003	0.0003	0.0002
	(0.0008)	(0.0006)	(0.0006)	(0.0006)
Meat	0.173***	0.172***	0.172***	0.171***
	(0.0043)	(0.0038)	(0.0038)	(0.0034)
Organic	0.026***	0.026***	0.026***	0.026***
	(0.0043)	(0.0039)	(0.0038)	(0.0038)
Organic*Dessert	-0.006	-0.006	-0.007	-0.007
	(0.0063)	(0.0051)	(0.005)	(0.0049)
Organic*Dinner	0.013***	0.014***	0.014***	0.014***
	(0.0041)	(0.004)	(0.0039)	(0.0039)
Organic*Fruit	0.007	0.006	0.006	0.006
	(0.0047)	(0.0046)	(0.0046)	(0.0045)
Organic*Meat	0.067***	0.060***	0.055***	0.055***
	(0.0072)	(0.0064)	(0.0067)	(0.007)
Promotion		-0.009***	-0.009***	-0.009***
		(0.0016)	(0.0016)	(0.0016)
Coupon		-0.027***	-0.028***	-0.028***
		(0.0019)	(0.0019)	(0.0019)
Other Store		-0.006	-0.005	-0.006
		(0.0061)	(0.0057)	(0.0058)
Apparel Store		0.0008	0.0008	0.0006
		(0.0068)	(0.0068)	(0.0069)
Discount Store		-0.014***	-0.014***	-0.014***
		（0.0013）	（0.0013）	（0.0012）
Drug Store		0.022**	0.021**	0.020**
		（0.0097）	（0.0099）	（0.0100）
Online Store		0.000	0.001	0.000
		(0.0061)	(0.0057)	(0.0056)

Toy Store		0.006	0.004	0.004
		(0.0082)	(0.0080)	(0.0079)
Metro			-0.005**	-0.005**
			(0.0023)	(0.0023)
New England			0.008**	0.008**
			(0.0034)	(0.0034)
Mid-Atlantic			0.013***	0.013***
			(0.0026)	(0.0027)
East North Central			0.004	0.004
			(0.0027)	(0.0028)
West North Central			0.010***	0.011***
			(0.0032)	(0.0033)
South Atlantic			0.008***	0.008***
			(0.0026)	(0.0026)
West South Central			0.002	0.002
			(0.0031)	(0.0031)
Mountain			0.004	0.004
			(0.0033)	(0.0034)
Pacific			0.015***	0.014***
			(0.0034)	(0.0033)
Household Income				0.000
				(0.0001)
Primary Shopper Education				0.001
				(0.0014)
Primary Shopper Age				0.000
				(0.0004)
Marital Status				0.000
				(0.0018)
No. of Children				-0.000
				(0.0007)
Avg. Work Hours				-0.000
				(0.0001)
Black				0.000
				(0.0042)
Asian				0.005
				(0.0033)
Other Race				0.004
				(0.0031)
Hispanic				-0.0017
				(0.0026)
_cons	0.302***	0.315***	0.312***	0.308***
	(0.0049)	(0.0046)	(0.0050)	(0.0069)
N	170642	170642	170642	170642
ADJ. R-SQ	0.802	0.836	0.838	0.839

Table 5.2: Results from Tobit Regressions for Organic and Non-GMO Shares

	Organic Share	Non-GMO Share
Household Income	0.011***	0.009***
	(0.0029)	(0.0030)
Primary Shopper Education	0.057**	0.024
	(0.0238)	(0.0246)
Primary Shopper Age	-0.057***	-0.037***
	(0.0072)	(0.0075)
Marital Status	0.02	0.049
	(0.0380)	(0.0399)
No. of Children	-0.032*	-0.037**
	(0.0173)	(0.0181)
Avg. Work Hours	-0.003***	-0.003***
	(0.0011)	(0.0012)
Black	-0.011	0.001
	(0.0535)	(0.0552)
Asian	0.136*	0.159***
	(0.0699)	(0.0667)
Other Races	-0.01	-0.042
	(0.0631)	(0.0670)
Hispanic	0.011	0.008
	(0.0548)	(0.0570)
Metro	0.068	0.042
	(0.0412)	(0.0443)
New England	0.185**	0.089
	(0.0754)	(0.0790)
Mid-Atlantic	0.145***	0.033
	(0.0589)	(0.0631)
East North Central	0.026	-0.017
	(0.0572)	(0.0617)
South Atlantic	0.106*	0.169***
	(0.0570)	(0.0597)
East South Central	0.0584	0.089
	(0.0705)	(0.0733)
West South Central	0.034	0.061
	(0.0654)	(0.0689)
Mountain	0.035	0.035
	(0.0696)	(0.0740)
Pacific	0.176***	0.146**
	(0.0619)	(0.0648)
Dairy Expense Share	1.852***	0.445
	(0.2890)	(0.2970)
Grain Expense Share	0.071	0.105
	(0.3610)	(0.3750)

Fresh Produce Expense Share	2.325***	1.337***
	(0.3840)	(0.3920)
Non-fresh Produce Expense Share	-1.105*	-0.119
	(0.6310)	(0.6580)
Protein Expense Share	-0.930**	-1.399***
	(0.3860)	(0.4090)
Snack Expense Share	-0.121	-0.003
	(0.5420)	(0.5550)
_cons	-0.310**	-0.451***
	(0.1260)	(0.1330)
Sigma_cons	0.539***	0.465***
	(0.0133)	(0.0174)
N	2270	2270

Table 5.3: Results of Tobit Regressions for Pouch and Jar Shares

	Pouch Share	Jar Share
Household Income	0.010*	-0.009***
	(0.0044)	(0.0025)
Primary Shopper Education	0.063*	-0.034*
	(0.0355)	（0.0208）
Primary Shopper Age	-0.054***	0.027***
	(0.0105)	（0.0064）
Marital Status	0.103	0.040
	(0.0616)	（0.0321）
No. of Children	-0.001	0.034**
	(0.0236)	（0.0151）
Avg. Work Hours	-0.003**	0.001
	(0.0017)	（0.0009）
Black	-0.203**	-0.037
	(0.0940)	（0.0454）
Asian	0.088	0.097
	(0.0947)	（0.0667）
Other Races	0.099	-0.078
	(0.0878)	（0.0565）
Hispanic	-0.015	-0.051
	(0.0793)	（0.0493）
Metro	0.111	0.025
	(0.0677)	（0.0347）
New England	0.303**	-0.179**
	(0.1170)	（0.0699）
Mid-Atlantic	0.228**	-0.046
	(0.0984)	（0.0533）
East North Central	0.075	0.066
	(0.0993)	（0.0517）
West North Central	0.147	-0.012
	(0.111)	（0.0601）
South Atlantic	0.143	0.001
	(0.0971)	（0.0515）
East South Central	0.174	0.039
	(0.115)	（0.0619）
West South Central	0.169	0.023
	(0.106)	（0.0582）
Pacific	0.193*	-0.044
	(0.102)	（0.0558）
Dairy Expense Share		-1.229***
		（0.264）

Grain Expense Share		-0.254
		（0.316）
Fresh Produce Expense Share		-0.611*
		（0.352）
Non-fresh Produce Expense Share		-0.524
		（0.539）
Protein Expense Share		-0.439
		（0.324）
Snack Expense Share		-1.089**
		（0.461）
_cons	-0.975***	0.674***
	(0.176)	（0.108）
Sigma_cons	0.563***	0.524***
	(0.0293)	（0.0099）
N	2270	2270

CHAPTER 6

CONCLUSION

6.1 Summary

In 2013, there were about 24.0 million children under the age of five in the United States, and these babies and the toddlers consumed $6.6 billion of baby food. The baby food consumption in the United States has increased 4% every year since 2008, and is expected to continue to increase in upcoming years. The landscape of the baby food market has significantly evolved in recent years. Not only have more consumers become interested in organic baby food, baby food with non-GM labels and baby food in the new pouch packaging also attract more consumers. This thesis has investigated consumers' response to the organic label, the non-GM label, and the new pouch packaging of baby food, and also how baby food consumers that show preferences for these labels and packaging style are correlated with household characteristics, market factors, geographic factors, and shopping behavior.

A descriptive analysis of the market for baby food using Nielsen Homescan data from 2008 to 2011 shows that both organic and non-GM baby food were priced much higher than conventional baby food. Specifically, the price of per ounce of

conventional baby food was lower than 15 cents, but the price of per ounce organic and non-GM baby food were higher than 20 cents. The average unit price of non-GM baby food was lower than organic baby food in 2008 and 2009, but non-GM baby food became more expensive than organic baby food since 2010. This shows that consumers might be increasingly interested in non-GM baby food.

The pouch packaging was introduced into the baby food market in 2009 and has become very popular. The pouched baby food is priced nearly double the price of jar and tub baby food. The market share for pouched baby food has increased from almost nothing in 2009 to more than 20% in 2013.

Empirical estimation was undertaken in two ways. First, I used a Hedonic pricing model to estimate the unit price of baby food as a function of product attributes, market factors, geographic factors, and household characteristics. Second, in order to better understand baby food consumers, Tobit regressions are undertaken to investigate consumer preference for organic, non-GM, pouch baby food. The organic, non-GM, pouch baby food shares are modeled as function of household characteristics, geographic factors, and consumers' shopping behavior.

In the Hedonic pricing model, the results reveal that baby food purchasers paid a premium of 2.6 cents per ounce for the organic label, and 2.9 cents per ounce for non-GM label. It is interesting to see that the price premium for the non-GM was higher than organic. And surprisingly, the natural label led to a decrease in consumers' willingness to pay by 1.2 cents per ounce. It implies that the natural label does not resonate with baby food consumers when there are competing labels like organic and non-GM. Regarding the impact of the packaging, baby food consumers paid a premium of 13.8 cents per ounce for the new pouch packaging compared with the plastic tub packaging. The price of the traditional jar is close to the plastic tub. The high price premiums that baby food consumers are willing to pay for the pouch packaging have had significant impact on the baby food market. Baby food consumers pay more when shopping in convenience stores, and pay less when shopping in discount stores, and in urban areas. Household characteristics have little influence on the price of baby food in terms of both statistical significance and magnitude relative to products attributes, market factors and region factors.

Results from the Tobit estimations in Table 5.2 show how household characteristics, geographic factors, and consumers' shopping behavior affect

consumers' organic and non-GM baby food shares. Household characteristics have a similar impact on organic and non-GM baby food purchasing. Younger purchasers, those with high incomes, those with fewer children, and those with more free time are more likely to purchase organic and non-GM baby food. Higher education would increase consumers' preference for organic baby food, but has no significant effects on consumers' preference for non-GM baby food. In terms of geographic factors, consumers from the Pacific region have strong preference for both organic and non-GM baby food. The result may be because the Pacific region supplies a lot of organic products, but also as consumers there are probably more aware of GM considering the mandatory labeling referendums that happened in California, Washington, and Oregon. The shopping behavior also has a similar impact on consumers' organic and non-GM baby food purchasing behavior. The consumers who spend more on fresh produce and less on protein products are more likely to purchase organic and non-GM baby food. Non-fresh produce expense shares have a significant negative effect on organic baby food purchasing but not on non-GM baby food purchasing.

Table 5.3 shows how household characteristics, geographic factors, and consumers' shopping behavior affect consumers' pouch and jar baby food shares.

Young purchasers with high income and higher levels of education are more likely to purchase pouch baby food. On the other hand, older purchasers with low income are more likely to purchase jar baby food. Pouch baby food is nearly double the price of jar baby food, so an income effect is not surprising. Relatively young purchasers are expected to place a higher value on the convenience of pouches, while older consumers would probably prefer the jars, perhaps because they are recyclable. Regarding geographic factors, consumers purchased larger shares of pouch baby food in New England, Mid-Atlantic, and Pacific. This is due, in part, to the fact that most of the premium baby food companies, which sell a lot of pouch baby food, are located in these regions.

6.2 Limitations

This study lacks information about consumers' awareness, perception, and concerns about organic and non-GM products, which are very important for their consumption of organic and non-GM baby food. Shopping behavior variables are used as proxies for consumers' attitudes and concerns, as the data are difficult to obtain, especially from an existing dataset like Nielsen Homescan.

Also, there is no data to describe consumers' attitudes towards homemade baby food versus processed commercial baby food. This decision that households make is expected to affect the price consumers are paying for baby food, and their consumption of different types of baby food.

Lastly, the market share of pouch baby food in Nielsen Homescan data 2011 is still relatively low which might create imprecise estimation results.

6.3 Future Research

The baby food packaging shows remarkable changes after 2011 in recent years. For example, the market share of the pouch baby food has increased dramatically, and Beech-Nut baby food are packaged in transparent jars since 2014. All these changes in packaging will probably impact baby food consumers' purchasing decisions, so that the landscape of the baby food market would change. Therefore, it would be interesting to investigate consumers' response to these packaging changes using more updated data.

The baby food market in China has evolved significantly in recent years. Unfortunately, the data for the baby food market in China are not available. In the future research, I would like to investigate the baby food market in China using data

from surveys, experiments, and interviews in China. I have conducted one-on-one in-depth interviews with more than 50 Chinese mothers during last year, and found many interesting preliminary findings (see Appendix 6).

APPENDIX: Additional Estimation Results

Appendix 1

The results of the likelihood ratio test for the Hedonic pricing model

Likelihood-ratio test LR chi2 (8) = 32152.44

(Assumption: A1[4] nested in B1) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
A1	170642	152703.3	291056.7	15	-582083.3	-581932.6
B1	170642	152703.3	307132.9	23	-614219.8	-613988.7

Likelihood-ratio test LR chi2 (9) = 2252.18

(Assumption: B1 nested in C1) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
B1	170642	152703.3	307132.9	23	-614219.8	-613988.7
C1	170642	152703.3	308259	32	-616453.9	-616132.4

Likelihood-ratio test LR chi2 (10) = 325.03

(Assumption: C1 nested in D1) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
C1	170642	152703.3	308259	32	-616453.9	-616132.4
B1	170642	152703.3	308421.5	42	-616759	-616337

[4] A1 includes product attribute variables. B1 includes product attribute variables, and market factors variables. C1 includes product attribute variables, market factors variables, and geographic factors variables. D1 includes product attribute variables, market factors variables, geographic factors variables, and household characteristics variables.

Appendix 2: The Results of Tobit Regression for Organic Share

	(1) Model A2	(2) Model B2	(3) Model C2
Household Income	0.016***	0.013***	0.011***
	(0.0029)	(0.0029)	(0.0029)
Primary Shopper Education	0.089***	0.090***	0.057**
	(0.0243)	(0.0242)	(0.0238)
Primary Shopper Age	-0.068***	-0.068***	0.057***
	(0.0071)	(0.0071)	(0.0072)
Marital Status	0.014	0.036	0.02
	(0.0382)	(0.0382)	(0.0380)
No. of Children	-0.027	-0.022	-0.032*
	(0.0175)	(0.0174)	(0.0173)
Avg. Work Hours	-0.004***	-0.003***	-0.003***
	(0.0011)	(0.0011)	(0.0011)
Black	-0.072	-0.088*	-0.011
	(0.0533)	(0.0534)	(0.0535)
Asian	0.240***	0.205***	0.136*
	(0.0703)	(0.0709)	(0.0699)
Other Races	-0.002	-0.009	-0.01
	(0.0648)	(0.0644)	(0.0631)
Hispanic	0.006	-0.001	0.011
	(0.0559)	(0.0560)	(0.0548)
Metro		-0.093**	0.068
		(0.0422)	(0.0412)
New England		0.197**	0.185**
		(0.0767)	(0.0754)
Mid-Atlantic		0.158***	0.145***
		(0.0599)	(0.0589)
East North Central		0.028	0.026
		(0.0586)	(0.0572)
South Atlantic		0.091	0.106*
		(0.0584)	(0.0570)
East South Central		0.0282	0.0584
		(0.0722)	(0.0705)
West South Central		-0.001	0.034
		(0.0668)	(0.0654)
Mountain		0.027	0.035
		(0.0711)	(0.0696)
Pacific		0.160**	0.176***
		(0.0631)	(0.0619)
Dairy Expense Share			1.852***
			(0.2890)
Grain Expense Share			0.071
			(0.3610)

Fresh Produce Expense Share			2.325***
			(0.3840)
Non-fresh Produce Expense Share			-1.105*
			(0.6310)
Protein Expense Share			-0.930**
			(0.3860)
Snack Expense Share			-0.121
			(0.5420)
_cons	-0.08	-0.214*	-0.310**
	(0.0951)	(0.1090)	(0.1260)
Sigma_cons	0.561***	0.555***	0.539***
	(0.0139)	(0.0137)	(0.0133)
N	2270	2270	2270

The results of the likelihood ratio test for the Tobit regression: organic expense share

Likelihood-ratio test LR chi2 (9) = 31.86

(Assumption: A2 nested in B2) Prob > chi2 = 0.0002

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
A2	2270	-1714.516	-1601.114	12	3226.229	3294.959
B2	2270	-1714.516	-1585.183	21	3212.367	3332.645

Likelihood-ratio test LR chi2 (6) = 93.07

(Assumption: B2 nested in C2) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
B2	2270	-1714.516	-1585.183	21	3212.367	3332.645
C2	2270	-1714.516	-1538.65	27	3131.3	3285.943

Appendix 3: The Results of Tobit Regression for Non-GMO Share

Household Income	0.012***	0.010***	0.009***
	(0.0030)	(0.0030)	(0.0030)
Primary Shopper Education	0.046*	0.043*	0.024
	(0.0247)	(0.0246)	(0.0246)
Primary Shopper Age	-0.039***	-0.038***	-0.037***
	(0.0073)	(0.0072)	(0.0075)
Marital Status	0.03	0.045	0.049
	(0.0395)	(0.0395)	(0.0399)
No. of Children	-0.036**	-0.033*	-0.037**
	(0.0181)	(0.0180)	(0.0181)
Avg. Work Hours	-0.003***	-0.003***	-0.003***
	(0.0012)	(0.0012)	(0.0012)
Black	-0.014	-0.044	0.001
	(0.0542)	(0.0543)	(0.0552)
Asian	0.221***	0.196***	0.159***
	(0.0661)	(0.0668)	(0.0667)
Other Races	-0.04	-0.038	-0.042
	(0.0682)	(0.0676)	(0.0670)
Hispanic	0.006	-0.008	0.008
	(0.0570)	(0.0570)	(0.0570)
Metro		0.057	0.042
		(0.0446)	(0.0443)
New England		0.113	0.089
		(0.0792)	(0.0790)
Mid-Atlantic		0.05	0.033
		(0.0631)	(0.0631)
East North Central		-0.006	-0.017
		(0.0620)	(0.0617)
South Atlantic		0.163***	0.169***
		(0.0601)	(0.0597)
East South Central		0.086	0.089
		(0.0739)	(0.0733)
West South Central		0.041	0.061
		(0.0694)	(0.0689)
Mountain		0.029	0.035
		(0.0746)	(0.0740)
Pacific		0.137**	0.146**
		(0.0649)	(0.0648)
Dairy Expense Share			0.445
			(0.2970)
Grain Expense Share			0.105
			(0.3750)
Fresh Produce Expense Share			1.337***
			(0.3920)

Non-fresh Produce Expense Share			-0.119
			(0.6580)
Protein Expense Share			-1.399***
			(0.4090)
Snack Expense Share			-0.003
			(0.5550)
_cons	-0.418***	-0.526***	-0.451***
	(0.1000)	(0.1150)	(0.1330)
Sigma_cons	0.477***	0.472***	0.465***
	(0.0179)	(0.0176)	(0.0174)
N	2270	2270	2270

The results of the likelihood ratio test for the Tobit regression: non-GMO share

Likelihood-ratio test LR chi2 (9) = 24.43

(Assumption: A3 nested in B3) Prob > chi2 = 0.0037

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
A3	2270	-1019.983	-975.5927	12	1975.185	2043.916
B3	2270	-1019.983	-963.3794	21	1968.759	2089.037

Likelihood-ratio test LR chi2 (9) = 25.92

(Assumption: A3 nested in B3) Prob > chi2 = 0.0002

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
B3	2270	-1019.983	-963.3794	21	1968.759	2089.037
C3	2270	-1019.983	-950.4213	27	1954.843	2109.486

Appendix 4: The Results of Tobit Regression for Pouch Share

	(1) Model A4	(2) Model B4	(3) Model C4
Household Income	0.013***	0.010**	0.008*
	(0.0043)	(0.0044)	(0.0045)
Primary Shopper Education	0.059*	0.063*	0.050
	(0.0354)	(0.0355)	(0.0359)
Primary Shopper Age	-0.055***	-0.054***	-0.052***
	(0.0105)	(0.0105)	(0.0110)
Marital Status	0.089	0.103*	0.119*
	(0.0611)	(0.0616)	(0.0629)
No. of Children	-0.005	-0.001	-0.002
	(0.0234)	(0.0236)	(0.0241)
Avg. Work Hours	-0.004**	-0.003**	-0.004**
	(0.0017)	(0.0017)	(0.0017)
Black	-0.190**	-0.203**	-0.146
	(0.0937)	(0.0940)	(0.0954)
Asian	0.105	0.088	0.070
	(0.0924)	(0.0947)	(0.0951)
Other Races	0.100	0.099	0.106
	(0.0877)	(0.0878)	(0.0880)
Hispanic	-0.001	-0.015	-0.004
	(0.0782)	(0.0793)	(0.0801)
Metro		0.111	0.098
		(0.0677)	(0.0680)
New England		0.303***	0.282**
		(0.1170)	(0.1170)
Mid-Atlantic		0.228**	0.214**
		(0.0984)	(0.0982)
East North Central		0.075	0.063
		(0.0993)	(0.0996)
West North Central		0.147	0.140
		(0.111)	(0.111)
South Atlantic		0.143	0.143
		(0.0971)	(0.0970)
East South Central		0.174	0.176
		(0.115)	(0.115)
West South Central		0.169	0.175
		(0.106)	(0.107)
Pacific		0.193*	0.195*
		(0.102)	(0.102)
Dairy Expense Share			0.707*
			(0.422)

Grain Expense Share			-0.433
			(0.551)
Fresh Produce Expense Share			0.562
			(0.578)
Non-fresh Produce Expense Share			-0.713
			(0.975)
Protein Expense Share			-1.331**
			(0.623)
Snack Expense Share			0.029
			(0.822)
_cons	-0.752***	-0.975***	-0.876***
	(0.146)	(0.176)	(0.202)
Sigma_cons	0.567***	0.563***	0.561***
	(0.0295)	(0.0293)	(0.0292)
N	2270	2270	2270

The results of the likelihood ratio test for the Tobit regression: pouch share

Likelihood-ratio test LR chi2 (9) = 16.43

(Assumption: A4 nested in B4) Prob > chi2 = 0.0585

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
A4	2270	-727.9285	-687.7281	12	1399.456	1468.187
B4	2270	-727.9285	-679.5142	21	1401.028	1521.307

Likelihood-ratio test LR chi2 (6) = 9.64

(Assumption: B4 nested in C4) Prob > chi2 = 0.1405

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
B4	2270	-727.9285	-679.5142	21	1401.028	1521.307
C4	2270	-727.9285	-674.6926	27	1403.385	1558.029

Appendix 5: The Results of Tobit Regression for Jar Share

	Model A5	Model B5	Model C5
Household Income	-0.010***	0.009***	0.009***
	(0.0024)	(0.0025)	(0.0025)
Primary Shopper Education	-0.040*	-0.043**	-0.034*
	（0.0207）	（0.0207）	（0.0208）
Primary Shopper Age	0.035***	0.035***	0.027***
	（0.0061）	（0.0061）	（0.0064）
Marital Status	-0.055*	-0.064**	0.040
	（0.0316）	（0.0317）	（0.0321）
No. of Children	0.028*	0.026*	0.034**
	（0.0150）	（0.0150）	（0.0151）
Avg. Work Hours	0.001	0.001	0.001
	（0.0009）	（0.0009）	（0.0009）
Black	-0.016	-0.022	-0.037
	（0.0440）	（0.0444）	（0.0454）
Asian	0.072	0.080	0.097
	（0.0658）	（0.0666）	（0.0667）
Other Races	-0.065	-0.069	-0.078
	（0.0568）	（0.0567）	（0.0565）
Hispanic	-0.054	-0.055	-0.051
	（0.0492）	（0.0495）	（0.0493）
Metro		0.024	0.025
		（0.0349）	（0.0347）
New England		-0.173**	-0.179**
		（0.0701）	（0.0699）
Mid-Atlantic		-0.047	-0.046
		（0.0536）	（0.0533）
East North Central		0.061	0.066
		（0.0519）	（0.0517）
West North Central		-0.026	-0.012
		（0.0603）	（0.0601）
South Atlantic		-0.000	0.001
		（0.0518）	（0.0515）
East South Central		0.044	0.039
		（0.0622）	（0.0619）
West South Central		0.029	0.023
		（0.0583）	（0.0582）
Pacific		-0.036	-0.044
		（0.0561）	（0.0558）
Dairy Expense Share			-1.229***

			（0.264）
Grain Expense Share			-0.254
			（0.316）
Fresh Produce Expense Share			-0.611*
			（0.352）
Non-fresh Produce Expense Share			-0.524
			（0.539）
Protein Expense Share			-0.439
			（0.324）
Snack Expense Share			-1.089**
			（0.461）
_cons	0.415***	0.405***	0.674***
	（0.0809）	（0.0932）	（0.108）
Sigma_cons	0.531***	0.529***	0.524***
	（0.0100）	（0.0100）	（0.0099）
N	2270	2270	2270

The results of the likelihood ratio test for the Tobit regression: jar share

Likelihood-ratio test LR chi2 (9) = 20.57

(Assumption: A5 nested in B5) Prob > chi2 = 0.0147

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
A5	2270	-1930.549	-1880.996	12	3785.993	3854.723
B5	2270	-1930.549	-1870.712	21	3783.423	3903.701

Likelihood-ratio test LR chi2 (6) = 35.12

(Assumption: B5 nested in C5) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
B5	2270	-1930.549	-1870.712	21	3783.423	3903.701
C5	2270	-1930.549	-1853.149	27	3760.298	3914.942

Appendix 6

I conducted in-person laddering interviews with 50 plus mothers (who have babies between 4 months and 2 years old) in five major cities in China in early 2014. The purpose of the interviews is to gain in-depth understanding of Chinese mothers' thoughts about organic and conventional baby foods and their purchase behaviors. Here are some preliminary findings from the interviews. Please feel free to contact me for details or if you have any questions.

Backgrounds:

1. Unlike in western countries, mothers in China don't have the tradition to feed their babies with processed commercial baby foods. Commercial baby foods start to get popular in recent ten years. Generally speaking, commercial baby foods are not widely accepted by most mothers in China.

2. There are only less than 5 brands of baby foods sold in the supermarkets or grocery stores in China. These brands are either Chinese domestic brands such as FangGuang, or the Chinese branches of the foreign companies such as Gerber China. These baby foods are produced in China. The imported baby foods (produced in the other countries) are only sold in high-end specialty stores at very high price. (At least double the price of the same products in the original countries. E.g. happy puffs can be sold at more than 10 dollars in some stores I visited.)

3. Mothers join in chatting rooms via the most popular chatting software, QQ, to talk to other mothers. They ask questions, share experiences, do online shopping together in QQ chatting rooms.

4. There are mainly four methods of buying processed baby food for Chinese mothers: ask friends who are living in foreign countries to buy and mail for them; buy during trips to foreign countries; online stores such as iHerb; specialty stores in China.

5. Several baby formula scandals happened in China in recent years. Consumers are terribly worried about food safety. Regulators or supervision departments in China

have been criticized being irresponsible.

Findings from the interviews:

There is a wall:

6. There is a built-in assumption among the Chinese mothers that anything that comes in a package, a package that looks like it's from the plastic family, just can't be healthy. And they don't understand the reasons why commercial baby food can last for such a long time (more than 1 year). They assume that there must be some **preservatives** or other chemical ingredients which are not good for babies in the processed commercial baby foods, so they feel the commercial baby foods are unsafe. None of the mothers know the technology of baby food packaging.

7. On the other hand, most mothers trust homemade baby foods, especially the grandparents, who never had processed commercial baby foods back then when they raised their babies. Both mothers and grandparents think that homemade baby foods are **fresher** and **safer** than commercial baby foods. They think homemade baby foods that made from the fresh produce they just bought are the best. They thought the processed baby foods are not fresh and had lost some nutrition.

8. It's very popular in China that grandparents move in with parents to help take care of babies. The way of feeding babies decades ago are very different from the way of nowadays. Some of the grandparents would admit that their ways are out of date, so they will just follow the parents of the babies; however, some grandparents couldn't accept commercial baby foods, so they refuse to feed babies any commercial baby foods and also ask parents not to.

9. Most mothers I interviewed are not clear about the exact meaning of "organic". They only heard that organic foods might be better, but they don't know the reasons. Organic has not got much attention among mothers in China. Organic is seldom the primary reason of buying processed baby food. Mothers in China also know little about organic certification. For example, most of them don't know what USDA Organic is. Moreover, Mothers don't trust any certifications by Chinese organizations, even some official organizations.
   Most mothers also don't know that organic can't be GMO.

10. Some mothers complain about the size of processed baby foods package. Mothers prefer small packaged baby foods. Mothers often just threw away or ate themselves the leftover baby food if the baby foods are not finished, even though the instruction says the leftover baby food can be preserved in the fridge for 1 or 2 days after the opening.

There are also windows:

11. Some mothers started to know and be interested in "organic" during buying imported baby foods. They realized that "organic" seemed very popular in other countries and might be good for their babies. Some mothers started paying attention to organic. Some mothers also claimed that they would like to buy organic baby food after they understood that Non-GMO is part of the characteristics of organic.

12. Most mothers trust the baby food from other countries, such as the U.S., Germany, and Japan, no matter the baby foods are organic or not. Therefore, imported>organic. (Moms don't have much awareness of organic food, so they don't care about that). The baby foods from the above countries have good reputation.
13. Power of word-of-mouth. Mothers like the recommendations from other mothers. They trust the products that are already very popular among other mothers and have been tried and accepted by other babies. Mothers often purchase the same products online in a group. (Following suit is really common in China). There are some mothers like studying imported baby foods, and they usually like to share their information with other mothers. The rest mothers who don't know much about the imported baby foods feel safe, comfortable and easy to make the same choices as the knowledgeable mothers. Promotion or marketing programs that take advantage of word-of-mouth, and with help from those active, enthusiastic and knowledgeable mothers, could be very efficient.

14. There are some particular baby foods that the mothers prefer the processed commercial ones. The reasons are: 1) Lack of ingredients. Some fresh fruits and fish are not widely available in China, such as cranberries, blueberries, plum, and

cod fish. Because the health benefits of these fruits or fish are very good for babies, they would like to buy the processed baby foods made from them. 2) Some processed baby foods are more delicious, have better food texture. For example, some mothers feel processed baby food made from animal livers, pureed meat and orange juice taste much better than the homemade.

15. Mothers like to bring commercial baby foods with them when they are away from home (e.g. play in parks, travels) because it is very convenient.

16. Mothers usually buy commercial baby foods in the early stages when babies just start to intake the foods other than milk (after 4 months), because some mothers have not learned how to make baby food at that time.

17. Oversea online shopping is the primary method that Chinese moms purchasing imported baby food. Even though the shipping fee is high, the total cost is usually still lower than the cost of buying in the high-end supermarkets in China. The baby foods from the other countries are only sold in those high-end supermarkets, but not the normal supermarkets. (There are only several domestic brands of baby food sold in the normal supermarkets in China. Most parents don't trust them. But sometimes parents would buy the domestic brands in the case that they don't have time to shop or wait for the imported baby food, or some mothers just think it is all right to feed their babies domestic baby food.)

18. Health benefits and ingredients are important factors that affecting moms' shopping choices. Before purchases, moms figured out which nutrients babies need for the different stages. Then they would look for the baby foods that contain the needed nutrients.

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