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## Parent Preferences for Baby Formula in China and Potential Implications for U.S. Dairy Product Exports

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PARENT PREFERENCES FOR BABY FORMULA IN CHINA  
AND POTENTIAL IMPLICATIONS FOR U.S. DAIRY  
PRODUCT EXPORTS

A Thesis Presented

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## Abstract

As the world's most populous country, with more than 16 million births every year, China has emerged as a large importer of baby formula. China's relaxation of the one-child policy, which was announced in 2015, is expected to increase the number of births significantly and therefore increase the demand for Chinese and imported baby formula. While information on parent preferences for baby formula is very important for understanding and predicting China's import demand for baby formula and other products used to produce baby formula, like milk powder, there are very limited empirical studies on Chinese parent preferences for baby formula in the literature due to data limitation and other reasons. This research collects primary data from China through a parent survey, uses the data to analyze parent preferences and willingness to pay (WTP) for selected baby formula attributes, and derives implications for U.S. dairy product exports. Specifically, with detailed data from a total of 433 respondents, this study first examines parent purchase behavior of baby formula through descriptive analysis, then assesses parent preferences and WTP for selected baby formula attributes through the estimation of a random utility model, and finally derives implications for U.S. exports of milk powder, whey, and other dairy products.

The descriptive analysis suggests that education level and income play an important role in parent purchase behavior of baby formula. The estimation results of the random utility model differed according to whether the survey was administered online or as a hardcopy. The results from the online survey indicate that imported, organic, and more reputable brands of baby formula are more attractive to respondents than domestic, non-organic, and less reputable brands. While respondents who completed the hardcopy survey also indicated a preference for organic baby formula from a reputable brand, they preferred domestic baby formula to imported formula. Further analysis of the WTP from the online survey for baby formula showed that parents have a strong preference and are willing to pay significantly more for baby formulas produced in Australia and the U.S. as compared to that produced in China. They are willing to pay more for organic baby formula and baby formula with an excellent reputation. The WTP results from the hardcopy survey indicate that parents are willing to pay more for domestic baby formula. They are also willing to pay more for organic baby formula and baby formula with an excellent reputation. China's emerging demand for imported baby formula, milk powder, and whey may bring more opportunities for the U.S. dairy industry, but U.S. dairy products are also facing increasing competition from similar products from other nations in the Chinese market. More studies are needed to identify the comparative advantages of U.S. baby formula and other dairy products in the Chinese market and to develop effective trade policies for enhancing U.S. exports to China.

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## **1. Introduction**

This introduction chapter first provides some background information about the research topic, then defines the objectives of this thesis research and discusses its significance, and finally introduces the organization of this thesis.

### **1.1. Background**

This section first reviews China's increasing infant population, then reviews the decreasing breastfeeding in China, and finally reviews the situation of China's imports of milk powder, whey, and other dairy products.

#### **1.1.1. China's increasing infant population**

China as the world's most populous nation has a large population of infants, creating a huge demand for infant products like baby formula. According to the National Bureau of Statistics of China (2014), the number of 0-3 year-old infants in China reached 69 million in 2013. As shown in Figure 1, China's newborns increased from 16 million in 2008 to 17.5 million in 2015, with an average annual increase rate of 1.29% over the period (China Industry Network, 2015). According to a conservative forecast, the population of newborn is likely to reach almost 18 million by 2017 (China Industry Network, 2015). The predicted growth is largely due to two factors: First, the significant growth of the newborn population in the 1980s and 1990s and a large proportion of that population has entered the childbearing period. Second, the relaxation of the one-child policy announced in 2015 is expected to increase the newborn population significantly in China. China will likely face a new peak of newborn population.

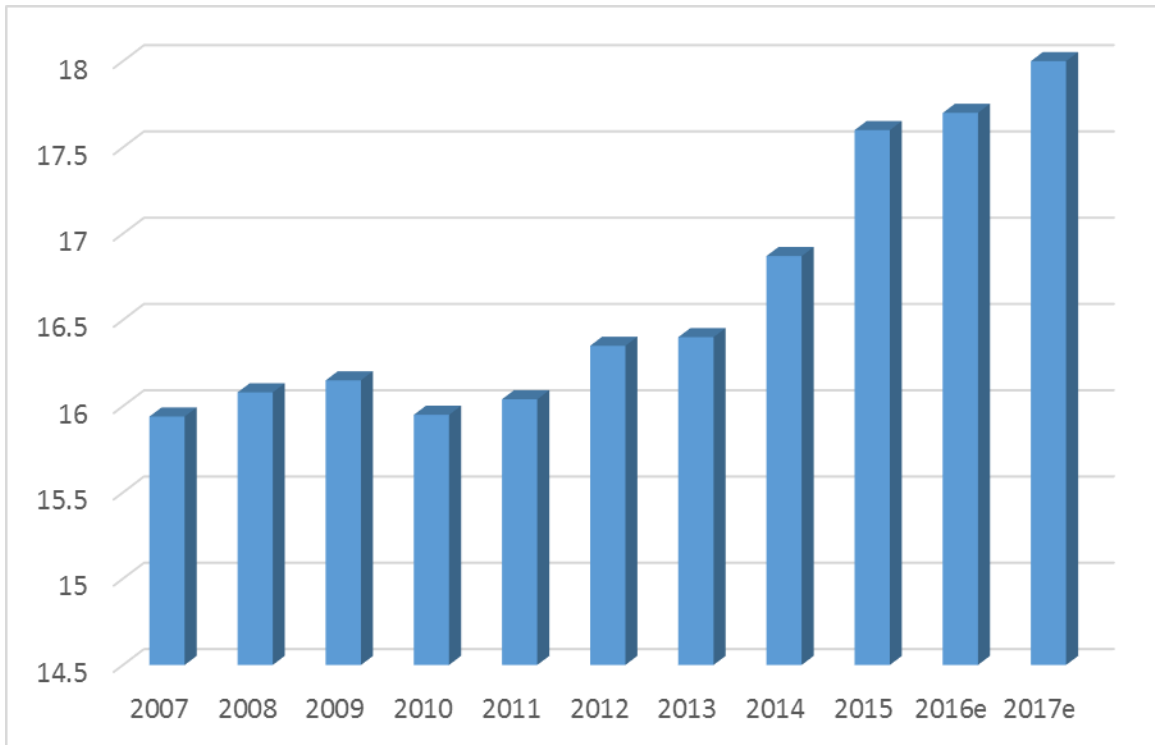


Figure 1. China's new-born population (million), 2007-2017

Source: China Industry Network, 2015.

### 1.1.2. Decreasing breastfeeding rate in China

Although breast milk is the natural and optimal infant food, the rate and length of breastfeeding has been changing over time. In China, the proportion of infants receiving breastfeeding has decreased significantly in the past two decades. The breastfeeding rate for six-month old infants in China, presented in Figure 2, shows a decreasing trend.

China's breastfeeding rate for six-month old infants reduced from 67% in 1998 to 49% in 2004 and was only 28% in 2015. China's rate of breastfeeding reduced by 21 percentage points from 2004 to 2015 (China Industry Network, 2015).

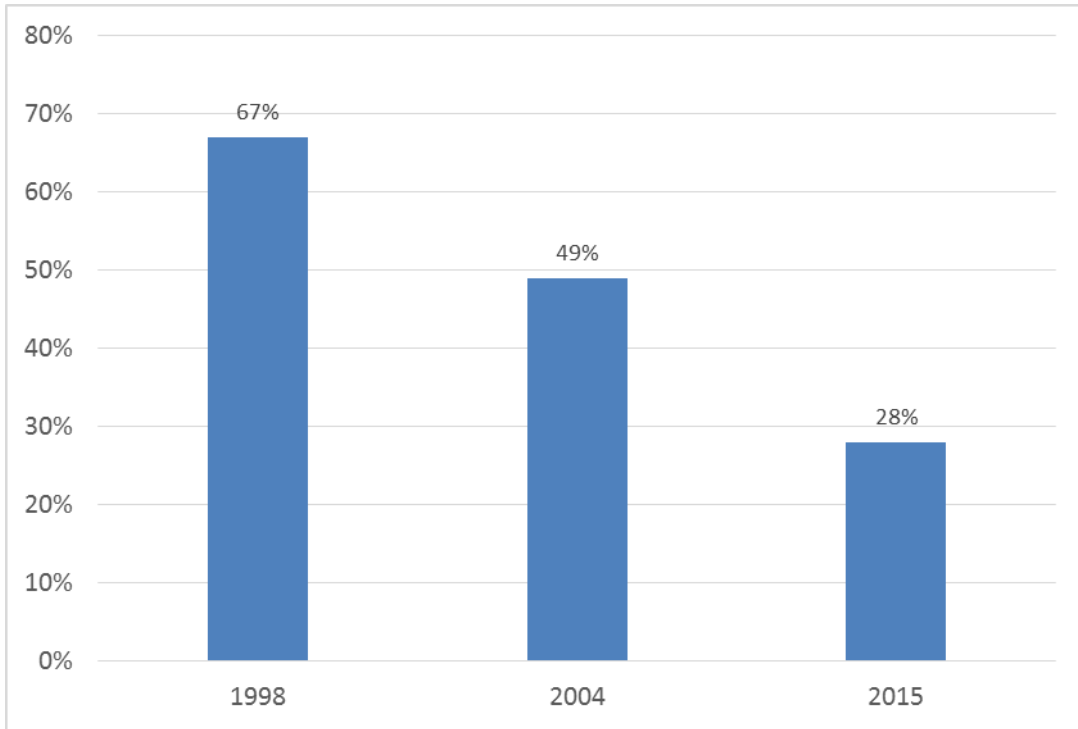


Figure 2. Breastfeeding rate of six-month old babies in China, 1998-2015

Source: China Industry Network, 2015.

Figure 3 displays the breastfeeding rates for six-month old babies in China, Japan, the U.S. as well as the global average in 2015. The table clearly shows that, while Japan has the highest rate of breastfeeding, with 51%, China and the U.S. have much lower rates, with 28% and 25%, respectively.

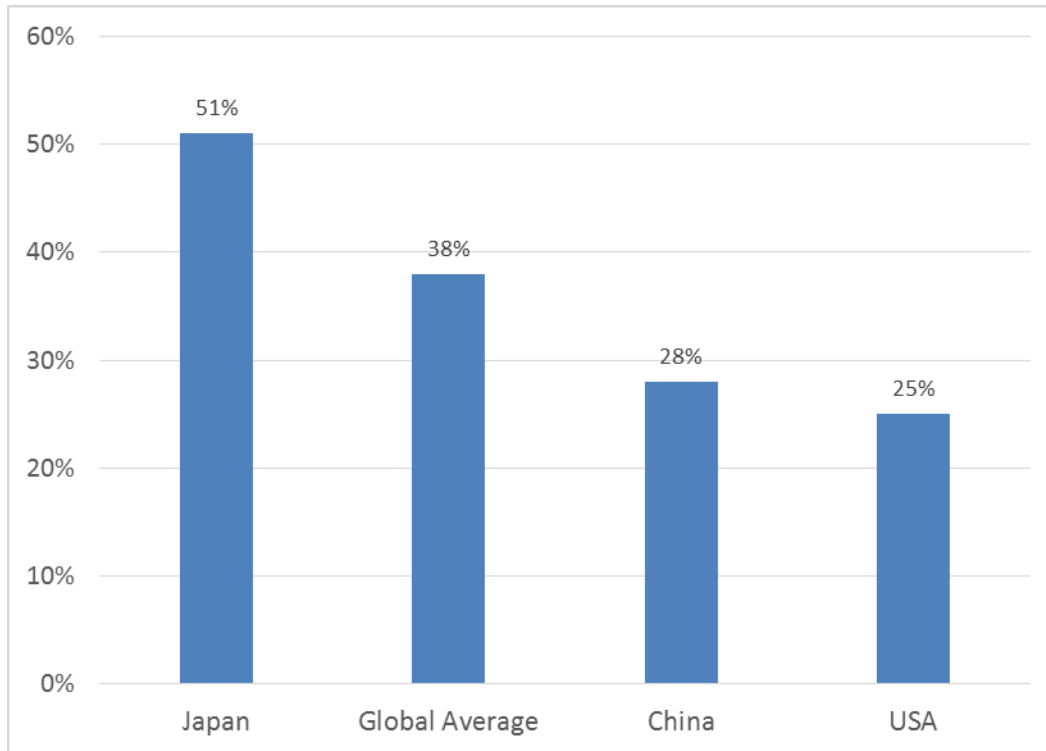


Figure 3. Breastfeeding rate of six-month old babies in China and selected countries in 2015

Source: China Industry Network, 2015.

The low and decreasing breastfeeding rate in China has contributed to the increase in the consumption of baby formula in China. China has a large market of baby formula. The increasing number of newborns and decreasing breastfeeding rate have inevitably lead to huge demand for baby formula, even though the Chinese government has advocated for breastfeeding (Garther et al, 2005).

### **1.1.3. China's imports of milk power, whey, and other dairy products**

To meet the increasing demand for baby formula, China has increased its imports of baby formula and products like milk powder and whey for producing more baby formula in China. The increase in consumer demand for imported baby formula and baby

formula produced with imported milk powder in China is due to increased income as well as safety problems with domestic baby formula and milk powder. For example, the Fuyang powdered baby formula problem in 2004 (Lu et al, 2014) and the melamine scandal in 2008 (Liu et al, 2013) severely weakened consumer confidence in the domestic baby formula and are the main reasons why many Chinese parents prefer to purchase imported baby formula.

Baby formula is used as a substitute for breast milk and is produced with cow milk or other animal milk as well as plant components as the basic ingredients. Compared with milk powder, baby formula removes part of the casein while adding whey protein. It removes most of the saturated fatty acids while adding vegetable oils, lactose and a sugar content similar to breastmilk. It reduces the content of calcium and minerals to mitigate the burden on a baby's kidneys. Finally, it adds trace elements, vitamins, and certain amino acids, making it more similar to breast milk.

The data of China's Customs Statistics Data (2015) shows that China's baby formula imports increased from 121,000 tons in 2014 to 175,972 tons in 2015 or 45%. In addition to the direct imports of baby formula, China has significantly increased its imports of milk powder and whey in the past two decades. As shown in Figure 4,

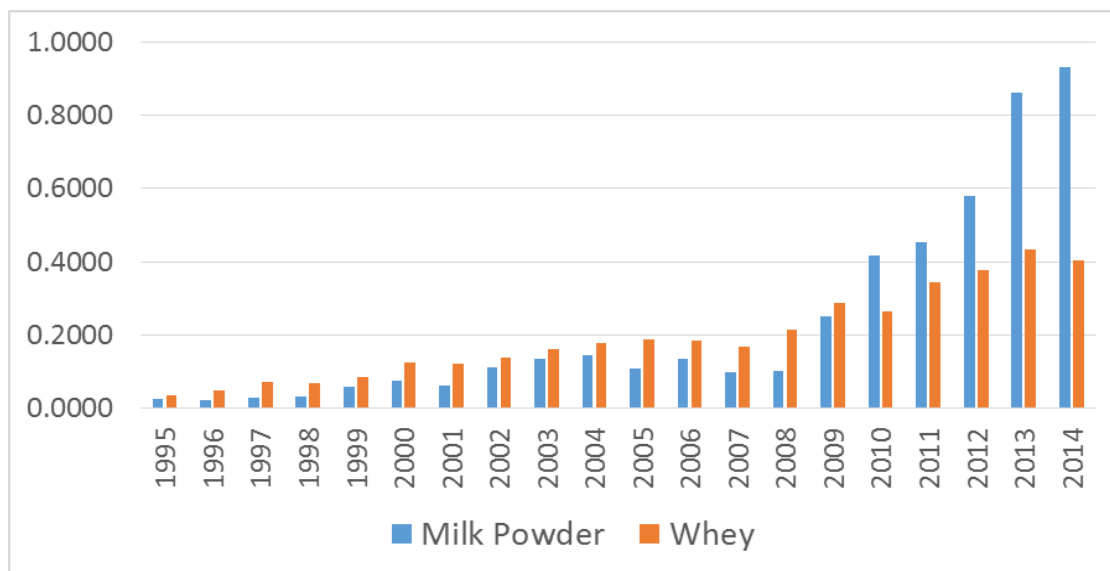


Figure 4. China's imports of milk powder and whey (mmt), 1995-2014

China's milk powder and whey imports have increased significantly since 1995, especially after the melamine scandal in 2008. For example, China's import of milk powder increased from 0.2 mmt (million metric ton) in 2009 to 0.9 mmt in 2014. China's import of whey increased from 0.2 mmt in 2008 to 0.4 mmt in 2014.

Figure 5 shows China's imports of dairy products in milk-equivalent quantity and total milk supply from 1995 to 2015. In Figure 5, all the data are from the U.S. Department of Agriculture. Figure 5 includes the data of China's milk output, imported milk powder, imported whey, imported cheese and total supply. As we know that the imports of whey, cheese, and milk powder contribute to China's total supply of milk, the total milk supply is the sum of domestic production and imports of dairy products converted to milk-equivalent quantity. The ratios of milk powder and whey to fluid milk are both 1:7.4 and the ratio of cheese to fluid milk is 1:10. Figure 5 shows that China's milk output had been increasing steadily from 1995 to 2007, but it has fluctuated around

37 mmt since 2008. Meanwhile, China's imports of powder milk, whey, and cheese have increased greatly since 2008. This is because of the melamine incident in China in 2008, where many children got kidney stones after drinking baby formula containing melamine. This baby formula was produced by a large and well-known Chinese dairy company called San Lu. When the government investigated this incident, it found that many other Chinese dairy producers had melamine in their baby formula as well. As a result of these incidents, Chinese consumers lost confidence in the quality of Chinese baby formula, and they turned to imported baby formula. It also shows that trade will be easily impacted by many factors, like quality problems. This indicates that China has a large demand of dairy products, but China's milk producers cannot produce enough dairy for China's demand itself. The increasing gap between imports and output means that China needs to import a lot of powder milk, whey, and cheese to meet its growing domestic demand for dairy products. In addition to powder milk, whey, and cheese, China also has imported butter, fluid milk, yogurt, ice creams and other dairy products, which, however, are not shown in figure 5 due to their small quantities.

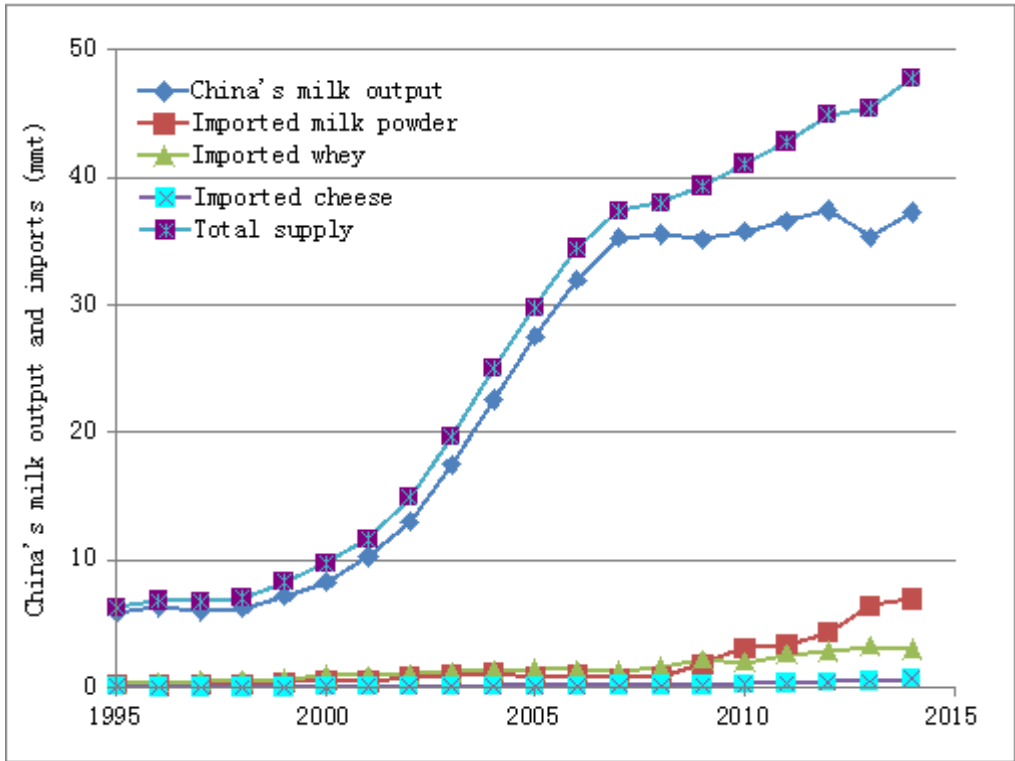


Figure 5. China's imports of dairy products in milk-equivalent quantity and total milk supply, 1995-2015

In summary, the demand for baby formula in the Chinese market will likely continue to increase due to increasing infant population, a decreasing breastfeeding rate, and the demand for imported baby formula, milk powder, and whey will likely increase at a higher rate due to consumer concerns about domestic products and strong preference for imported products. Chinese consumers' concerns about the quality of domestic brands of baby formula will increase demand for imported baby formula. After the background of China's huge market demand for baby formula, I will discuss the preferences of Chinese parents to buy baby formula in this article.

## **1.2. Problem statement and significance of this research**

As discussed in the previous section, parent preferences for baby formula have attracted a lot of interest in the literature around the world, especially in China. China has become the world's largest market for baby formula with significant imports. In recent years, China's number of newborns per year is over 16 million. Due to China's family planning policy and the special culture of child support, the parents pay much more attention and spend a lot on baby formula. Chinese dairy producers' repeated failures to meet quality assurance standards for baby formula have led to the poor reputation of domestic baby formula brands. As a result, imported baby formula brands have become more popular than domestic brands. Because of this, it is very important to research the consumer preference for imported products as compared to domestic products.

Most studies on China's consumption of baby formula have focused on consumption behavior in large cities, such as Beijing, Shanghai, and Guangzhou. There is limited research effort in other regions, especially the inland regions and rural areas. This research is motivated by the growing baby formula demand in China and the lack of information on parent preferences and WTP for baby formula attributes. To this end, this thesis has collected primary data from some cities in China. Since data was collected from four different cities, the respondent distribution is very diverse, and the collected data could well represent the basic current status of China for the demand for baby formula. The significance of this study is based on the following considerations.

First, the large dataset of parents in both urban and rural regions will make it feasible to identify the potential factors of consumer preference for baby formula

quantitatively. Second, a well-designed survey will make the collected data more specific to this study, and the diverse respondents would help show a big picture of baby formula demand throughout China.

### **1.3. Objectives**

The overall goals of this study are to collect primary data through a parent survey in China, examine Chinese parent preferences and WTP for selected baby formula attributes, and discuss the potential implications for U.S. dairy product exports. Five specific objectives are developed to attain the goals:

1. To collect primary data through a survey,
2. To examine parent purchase behavior of baby formula through descriptive analysis,
3. To evaluate parent preferences and willingness to pay for baby formula attributes through the estimation of a random utility model (RUM),
4. To identify the cluster effects of parent preferences for baby formula through a Latent class model (LCM), and
5. To discuss the potential implications for U.S. dairy product exports.

### **1.4. Thesis organization**

This thesis is organized into six chapters. Following this introduction chapter, Chapter 2 reviews the findings and methods of recent studies in the literature, Chapter 3 introduces the methodology, Chapter 4 discusses the data collection procedures and reports the descriptive results, Chapter 5 presents the empirical analysis results, Chapter 6

reviews the trends analysis of China's baby formula market and potential implications for U.S. dairy product exports, summarizes the major conclusions and implications of this research, discusses the major limitations of this study, and lists suggestions for further research.

## **2. Literature Review**

This chapter presents a comprehensive literature review and is organized into three sections. The first section summarizes the empirical results of previous studies on baby formula, the second section reviews the commonly used methods of measuring consumer preferences related to this thesis, and the final section reviews the trade of baby formula.

### **2.1. Research on baby formula**

China's dairy industry is developing rapidly. Baby formula is a part of the dairy industry and there are very limited studies on baby formula in the field of economics in China. Furthermore, there are even fewer research efforts on the main factors influencing baby formula consumption, and the main factors impacting consumer choice between imported and domestically produced baby formula. The following sections will review the studies of food consumption, the main factors influencing dairy product consumption and the factors impacting baby formula consumption.

Consumption is the ultimate goal of all economic behaviors, therefore, research on consumption is an important part of the economy. There is a lot of research in the field of food consumption. Research on baby formula demand in China and other countries has been conducted recently. Since 2008, accidents impacting the quality of domestic infant formula brands have happened frequently and as a result consumer confidence in domestic brands is very low. As a new kind of business model, "overseas shopping" has risen sharply from 2012, and so has Chinese consumers' willingness to buy infant

formula product. There is much research being done on consumer preferences for baby formula as shown in different studies.

Research efforts on baby formula are mainly spent on nutritional ingredients, recipes, and other aspects. Chinese consumers prefer to buy formula products from overseas markets with some negative consequences resulting from large amounts of “overseas shopping” (Lu et al., 2014). Furthermore, some feasible policy suggestions were put forward to solve quality problems and restore consumer confidence. However, Wang (2009) took domestic brand Wandashan as an example and analyzed a variety of nutrients, which showed that its index fully met the needs of modern infants and young children. Song’s (2001) study not only pointed out that there was no difference between domestic baby formula and imported baby formula, but also considered domestic baby formula more suitable for Chinese babies than imported baby formula because imported baby formula would cause more Chinese infants to get angry, experience dry stools, and other symptoms.

For the research on factors influencing baby formula consumption, He (2010) pointed out that consumer habits and preferences, product price, product quality and alternatives are the main factors. Yu and Li (2012) also pointed out that the consumer's gender, household income, number of children at home, and consumer perception of risk will also have a significant impact on the purchase of baby formula. Wang and Liu (2013) studied how the baby formula market of exported countries impacted China's baby formula consumption.

Due to high infant formula industry investment profits (Gao, 2013), it is a good time for domestic businesses that make baby formula to develop, but the quality and

safety problems that occur repeatedly hinder the development of the China-made baby formula industry. Tian and Li (2005) pointed out that problematic technical issues are not the root cause of safety problem of baby formula, but instead market oversight. Ma (2011) also mentioned that regulations are not in place and the opaque crisis management mechanisms are the major reasons that consumers cannot understand when domestic infant formula milk powder quality problems arise. Yang (2013) considered that the rapid development of domestic baby formula industry needs to establish reasonable production and industry self-regulation standards. He and Zhou (2014) demonstrated the importance of establishing an effective food safety system for infants and young children. Ma (2002) showed that the major solution to making domestic baby formula stand out in the competition is by improving baby formula nutritional completeness, increasing innovation, and producing more targeted products with their own characteristics. Ling (2013) proposed to enhance the competitiveness of domestic baby formula through the analysis of Chinese milk consumer market characteristics.

Infant Milk Formula (IMF) was taken as an example by Yin (2014), who studied consumers' preferences on the attributes of quality information, such as brand, organic certification label (OCL), origin and price by using conjoint analysis (Yin et al., 2014). The results showed that the origin became the most important attribute in determining consumer preference, and the importance of OCL has exceeded brand; consumers prefer products from abroad, especially in the developed countries.

Liu et al. (2013) took Nanjing as an example and used the method of statistical analysis to research the influential factors. From their conclusions, security was the most important consideration when consumers buy infant milk powder. Secondly, payment

ability was the next largest influencing factor. Thirdly, consumers who have greater cognitive ability and purchasing power tend to buy imported milk powder. Lastly, consumers with higher education level, cognitive ability, and risk perception are more unwilling to buy infant milk powder having security problems, while consumers with higher trust levels are more likely to buy infant milk powder that has security problems.

Furthermore, two representative cities, i.e., Harbin and Zhengzhou were chosen to analyze the dairy products consuming condition, the purchase factors and consumer preferences of China's citizen consumer (Zhang et al. 2002). Further, they analyzed the trends of changes in citizens group's consumption of dairy products, the state in which various types of products were consumed, and the factors affecting the way dairy products were consumed. They concluded that it was very essential to build the brand reputations, especially when people are more interested in imported milk powder nowadays.

Milk powder preference research attracted increasing interests not only in China, but also in other countries. Allen et al. (2012) aimed to research such questions: whether or not respondents consume milk/yogurt, the frequency with which they consume it, which type of product they typically consume, and how much they would be willing to pay for new milk or yogurt attributes. They indicated that several aspects of the Health Belief Model as well as general nutrition knowledge can predict purchasing and consumption intentions for milk and yogurt products. All else being equal, the influences on an individual's willingness to pay for unique milk or yogurt characteristics in stated choices are different than the influences on their self-identified willingness to seek out milk or yogurt to increase calcium in their diet.

Yayar (2012) conducted a study to investigate packed and unpacked fluid milk consumption and preferences among Turkish households using the data from a consumer survey. A multinomial logit procedure was used to investigate the selected socioeconomic and demographic characteristics of consumers that determine households' fluid milk consumption choices among packed, unpacked, and both packed-unpacked milk consumption choices.

Mila et al. (2013) examined the consumer preferences for processed milk in Mymensingh town. The study was mainly based on primary data in which 40 consumers were purposively selected from Mymensingh town. In the study, preference of consumers for processed milk, for example, powder milk, condensed milk, and pasteurized milk were investigated. Consumers' preference for processed milk was ascertained through a 4-point numerical rating scale.

## **2.2. Research on methods**

Currently, research done on consumers' preference affecting their purchasing habits is very popular using many different methods. For example, Zhang (2012) discussed the theoretical basis of the choice experiment, and analyzed residents' willingness to pay for pollution abatement in the Xiangjiang River. This study concluded that people's willingness to pay for said pollution abatement would lead to improved water quality and environmental value of the Xiangjiang River. In this study, the author selected the eight major cities in the Xiangjiang River distribution and surveyed 587 residents to collect questionnaire data.

Wang et al. (2014) built conditions logit models and stochastic parameters logit model using utility theory and welfare economics theory attributes to research the importance of coastal resources and environment, the impact of the marginal value of environmental resources, and changes to the social welfare state. Take Dalian City Fujiashuang Coastal Park for example, this paper conducted empirical research by using survey data.

Ma et al. (2013) collected questionnaire survey data from 361 members of the public of Wuhan City and 383 farmers in the field. Then they analyzed arable land for urban and rural residents from the perspective of choice experiment. Specifically, they analyzed the quality and fertility of arable farmland surrounding landscape and ecological environment and the protection of farmland pay the cost of four possible responses and willingness to accept the protection of property and the combined program policies.

Briol et al. (2006) aimed to assist policy makers in formulating efficient and sustainable wetland management policies by providing results of a valuation study on the Cheimaditida wetland in Greece. A choice experiment was employed to estimate the values of changes in several ecological, social, and economic functions that Cheimaditida wetland provided to the Greek public. In addition to the conditional logit model, a random parameter logit model and a latent class model were estimated to account for heterogeneity in the preferences of the public for the various functions of the wetland.

Louviere et al. (2008) showed how to combine statistically efficient ways to design discrete choice experiments based on random utility theory with new ways of collecting additional information that can be used to expand the amount of available

choice information for modeling the choices of individual decision makers. The paper provided several simulated examples, a small empirical example to demonstrate proof of concept, and a larger empirical example based on many experimental conditions and large samples that demonstrates that the individual models capture virtually all the variance in aggregate first choices traditionally modeled in discrete choice experiments.

Loureiro et al. (2007) used choice experiments to analyze U.S. consumers' relative preferences and willingness-to-pay for meat attributes in labeled ribeye beef steaks. Relatively speaking, consumers value certification of USDA food safety inspection more than any of the other choice set attributes, including country-of-origin labeling, traceability, and tenderness. As a result, indication of origin may only become a signal of enhanced quality if the source-of-origin is associated with higher food safety or quality.

Chen et al. (2013) examined consumer perceptions and estimated willingness to pay for vacuum packaging of fresh beef under different information treatments by using non-hypothetical consumer choice experiments and the food technology neophobia scale (FTNS). The findings suggested that information about the positive and potential negative properties of vacuum packaging play an important role in shaping consumers' attitudes towards vacuum packaging and WTP for vacuum-packaged beef steaks. Results for participants FTNS scores are significantly correlated with their stated food safety perceptions, indicating that risk perceptions together with food safety concerns are major determinants of consumer resistance to food technologies.

Wezemael et al. (2014) investigated consumer preferences for nutrition and health claims on lean beef steak. Two choice experiments were conducted among 2,400 beef consumers in four EU countries (Belgium, France, the Netherlands, and United Kingdom). Multinomial logit and error component models were estimated. Their results generally suggest that consumer valuation of nutritional and health claims varies across countries.

Sagebiel et al. (2014) developed a theoretical framework seeking to explain preferences for electricity supplied by cooperatives from a consumer perspective. Drawing on a convenience sample of 287 German electricity consumers and choice experiment data from an online survey, they estimate willingness to pay values for organizational attributes of electricity suppliers, while accounting for observed and unobserved heterogeneity. Their results also indicate a substantial willingness to pay for transparent pricing, participation in decision making, and local suppliers.

Denver et al. (2014) investigated consumers' preferences for local production of apples. The analysis was based on a choice experiment among 637 Danish consumers used in combination with a principal component analysis of a set of opinion questions. The principal component analysis identifies two components of questions. Component 1 concerns benefits related to organic products while component 2 relates to positive features of locally produced products.

Tempesta et al. (2013) described the use of a choice experiment to investigate the willingness to pay a premium price for milk while considering three attributes: origin, area of production, and rearing. The data collected were analyzed by means of three

approaches. First, they used a multinomial logit model to estimate the average premium price for the three attributes considered. Second, an interaction term between price and quantity of milk purchased weekly was introduced into the model. Finally, the latent class method was used to explore the heterogeneity of the preferences.

Wu et al. (2014) used consumers' willingness to pay as a criterion for judging the effectiveness of China's organic certification policy. A choice experiment infant milk formula (IMF) with four attributes, including organic certification label, brand, country of origin, and price was conducted in Shan dong province of China. Estimation with a mixed logit model revealed that consumers' WTP for IMF with an American or European organic certification label was higher than IMF with a Chinese label. Moreover, consumers' knowledge of organic food and food safety risk perceptions had an impact on their WTP.

Based on existing literature, we can observe several things. First of all, it has become the frontier approach to combine the CE with RPL model for the European and American scholars on the research of consumers' choice. However, it is not well studied by using WTP in China, even though it is not common to adopt IMF as an object of study. Secondly, existing studies are more concerned about consumer preferences from the micro level, but the literature has not been reported to combine it with macroeconomic policy to propose policy criteria for public consumption. Thirdly, there is no systematic study that traces information, for example, labels, brands, production, and sales channels to quality information, due to attributes of CE models that are designed differently based on scholars' concern.

### **2.3. Research on the trade of baby formula**

The growth of global networks of baby formula production is closely linked to the globalization of milk production. A few dairy businesses have become global in scale. The largest dairy exporter in the world is Fonterra, based in New Zealand. Fonterra and other New Zealand firms are promoting industrial-style milk production in Brazil, Chile, Uruguay, the U.S. Midwest, and Hawaii. In 2013 the baby formula market is still growing rapidly with the development of markets like Asia, particularly China with a growth rate close to 20% per year.

One unique feature in China's baby formula history helps to explain the growth of this market sector. In 2008 it was discovered that some baby formula produced in China was tainted by deliberate contamination with melamine (Montague, 2010; Yan, 2011). Low-cost melamine was added to give the appearance that the formula had proper nutrient levels, but it did not. The result was that at least six children died, and many became ill. Two Chinese executives were sentenced to death because of their participation in the crime (Montague, 2010). The harm to the economy continues. Chinese people have become wary of baby formula made by Chinese companies, and go to great lengths to import the product. They pay high prices, and the practice has stimulated a variety of illegal activities such as thefts and the smuggling of formula into China. The high demand for formula in China has resulted in significant depletion of supplies elsewhere (Chibber, 2014).

The vigorous thrust of Fonterra and others to sell formula and other baby foods to China has been described as a "goldrush" (Adams, 2014). Entrepreneurs in Australia and many other places are trying to get a share (Kitney, 2014). The continuing impact of the

melamine scandal is demonstrated by an installation by Chinese dissident artist Ai Weiwei (Wyatt, 2013; Vega, 2014). In museums in Hong Kong, Singapore, and the Philippines, he created floor maps of China stacked with cans of infant formula. The map highlights the preoccupation of China with infant formula. An art review said it “draws attention to the issue of milk safety and ensuing scarcity of supply in China resulting from the melamine scandal (Vega, 2014).” Unfortunately, the installation and the review said nothing about how increasing consumption of safe infant formula might have a negative effect on the well-being of Chinese children and their mothers, and the country as a whole.

Through the literature review, it can be observed that many researchers consider such factors as consumer's gender, age, education, disposable income, household size, and urbanization rate. Like many other countries, China has a growing middle class with money to spend. But China is different in important ways. Demand for baby formula in China was expected to grow to more than US \$14 billion in 2014. China's baby formula imports mainly focus on only several countries, i.e., European Countries and New Zealand. United State only contributes a small portion to China's imports. Therefore, there is less research on the trade between China and United State. Besides, questionnaire and random logit model are well applied in current preference analysis. Based on the existing literature in research methods, this paper adopts survey method and random logit model to empirically analyze the parent preference on baby formula consumption.

### **3. Methodology**

This chapter includes five sections. The first section introduces the survey design, the second section discusses the basic statistical analysis methods, and the last three sections present the proposed analysis methods.

#### **3.1. Survey design**

According to the literature review, many of the previous studies were based on data from some national surveys. This thesis research collects primary data through a parent survey in China. The survey contains two major parts. The first part is to collect information on the purchase behavior of baby formula and household characteristics. For example, “when do babies drink baby formula at the first time”, “what is the total household income”, etc. The other part is to assess parent preferences and WTP through choice experiments, where we design several virtually different products based on different attributes and their levels. Through the choice experiments, we can analyze the consumers’ preference in a constrained environment. In this section, we mainly discuss how to design the choice experiment. Specifically, we selected 4 attributes: price, product origin, organic certification, and brand reputation.

Price is a very important factor in determining parent purchase behavior, especially in China because most Chinese families are not very rich and have limited budget to buy baby formula. Due to large population of low-level income, the price attribute should be taken into consideration. In this thesis, we choose three levels for the price attribute: 200 yuan/900 grams, 275 yuan/900 grams and 325 yuan/900 grams. 900 grams are a popular size of baby formula in the Chinese market.

Chinese parents also pay attentions to where the baby formula is produced. Parents have their own favorite country when choosing baby formula. For example, some people prefer American brand and some may like baby formula from Australia. In this way, the product origin should also be considered when designing the choice experiments. Lim et al. (2013) found that the WTP of the domestic beef for US consumers was higher than imported beef. Yin et al. (2014) indicated that "Trimer Cyanamid", "DCD", and other events have made the Chinese consumers particularly concerned about food's origin and quality. In this thesis, we select three levels for product origin attribute: China, United States, and Australia.

Organic certification is another factor that influences parent preferences. As we know, organic foods are more attractive to consumers since they are much safer due to the special production processing. In this case, we set two levels for organic certification attribute: "certified organic" and "not certified".

Brand reputation plays a very important role in consumption decisions. In China's dairy market, repeated scandals have influenced consumers' brand preferences in varying degrees. Current government's encouragement on the merge and acquisitions of baby formula companies will undoubtedly contribute to a strong policy for baby formula supervision on the quality of production. However, consumers' brand preferences still play a more essential role in baby formula choice. In this thesis, we select two levels for brand reputation: "excellent" and "good". "Excellent" means that products exceed the quality and safety standards and there has never been any reported quality or safety problem, penalty or recall in the past 10 years. "Good" means the products meet the government's quality and safety standards.

In this study, based on the attributes and level settings, there are many combinations of virtual baby formula product profiles. If two products are selected each time, it is impossible for the respondents to carry out so many comparisons to choose the product with the greatest utility. Based on the attributes and levels, there are 36 possible product profiles (3 price levels\* 3 product origin levels\* 2 organic certification levels\* 2 product reputation levels).

In general, consumers will feel tired when they have to choose between two products over 20 times. Because of this, it is very essential to reduce the number of products to improve the efficiency of selection for respondents. To help with this, in this survey, respondents only need to choose between two products 16 times, which makes the survey easier for respondents to do. The 16 pairs of baby formula product profiles are selected through orthogonal design.

Table 1. Four attributes and their levels

<b>Attributes</b>	<b>Levels of Attribute</b>
Price	200 yuan
	275 yuan
	350 yuan
Origin	China
	USA
	Australia
Organic	Yes
	No
Brand quality and safety reputation	Excellent
	Good

### 3.2. Descriptive analysis

When data are collected, the next step is to do a basic statistical analysis to get general background information like the proportion of each gender, the age range, the family income, the education level of respondents, and living place, etc. Descriptive analysis provides basic analysis information of parent preferences for baby formula.

### 3.3. Random utility model (RUM)

Random utility model (RUM) is used to analyze consumer preferences. Choice experiments are based on the assumption that individual  $n$  obtains utility  $U_{nit}$  from selecting alternative  $i$  from a finite set of  $J$  alternatives contained in choice set  $C$  in situation  $t$ . In the RUM, utility is composed of a deterministic component  $V_{nit}$ , which depends on the attributes of an alternative, and a stochastic component  $\varepsilon_{nit}$  as

$$(1) U_{nit} = V_{nit} + \varepsilon_{nit}.$$

Therefore, individual  $n$  will choose alternative  $i$  if  $U_{nit} > U_{njt}, \forall j \neq i$ . Consequently, the probability of individual  $n$  choosing alternative  $i$  is given by

$$(2) P_{nit} = \text{Prob} (V_{nit} + \varepsilon_{nit} > V_{njt} + \varepsilon_{njt}; \forall j \in C, \forall j \neq i).$$

Given the underlying distribution of the error term, the closed form of the logit choice probability can be expressed as:

$$(3) P_{nit} = \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})}.$$

This study uses a random effects specification by implementing a random parameters logit model. Unlike the traditional logit model, where consumers are assumed to be homogeneous, heterogeneity in consumer preferences for food safety informational attributes is measured using random parameters logit model. The random parameters logit model relaxes the limitations of the traditional logit by allowing random taste variation

within a sample according to a specified distribution (McFadden and Train, 2000). Under RPL, the deterministic component of utility,  $V_{nit}$ , in the RUM takes the form of

$$(4) \quad V_{nit} = \beta x_{nit}$$

where  $\beta$  is a vector of random parameters, which has its own mean and variance, representing individual preferences, and  $x_{nit}$  is the vector of attributes found in the  $i$ th alternative. Following Train (2003), the probability that individual  $n$  chooses alternative  $i$  from the choice set  $C$  in situation  $t$  is given by

$$(5) \quad P_{nit} = \int \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} f(\beta) d\beta$$

where we can specify the distribution of the random parameter  $f(\cdot)$ . If the parameters are fixed at  $\beta_c$  (nonrandom), the distribution collapses, i.e.,  $f(\beta_c) \rightarrow \infty$  and  $f(\beta) = 0$  otherwise.

### 3.4. Estimation

The random parameter model specification can be estimated using NLOGIT version 4.0. We hypothesize that the product-specific parameters are random and follow normal distributions and, for modeling purposes, we treat price and the constant terms as fixed (Ubilava and Foster 2009). The estimated model coefficients are not conveniently interpretable in economic terms given the noncardinal nature of utility. Therefore, consumer WTP estimates were calculated as:

$$(6) \quad WTP = -2 \beta_k / \beta_p,$$

where  $\beta_k$  is the estimated parameter of the  $k$ th attribute, and  $\beta_p$  is the estimated price coefficient. In this analysis, the WTP estimates are multiplied by 2 due to our use of effects coding (Lusk, Roosen, and Fox, 2003). 95 percentage confidence intervals can be

created using the parametric bootstrapping procedure suggested by Krinsky and Robb (1986).

### **3.5. The latent class model (LCM)**

The LCM for the analysis of individual heterogeneity has been used in several previous studies. See Heckman and Singer (1984) for a theoretical discussion and more details. However, a review of the literature suggests that the vast majority of the reviewed applications have been in the area of models for counts using the Poisson or negative binomial models. See Nagin and Land (1993) for an application and Greene (2001) for a survey of the literature. The model has had limited applications to the analysis of discrete choice among multiple alternatives. Two exceptions are Swait (1994) and Bhat (1997).

The underlying theory of the LCM posits that individual behavior depends on observable attributes and on latent heterogeneity that varies with factors that are unobserved by the analyst. This study proposes to analyze this heterogeneity through a model of discrete parameter variation. Thus, it is assumed that individuals are implicitly sorted into a set of  $Q$  classes, but which class contains any particular individual, whether known or not to that individual, is unknown to the analyst.

## 4. Data Collection and Descriptive Results

This chapter first explains how the survey was conducted to collect primary data from China and then presents the descriptive results from the data. This chapter also examines the impacts of sociodemographic variables like income and education on the consumption behavior of baby formula.

### 4.1. Data collection

The survey was conducted in Beijing city, Hebei, Shaanxi and Guangdong provinces in 2015. The respondents were the parents or grandparents of children at the age of five or under. See Figure 6 for the geographic locations of the survey.

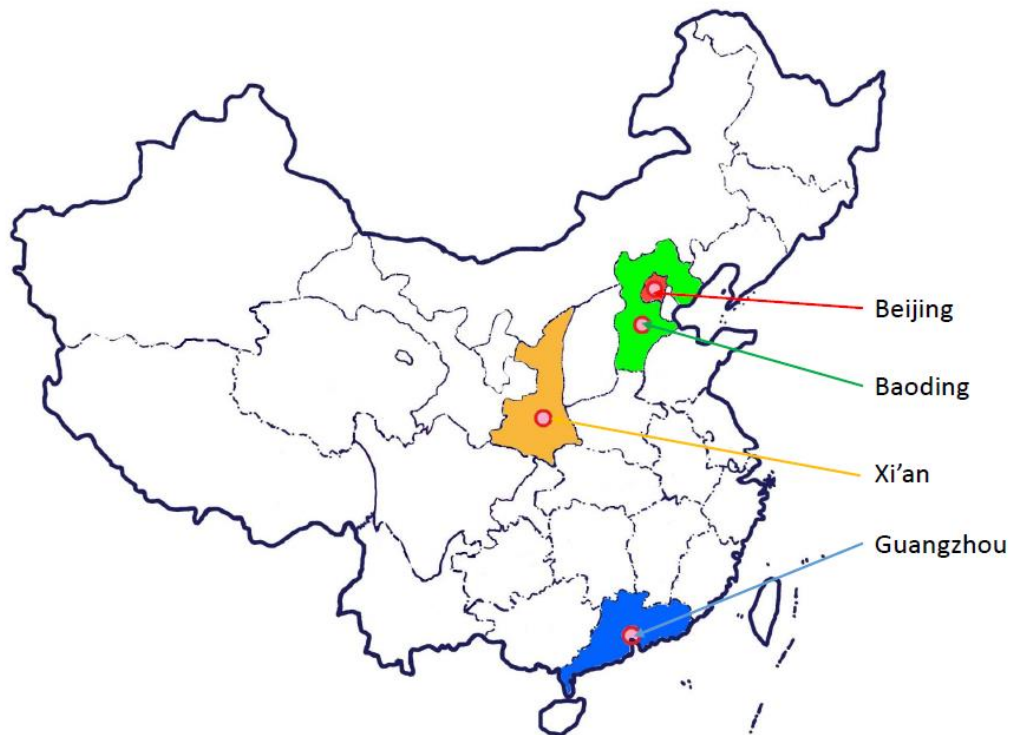


Figure 6. Geographic locations of those surveyed

The survey was conducted through two ways: (1) hardcopies were distributed through kindergartens, day care centers, and doctors' offices, and (2) online survey through a Chinese survey site.

The survey was administrated from June 10, 2015 to September 30, 2015 in the study regions. There were 433 completed surveys: 356 from hardcopies and 77 from the online survey. Although efforts were made to get a representative sample, the survey is not from a statistically random sample due to the lack of funding.

#### **4.2. Descriptive results**

SPSS 20.0 software was used to analyze the collected data and the descriptive results are presented in tables 2 and 3.

Among all the respondents, (1) 64.9% are females and 35.1% are males; (2) the average age is 36.3 with 67.29% between 18 and 35 years old, 13.65% between 36 and 50 years old, 16.71% between 51 and 65 years old, 2.12% between 66 and 85 years old, and 0.23% older than 85 years old; (3) 25.17% of the respondents have less than associate degree, 33.1% have an associate degree, 35.61% have undergraduate degree, and 6.06% have a graduate degree; (4) 11.24% live in Beijing or provincial capital cities, 46.67% live in other large and medium-sized cities, 30.14% live in small cities, and 11.95% live in town or rural areas; (5) more than half of the respondents' incomes are between 20,000 and 100,000 RMB per year; (6) 55.4% of respondents own one house or apartment, 23.6% of them own two, and only 6.5% of them do not own any; (7) 66.67% of respondents have cars, and 33.33% of them do not have any.

Table 2. Summary of basic information about the respondents

<b>Variable</b>	<b>Classification</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Gender</b>	male	146	35.10
	female	270	64.90
<b>Age</b>	18-35	286	67.29
	36-50	58	13.65
	51-65	71	16.71
	66-85	9	2.12
	>85	1	0.23
<b>Educational level</b>	primary school	10	2.33
	middle school	32	7.46
	high school	66	15.38
	associate degree	142	33.10
	under graduate	153	35.67
	graduate	26	6.06
<b>Residence</b>	municipality or capitals	47	11.24
	other large and medium-sized cities	195	46.67
	small cities	126	30.14
	town	18	4.30
	countryside	32	7.65
<b>Income</b>	< 20000	34	7.89
	20000-100000	228	52.90
	100000-200000	123	28.54
	200000-240000	25	5.80
	>240000	21	4.87
<b>House</b>	no house	28	6.50
	1	240	55.40
	2	102	23.60
	3	39	9.00
	4	16	3.70
	> 4	8	1.80
<b>Car ownership</b>	have cars	288	66.67
	don't have cars	144	33.33

Summary statistics about the babies are reported in Table 3: (1) 71.4% of the babies are under 3 years old and the average age of all the babies is 2.14; (2) 45.4% are

boys and 54.6% are girls; (3) 32.1% of the babies began to drink baby formula between 0 and 3 months old, 26.7% of the babies began to drink baby formula between 3 and 6 months old, 24.4% of the babies began to drink baby formula between 6 and 12 months old, 13.7% of the babies began to drink baby formula between 1 and 2 year old, 2.1% of the babies began to drink baby formula between 2 and 3 years old, 0.5% of the babies began to drink baby formula between 3 and 4 years old, and 0.5% of the babies began to drink baby formula between 4 and 5 years old; (4) 7.9% of babies are only fed with breast milk, 70.8% of babies are given a combination of breast milk and baby formula, and 21.3% of the babies are only fed with baby formula; (5) 35.4% of the parents have bought only one baby formula brand, 46.3% have bought two to three brands of baby formula, 12.1% have bought four to five brands of baby formula, 4.6% of the parents have bought six to seven brands of baby formula, 0.9% have bought eight to nine brands of baby formula, and only 0.7% of the parents have bought ten to eleven brands of baby formula; (6) For the expenditure on baby formula, the distribution is scattered and reported in Table 3. The average of the expenditure on baby formula is 576 RMB per month; 4.2% of the parents expenditure on baby formula is less than 100 yuans, 8.3% of the parents expenditure on baby formula is between 100 to 200 yuans, 15.5% expenditure on baby formula is between 201 to 300 yuans, 9.9% of the parents expenditure on baby formula is between 301 to 400 yuans, 9.2% of the parents expenditure on baby formula is between 401 to 501 yuans, 8.3% of the parents expenditure on baby formula is between 501 to 600 yuans, 9.9% expenditure on baby formula is between 601 to 700 yuans, 5.5% expenditure on baby formula is between 701 to 800 yuans, 12.7% of the parents expenditure on baby formula is between 801 to 900 yuans, 8.3% of the parents

expenditure on baby formula is between 901 to 1000 yuans, 3.0% expenditure on baby formula is between 1001 to 1100 yuans, 0.7% expenditure on baby formula is between 1101 to 1200 yuans, 0.9% of the parents expenditure on baby formula is between 1201 to 1300 yuans, 0.3% of the parents expenditure on baby formula is between 1301 to 1400 yuans, and only 3.2% of the parents expenditure on baby formula is more than 1500 yuans; (7) For how often the parents buy baby formula, 6.5% of the parents buy baby formula every week, 21.3% of the parents buy baby formula biweekly, 31.3% of the parents buy baby formula every month, 17.1% of the parents buy baby formula every two months, 4.9% of them buy baby formula longer than two months, 18.9% of the parents buy baby formula varies; (8) Regarding where they purchase baby formula, 35.5% of parents like to purchase baby formula from supermarket, 46.5% of parents like to purchase it from maternal and child supplies stores, 9.0% of parents like to purchase baby formula on internet, 5.9% of the parents like to purchase baby formula through overseas shopping and 3.1% like to purchase baby formula through other ways; The results show that parents prefer to purchase baby formula for physical stores. (9) 9.7% of the parents get the information about brand selection for the first time they buy baby formula from TV advertisements, 7.1% of them get the information from Internet, 3.6% of the parents get the information from magazines and newspapers, 17.2% of the parents get the information from supermarket directly, 12.5% of them get the information from charitable activities, 15.1% of the parents get the information from doctors and nurses recommendation, 29.1% of the parents get the information from friend recommendations, and only 5.7% of the parents get the information from another way. It shows that many parents get the information about baby formula brands from their friend; (10) 18.4% of

the parents change the baby formula brand because their baby does not like the taste, 27.9% of the parents change the baby formula brand because their baby does not feel well, 12.4% of the parents change the brand of baby formula because of a price change, 13.1% of them change the baby formula brand because of other brand promotional activities, 13.1% of the parents change baby formula brand because of friend recommendations, 4.1% change the baby formula brand because of doctor's and nurse's recommendations, and 11.0% of the parents change baby formula brand for other reasons. It indicates that parents change the baby formula brand mainly according to their babies' preference or health; (11) 32.6% of the parents tend to choose the imported baby formula, 25.1% tend to choose Chinese production or packaging of foreign brands of baby formula, 33.8% of the parents tend to choose large domestic enterprises brands baby formula, 3.5% of them tend to choose other brands baby formula, and only 5.0% of the parents do not care about it. The results show that parents prefer to the imported baby formula and large domestic enterprises brands baby formula; (12) For what packaging of baby formula the parents like to purchase, 49.1% of the parents like to purchase canned packaging of baby formula, 17.9% of them like bag packaging of baby formula, 20.0% of the parents like to purchase the box packaging of baby formula, and 13.0% of the parents think the packaging of baby formula does not matter. The results show that the canned packaging of baby formula is more popular.

Table 3. Summary of the babies' information

<b>Variable</b>	<b>Classification</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Age</b>	0-6 months	58	13.4
	6-12 months	101	23.3
	1-2 years	86	19.9

Table 3. Summary of the babies' information (Continued)

<b>Variable</b>	<b>Classification</b>	<b>Frequency</b>	<b>Percent (%)</b>
	2-3 years	64	14.8
	3-4 years	50	11.5
	4-5 years	32	7.4
	older than 5 years	42	9.7
<b>Gender</b>	male	196	45.4
	female	236	54.6
<b>Starting to drink baby formula</b>	0-3 months	138	32.1
	3-6 months	115	26.7
	6-12 months	105	24.4
	1-2 years	59	13.7
	2-3 years	9	2.1
	3-4 years	138	0.5
	4-5 years	2	0.5
<b>Ratio of breast milk and baby formula</b>	only breast milk	34	7.9
	mainly breast milk	246	56.9
	mainly baby formula	60	13.9
	only baby formula	92	21.3
<b>Number of baby formula brands have been bought</b>	1	153	35.4
	2-3	200	46.3
	4-5	52	12.1
	6-7	20	4.6
	8-9	4	0.9
	10-11	3	0.7
<b>Expenditure on baby formula per month</b>	< 100 yuans	18	4.2
	100-200 yuans	36	8.3
	201-300 yuans	67	15.5
	301-400 yuans	43	9.9
	401-500 yuans	40	9.2
	501-600 yuans	36	8.3
	601-700 yuans	43	9.9
	701-800 yuans	24	5.5
	801-900 yuans	55	12.7
	901-1000 yuans	36	8.3
	1001-1100 yuans	13	3.0
	1101-1200 yuans	3	0.7
	1201-1300 yuans	4	0.9
	1301-1400 yuans	1	0.3
	> 1500 yuans	14	3.2
<b>How often do you buy baby formula</b>	weekly	28	6.5
	biweekly	92	21.3
	monthly	135	31.3
	every two months	74	17.1

Table 3. Summary of the babies' information (Continued)

<b>Variable</b>	<b>Classification</b>	<b>Frequency</b>	<b>Percent (%)</b>
	longer than two months	21	4.9
	varies	82	18.9
<b>Where purchase baby formula</b>	supermarkets	194	35.5
	maternal and child supplies stores	254	46.5
	Internet	49	9.0
	overseas shopping	32	5.9
	others	17	3.1
	<b>Where get the information for brand selection for the first time to buy baby formula</b>	TV advertisement	60
Internet		44	7.1
magazines and newspapers		22	3.6
supermarket promotions		106	17.2
charitable activities		77	12.5
doctors and nurses recommendation		93	15.1
friend recommendation		179	29.1
others		35	5.7
<b>Reason for changing the baby formula brands</b>		baby does not like taste	98
	baby does not feel well	149	27.9
	price change	66	12.4
	other brand promotional activities	70	13.1
	friend recommendation	70	13.1
	doctors and nurses recommendation	22	4.1
	others	59	11.0
	<b>Which brand of baby formula parent tend to choose</b>	imported	166
Chinese production or packaging of foreign brands		128	25.1
large domestic enterprises brands		172	33.8
other brands		18	3.5
I do not care		25	5.0
<b>What packaging of baby formula parent like to purchase</b>		can	256
	bag	93	17.9
	box	104	20.0
	it does not matter	68	13.0

### 4.3. Impacts of education level and income on baby formula consumption behavior

This section reports the impacts of education level and income on baby formula, measured by two variables: the monthly expenditure on baby formula and the starting time of feeding the baby with baby formula.

Table 4. Impacts of education level and income on baby formula consumption behavior

<b>Independent Variables</b>	<b>Dependent Variables</b>	<b>p-value</b>
Education level	Expenditure on baby formula	0.038
	Starting to drink baby formula	0.002
Household Income	Expenditure on baby formula	0.001
	Starting to drink baby formula	0.02

According to the results reported in Table 4, respondents' education level has significant impact on the monthly expenditure on baby formula as the p value is 0.038. This result shows that parents' education level influences the monthly expenditure on baby formula and parents with higher education levels are more likely to spend more on baby formula. Similarly education level affects the starting time of drinking baby formula.

Household income has a significant impact on the monthly expenditure on baby formula as the p value is 0.001. Parents with higher household income are likely to spend more on baby formula. It is likely that high-income households are more likely to buy baby formula such as imported baby formula.

Respondents' education level has significant impact on the babies' starting time to drink baby formula as the p value is 0.002. This result shows that parents' education level influences the babies starting time of drinking baby formula.

Household income has a significant impact on the babies' starting time to drink baby formula as the p value is 0.02. Parents with higher household income may have the financial capacity to focus on feeding their babies at an earlier age.

## 5. Experimental Results and Discussion

This chapter presents the results from the choice experiment included in the survey. Specifically, this chapter first presents the frequency statistics of the choice experiment, then reports the estimation results of a random utility model and the estimated WTP for selected baby formula attributes, and finally presents the results of a latent class logit model.

### 5.1. Frequency results of the choice experiment

As reported in chapter 4, the choice experiment included 16 pairs of baby formula profiles in 16 tables. Since seven profiles appeared in more than one table, the experiment included 25 unique baby formula profiles. Through basic statistical analysis, the selection frequency for each of the 25 products in calculated and such frequency results provide basic indications of parent preferences for the baby formula products. (See Table 5).

Table 5. The frequency statistic of the 25 products in the choice experiments

<b>Product</b>	<b>Price</b>	<b>Origin</b>	<b>Organic</b>	<b>Reputation</b>	<b>Frequency</b>
1	275 Yuan	Australia	Yes	Excellent	581
2	350 Yuan	USA	Yes	Excellent	480
3	200 Yuan	Australia	Yes	Good	443
4	350 Yuan	China	Yes	Good	399
5	275 Yuan	USA	Yes	Excellent	318
6	200 Yuan	China	Yes	Excellent	310
7	200 Yuan	USA	Yes	Excellent	300
8	200 Yuan	China	No	Good	267
9	350 Yuan	Australia	Yes	Excellent	264

Table 5. The frequency statistic of the 25 products in the choice experiments (continued)

<b>Product</b>	<b>Price</b>	<b>Origin</b>	<b>Organic</b>	<b>Reputation</b>	<b>Frequency</b>
10	350 Yuan	China	No	Excellent	231
11	275 Yuan	China	Yes	Good	213
12	275 Yuan	USA	Yes	Good	212
13	350 Yuan	USA	Yes	Good	171
14	275 Yuan	Australia	No	Good	165
15	200 Yuan	China	No	Excellent	163
16	350 Yuan	USA	No	Good	131
17	200 Yuan	Australia	No	Excellent	128
18	200 Yuan	China	No	Good	126
19	275 Yuan	China	No	Excellent	123
20	350 Yuan	China	No	Excellent	121
21	200 Yuan	USA	No	Good	94
22	275 Yuan	USA	No	Excellent	92
23	350 Yuan	Australia	No	Excellent	71
24	275 Yuan	USA	No	Good	51
25	275 Yuan	Australia	No	Good	48

In this thesis, we mainly discuss the eight most popular products among 25 products. Results reported in Table 5 indicate that the top eight products with the highest frequency of selection is an organic, Australian baby formula with excellent reputation at the price of 275 yuans. Among the eight products, there are 4 products with a price of 200 Yuan, 2 products with price of 275 Yuan and 2 products with price of 350 Yuan. This shows that the price is lower than 300 for 75% of these products, while the price is

higher than 300 for only 25% of the products. This indicates that respondents prefer cheaper products. This is consistent with the data from the China Industry Information Network in 2014 (Figure 7). As can be seen, the majority of people would like to purchase the products with the price between 200-300 Yuan. However, when other properties of the product are considered, consumers will accept products with higher prices. For example, for two products from United States and Australia respectively that are both organic and have an excellent reputation, parents would still choose them even if the price of these two products is up to 350 Yuan. Therefore, price is not the only most important attribute when parents desire to buy baby formula and other properties of the product meet parents' satisfaction.

For the origin, three products' origin is in the United States, three are Australian products, while only two products are from China. This result shows that respondents are more inclined to buy imported baby formula. According to the China Industry Information Network in 2015, 55% of people would prefer foreign brands of baby formula, whilst 45% of people will tend to buy domestic brands. This also denotes that the foreign brands are more welcome than domestic ones for Chinese parents.

For the top 8 most preferred products, 7 of them have organic certification, which indicates that parents prefer to purchase certified organic products.

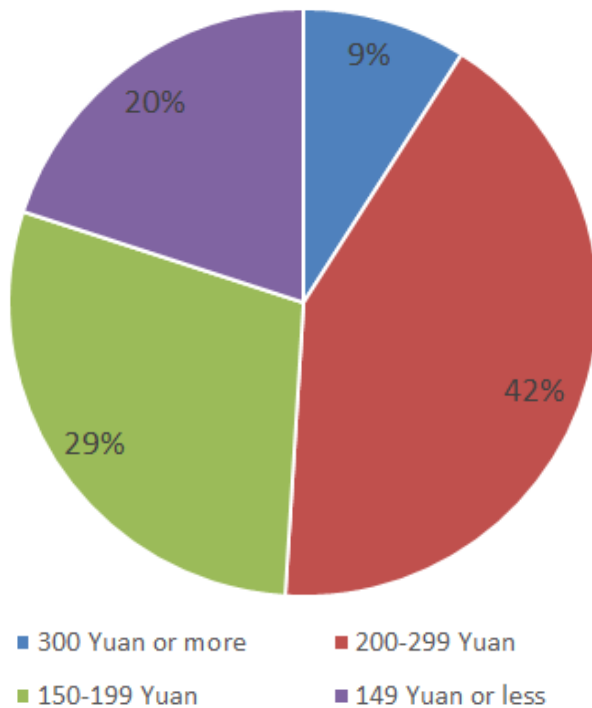


Figure 7. The ratio of different baby formula prices

Source: China Industry Information Network in 2014.

For the brand, 75% of the product's brands have excellent reputation, while only 25% of the products have good brand reputation. This result shows that parents tend to buy the products with excellent reputation. However, for products with low prices, it reduces the credibility of the brand reputation.

## 5.2. Estimation results of random utility model (RUM)

The random utility model (RUM) presented in chapter 3 is estimated using the online survey data and data collected for hard copies, respectively, and the estimation results are reported in Table 6.

Table 6. Estimation results of the random utility model using the online survey data

<b>Choice</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z</b>	<b>Prob.  z &gt;Z*</b>	<b>95% Confidence Interval</b>	
<b>US</b>	.47702**	.18982	2.51	.0120	.10498	.84905
<b>AU</b>	.44149**	.22037	2.00	.0451	.00958	.87340
<b>ORG</b>	1.69523***	.20922	8.10	.0000	1.28517	2.10529
<b>REP</b>	.69047***	.13084	5.28	.0000	.43403	.94691
<b>P</b>	-.00883***	.00138	-6.39	.0000	-.01153	-0.00612

The random utility model is adopted to analyze the data collected from the online survey. The adjusted R square is .42, which means the goodness of fit is not very high. From the results (Table 6), it can be observed that the five variables above (US, AU, ORG, REP, and Price) are identified as significant factors affecting parent preferences on baby formula.

Next, quantitative analysis is done on the data. Specifically, the significance of each association is based on the p-value ( $|z|>Z$ ) column above, which is no larger than 0.05. All four attributes have a p-value  $\leq 0.05$ . Moreover, the strength of the association between each factor and parent preference can be estimated using an odds ratio. For ORG, it is calculated as  $e^{1.695} = 5.4466$ , which means that the parents are 545% more likely to choose organic baby formula than non-organic baby formula, while 95% Confidence interval for this coefficient is:  $[e^{1.285}, e^{2.105}] = [3.6147, 8.2071]$ . For US, it is calculated as  $e^{0.477} = 1.6112$ , which means that the parents are 161% more likely to choose US baby formula than non-US baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.10498}, e^{0.84905}] = [1.1107, 2.3374]$ . For AU, it is calculated as  $e^{0.44194} = 1.5557$ , which

means that the parents are 156% more likely to choose AU baby formula than non-AU baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.00958}, e^{0.8734}] = [1.0096, 2.3950]$ . For REP attribute, it is calculated as  $e^{0.69047} = 1.9947$ , which means that the parents are 199% more likely to choose excellent reputation baby formula than good reputation baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.43404}, e^{0.94691}] = [1.5435, 2.5777]$ . For Price, it is calculated as  $e^{-0.00883} = 0.9912$ , which means that the parents are 99% more likely to choose expensive baby formula than cheap baby formula, while 95% Confidence interval for this coefficient is:  $[e^{-0.01153}, e^{-0.00612}] = [0.9885, 0.9939]$ .

Through the above analysis, it is concluded that parents prefer to buy baby formula from the United States and Australia. In other words, imported brands of baby formula are more popular with consumers completing the online survey. Consumers also indicate a preference for organic baby formula.

Table 7. Estimation results of the random utility model using the hardcopy survey data

<b>Choice</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z</b>	<b>Prob.  z &gt;Z*</b>	<b>95% Confidence Interval</b>	
<b>US</b>	-.42609***	.07688	-5.54	.0000	-.57678	-.27541
<b>AU</b>	-.53092***	.07647	-6.94	.0000	-.68080	-.38103
<b>ORG</b>	1.38998***	.09519	14.60	.0000	1.20341	1.57656
<b>REP</b>	.68456***	.05708	11.99	.0000	.57269	.79643
<b>P</b>	-.00606***	.00049	-12.31	.0000	-.00702	-.00509

The random utility model is also adopted to analyze the data collected from the hardcopy survey, and the estimation results are reported in Table 7. The adjusted R

square is .26, which means the goodness of fit is very low. From the results (Table 7), it can be observed that the five variables above (US, AU, ORG, REP and Price) are identified as significantly associated with the parent preferences for baby formula.

An odds ratio method is used again to estimate parent preferences. For ORG, it is calculated that  $e^{1.695} = 5.4466$ , which means that the parents are 545% more likely to choose organic baby formula than non-organic baby formula, while 95% Confidence interval for this coefficient is:  $[e^{1.285}, e^{2.105}] = [3.6147, 8.2071]$ . For US, it is calculated that  $e^{0.477} = 1.6112$ , which means that the parents are 161% less likely to choose US baby formula than non-US baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.10498}, e^{0.84905}] = [1.1107, 2.3374]$ . For AU, it is calculated that  $e^{0.44194} = 1.5557$ , which means that the parents are 156% less likely to choose AU baby formula than non-AU baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.00958}, e^{0.8734}] = [1.0096, 2.3950]$ . For REP, it is calculated that  $e^{0.69047} = 1.9947$ , which means that the parents are 199% more likely to choose excellent reputation baby formula than good reputation baby formula, while 95% Confidence interval for this coefficient is:  $[e^{0.43404}, e^{0.94691}] = [1.5435, 2.5777]$ . For Price attribute, it is calculated that  $e^{-0.00883} = 0.9912$ , which means that the parents are 99% more likely to choose expensive baby formula than cheap baby formula, while 95% Confidence interval for this coefficient is:  $[e^{-0.01153}, e^{-0.00612}] = [0.9885, 0.9939]$ .

Through the above analysis, it shows that parents do not prefer to buy baby formula from the United States and Australia. Also, parents have a strong preference for organic baby formula and baby formula with excellent reputation.

### 5.3. Estimation results of consumer WTP

Based on the results of online survey with random utility model of Table 6, the willingness to pay (WTP) can be further calculated using the following formulation:

$$WTP = -2 \beta_k / \beta_p,$$

where  $\beta_k$  is the estimated parameter of the  $k$ th attribute, and  $\beta_p$  is the estimated price coefficient.

Table 8. The WTP results of attributes from online survey

Attribute	Attribute Level	WTP (Yuan)
Origin	US	54.022
	Australia	49.998
Organic	Organic	191.985
Reputation	Excellent	78.195

Table 8 reports the estimation results of WTP for all attributes from the online survey. The parents' willingness to pay for baby formula from the United States and Australia is 54.022 yuan and 49.998 yuan more than the domestic ones respectively. This also shows that parents are more inclined to purchase imported baby formula. For baby formula produced in the United States, consumers are also willing to pay slightly higher than that produced in Australia.

For certified organic baby formula, parents are willing to pay 191.985 yuan more for organic baby formula compared to the non-organic baby formula.

For the credibility of baby formula, compared to the general quality of baby formula, parents are willing to pay 78.195 yuan more to buy reputable baby formula. This

also shows that the reputation of the baby formula is a very important factor. As indicated by the WTP for organic certification and the credibility of two attributes, parents are more concerned about quality of the baby formula.

Table 9. The WTP results of attributes from hardcopy survey

<b>Attribute</b>	<b>Attribute Level</b>	<b>WTP (Yuan)</b>
Origin	US	70.311
	Australia	87.610
Organic	Organic	229.369
Reputation	Excellent	112.963

Table 9 lists the results of WTP for all attributes of hardcopy survey. For parents' willingness to pay for different origins, the parents' willingness to pay for baby formula in United States is 70.311 yuan and in Australia it is 87.610 yuan less than the domestic ones. This also shows that parents are more inclined to purchase domestic baby formula. For baby formula produced in the Australia, parents are willing to pay slightly higher than for baby formula produced in the United States.

For certified organic baby formula, parents are willing to pay 229.369 yuan more to buy organic baby formula compared to the non-organic baby formula. This also shows that parents are more concerned about whether the organic baby formula is certified or not. For the credibility of baby formula, compared to the general quality of baby formula, parents are willing to pay more 112.963 yuan to buy reputable baby formula. For the WTP of organic and excellent reputation baby formula, parents of the hardcopy survey are willing to pay more money compared with parents from online.

Analysis of the online survey shows that parents have a strong preference and are willing to pay more for baby formulas produced in the U.S. and Australia. Also they prefer to buy organic baby formula and baby formula with excellent reputation. Parents of the hardcopy survey have a preference for domestic baby formula over imported baby formula. This difference results from many reasons, which is that there are many variances between two kinds of parents, such as income, age, educational background and so on. The following section will further show that different groups of parents would have different preferences.

#### 5.4. The results of latent class logit model

All the parents are grouped into three classes based on two attributes, which are age and education level. Then some potential results are achieved using latent class logit model with samples from both online and hardcopy. The latent class logit models parent's preference by "class". For example, parents in different classes show different preferences for baby formula. The adjusted R square of model is .30, which means the goodness of fit is a little low. The model indicates that 42.3%, 34.8% and 22.8% of all respondents belong to the first class, second class and third class, respectively.

Table 10. The results of latent class logit model

<b>Choice</b>	<b>Class</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z</b>	<b>Prob.  z &gt;Z*</b>	<b>95% Confidence Interval</b>	
<b>US</b>	1	.42015***	.09301	4.52	.0000	.23786	.60244
<b>AU</b>	1	.50162***	.10123	4.96	.0000	.30321	.70002
<b>ORG</b>	1	1.78635***	.05736	31.14	.0000	1.67393	1.89877
<b>REP</b>	1	.15858**	.06664	2.38	.0173	.02796	.28919

Table 10. The results of latent class logit model (Continued)

<b>Choice</b>	<b>Class</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>z</b>	<b>Prob.  z &gt;Z*</b>	<b>95% Confidence Interval</b>	
<b>P</b>	1	-.00664***	.00056	-11.83	.0000	-.00774	-.00554
<b>CHN</b>	1	-2.42462***	.17010	-14.25	.0000	-2.75801	-2.09122
<b>US</b>	2	-.96028***	.05278	-18.19	.0000	-1.06373	-.85682
<b>AU</b>	2	-.85263***	.06137	-13.89	.0000	-.97292	-.73235
<b>ORG</b>	2	.01614	.05630	.29	.7744	-.09420	.12648
<b>REP</b>	2	.28528***	.04485	6.36	.0000	.19737	.37318
<b>P</b>	2	.00074*	.00045	1.65	.0983	-.00014	.00162
<b>CHN</b>	2	-1.21729***	.15219	-8.00	.0000	-1.51558	-.91900
<b>US</b>	3	-.03360	.13579	-.25	.8046	-.29975	.23255
<b>AU</b>	3	-.17799	.12984	-1.37	.1704	-.43248	.07650
<b>ORG</b>	3	3.16279***	.14348	22.04	.0000	2.88157	3.44401
<b>REP</b>	3	1.00719***	.08750	22.03	.0000	1.82570	2.16868
<b>P</b>	3	-.00710***	.00075	-9.49	.0000	-.00856	-.00563
<b>CHN</b>	3	2.49514***	.17897	13.94	.0000	2.14437	2.84591

Table 10 lists the estimation results. Those results show that (1) Parents in the first class are relatively younger, have a slightly lower education level, and prefer imported, organic, and excellent reputation baby formula. (2) Parents in the second class are older and less educated, and they prefer domestic and good reputation baby formula, but they don't care whether it is organic or not. What's more, they don't care about price. (3) Parents in the third class don't care about the origin, but they prefer organic and good reputation baby formula.

From the above analysis, it indicates that all the parents prefer the excellent reputation baby formula no matter which class they belong to. The young parents prefer imported and organic baby formula, while older parents are more likely to buy domestic baby formula. It does not matter whether or not it is organic baby formula once the quality is ensured. This also shows that the difference of parents' preference on baby formula is indeed affected by the parent's own background.

## **6. Conclusions and Implications**

This chapter first summarizes the research and major conclusions, then discusses the potential implications for U.S. dairy product exports, and finally discusses the limitations of this study and lists some suggestions for future research.

### **6.1. Summary of this thesis research**

As the world's most populous country and with more than 16 million births every year, China has emerged as a large importer of baby formula. China's relaxation of the one-child policy, which was announced in 2015, is expected to increase the number of births significantly and therefore increase the demand for Chinese and imported baby formula. While information on parent preferences for baby formula is very important for understanding and predicting China's import demand for baby formula and other products used to produce baby formula, like milk powder, there are very limited empirical studies on Chinese parent's preferences for baby formula in the literature due to data limitation and other reasons.

With detailed data from a total of 433 respondents, this study has first examined parental purchase behavior of baby formula through descriptive analysis, then evaluated their preferences and willingness to pay for selected baby formula attributes through the estimation of a random utility model (RUM) and latent class model (LCM), and discussed the potential implications for U.S. exports of baby formula, milk powder, whey, and other dairy products.

## **6.2. Major conclusions and implications**

This research suggests four major conclusions:

First, the descriptive analysis suggests that education level and household income play an important role in parent purchase behavior of baby formula. The parents who have higher education level and higher income are more likely to spend more on baby formula and focus on feeding their babies at an earlier age.

Second, The WTP and estimation results of the random utility model showed that parents preferred and were willing to pay more for organic baby formula that was produced by a reputable brand. Whether parents preferred imported baby formula to domestic formula was related to the mode in which the survey was administered. Parents who took the hardcopy survey tended to say that they preferred domestic to imported baby formula, while those who did the online survey tended to say that they preferred imported to domestic baby formula.

Third, the latent class logic model indicates respondents with different ages and education levels will have different preferences for purchasing baby formula. The results show that all the parents also prefer the excellent reputation baby formula no matter which class they belong to. Younger parents prefer imported and organic baby formula, while older consumers are more likely to buy domestic baby formula.

Fourth, trend analysis of China's baby formula market shows that dairy imports from the U.S. are increasing. China's emerging demand for imported baby formula, milk powder, and whey may bring more opportunities for the U.S. dairy industry, but U.S. dairy products are also facing increasing competition from similar products from other

nations in the Chinese market. The findings from this study illustrate comparative advantages of U.S. baby formula and other dairy products in the Chinese market and can be used to develop effective trade policies for enhancing U.S. exports to China.

### **6.3. Trends of China's baby formula market and implication for U.S. dairy product exports**

China's Customs Statistics Data (2015) shows that China imported 175,972 tons of baby formula in 2015, while the imports of baby formula amounted to 121,000 tons in 2014. Compared with the same period in 2014, 2015 had an increase of 45%. Baby formula imports in 2015 were worth \$ 2.471 billion, an increase of 59.5% compared to 2014.

Consumers' annual demand for baby formula was 600,000 tons in 2015 with 170,000 tons, close to one-third of the overall market demand being supplied by imported baby formula. Overall, Chinese imports of baby formula may be rising. There are several reasons why China's baby formula market is highly dependent on imported baby formula:

(1) The most important reason is parents' considerations for baby formula quality. Especially after serious security incidents happened in China, Chinese parents have lost confidence in domestic baby formula, and prefer to purchase imported baby formula.

(2) With a general increasing of income and education level of Chinese parents, parents pay more attention to the quality of the baby formula, and have the financial ability to buy higher-quality baby formula. From the demographic data of respondents collected by questionnaire, 68.77% of the respondents have an associate degree and

above, indicating that more than half of the respondents were highly educated. 52.9% of respondents have an annual income of 20,000-100,000 yuan, which means more than half of the respondents have reached a normal income level in China. The annual income of nearly 30% of respondents reaches 100,000-200,000 yuan, which also shows the proportion of people with higher income is increasing in China.

(3) The large number of newborns and low breastfeeding rates in China may also increase China's parents demand for baby formula, which also prompted demand for imported baby formula.

(4) Currently, parents have diverse ways to buy baby formula. Online shopping is becoming increasingly popular daily, which also enables parents to buy imported baby formula. The changes in shopping habits also influences parents' demand for imported baby formula.

Meanwhile, China imported a lot of dairy products from the US. Figure 8 shows China's dairy imports from the United States from 1995 to 2015. For Figure 8, all the data is also provided from World Trade Atlas International, China's Customs Data in July 2016. Whey, and cheese imports are in terms of milk-equivalent quantities using the ratio of 1:7.4 for whey and 1:10 for cheese, respectively. Although whey is a byproduct of cheese production in the United States and other exporting countries, it has been used as a close substitute of powder milk in baby formula and other food production in China. It can be seen from Figure 8 that the trend of China's total imports on dairy products from the United States is increasing. For example, China's dairy products imported from the U.S. in 1995 reached about 25 thousand metric tons, and by 2015, China's dairy products

imported from the U.S. increased to around 260 thousand metric tons, with an increase of 940%. This also indicates that China's imports of dairy products will continue to increase from the U.S.

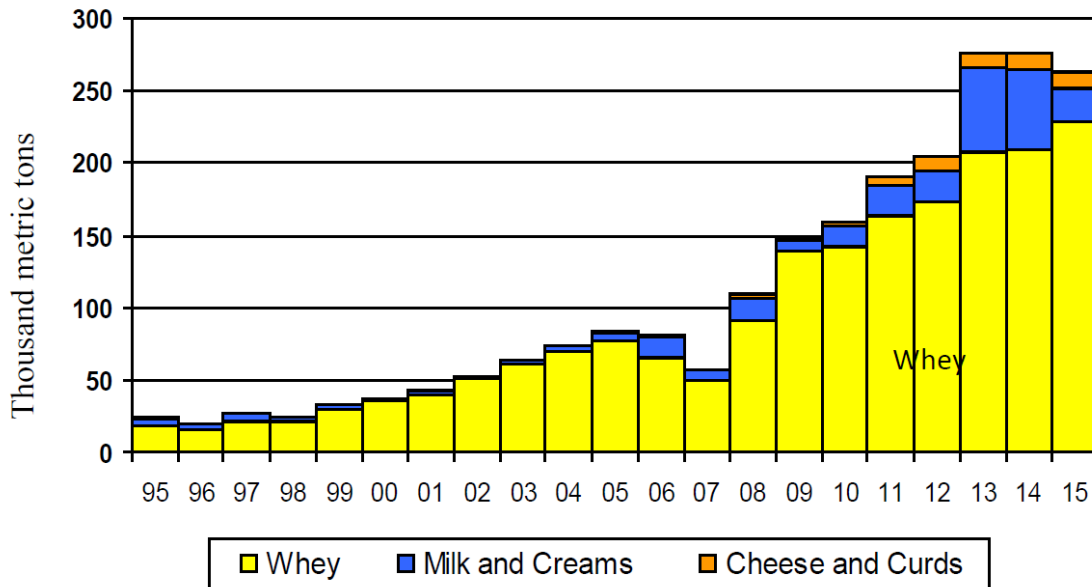


Figure 8. China's dairy imports from United States, 1995-2015

Source: World Trade Atlas International, China's Customs Data, July 2016.

China's emerging markets for baby formula and other dairy products suggest three potential implications for U.S. dairy product exports:

First, there will be an increasing trend for the years to come on U.S exports of baby formula and dairy product to China. The U.S. is one of the major exporters to China on baby formula and dairy products. Such a situation would provide opportunities for US to export baby formula and dairy products to China.

Second, U.S.'s exports of baby formula to China will also be facing some challenges from some other European countries. China has lots of choices on where they

import baby formula. In the promotions of "global economic integration" and the diversification of shopping patterns, China could import from different countries, e.g., New Zealand and European countries, which makes U.S. exports of baby formula to China face lots of competition. China's Customs Data (2015) show that China's imports of baby formula from the Netherlands was 57,694 tons, accounting for 32.8% of total imports of baby formula. China's imports of baby formula from Ireland was 24,436 tons, accounting for 13.9% of total imports of baby formula. China's imports of baby formula from Germany was 17,100 tons, accounting 9.7% of total imports of baby formula. China's imports of baby formula from France was 15,715 tons, accounting for 8.9% of total imports of baby formula, whilst China's imports of baby formula from New Zealand was 14,469 tons, accounting for 8.2% of total imports of baby formula. About 70% of imports are from the EU countries. As it can be seen, the U.S. faces many challenges from other countries.

Third, U.S. exports of baby formula also face competition from China's domestic brands. Although the melamine incident occurred in 2008, which made Chinese parents lose confidence in domestic brands, the Chinese government has enacted a number of milk deal initiatives to develop domestic brands since 2008. After several years, domestic brands have obtained a great improvement (China's Customs Statistics Data, 2015).

In short, with the large number of newborns and low breastfeeding rates in China, China will have an increasing demand for baby formula and dairy products and need to import baby formula and dairy products to meet its demand from U.S. and other countries. As the U.S. is one of the major exporters to China of baby formula and dairy products, it

brings opportunities to the U.S. exports on baby formula and dairy products, but the U.S. also faces challenges from other countries.

#### **6.4. Limitations of this study and suggestions for further research**

This study has several limitations. First, the sampling method is not totally random due to the lack of funding and time restrictions. Second, the sample size and regional coverage is too small. Third, there are some missing data points as some respondents did not answer all the questions.

In the future, the study should choose a larger sample selected randomly, use choice experiments in a controlled environment, such as a behavior experiment lab, and use alternative specifications of the econometric models and estimation methods.

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## Appendix

### A. 儿童奶粉调查问卷

地点: \_\_\_\_\_ 日期: \_\_\_\_\_ 编号: \_\_\_\_\_

各位家长:

你们好! 为了更好地了解儿童奶粉的消费情况及家长对奶粉市场的意见和建议, 我们专门设计了这份调查问卷, 请家里现在或最近 2-3 年有吃奶粉儿童的家长自愿参加 (请由购买奶粉的家长填写)。问卷完全匿名, 收集的数据仅用于统计研究。问卷大约需要 10 - 15 分钟完成, 请您根据实际情况回答每一个问题。若有疑问, 请拨打电话或发送邮件咨询。电话: 15033791728, 邮箱: hcui1@uvm.edu。

非常感谢您对我们此项研究的理解与支持, 祝您一切顺利!

2015 年 6 月

1. 您家宝宝的年龄:

0-6 个月  6-12 个月  1-2 岁  2-3 岁  3-4 岁  4-5 岁  5 岁以上

2. 您家宝宝的性别:  男  女

3. 您家宝宝什么时候开始吃奶粉:

0-3 个月  3-6 个月  6-12 个月  1-2 岁  2-3 岁  3-4 岁  4-5 岁

4. 您家宝宝吃母乳和奶粉的比例:

只喂母乳  母乳为主、奶粉为辅  奶粉为主、母乳为辅  只喂奶粉

5. 您第一次买奶粉是根据什么信息选择品牌的 (可多选):

电视广告  网络  杂志报纸  超市促销  公益活动  医生护士推荐

亲友推荐  其他

6. 您已经购买过几个品牌的奶粉:

1 个  2-3 个  4-5 个  6-7 个  8-9 个  10-15 个  15 个以上

7. 如果您换过奶粉品牌, 换奶粉品牌的主要原因包括 (可多选):

宝宝不喜欢  宝宝身体不适应  价格变化  其他品牌促销  朋友推荐

医生护士推荐  其他

8. 您每月购买奶粉大概花费多少钱:

100 元以下  100-275 元  201-275 元  301-400 元  401-500 元

501-600 元  601-700 元  701-800 元  801-900 元  901-1000 元

1001-1500 元  1500 元以上

9. 您一般多久购买一次奶粉:

每周  每半个月  每月  每两个月  每两个月以上  不固定

10. 您通常在哪里购买婴幼儿奶粉 (可多选):

商场超市  母婴用品专卖店  网上  海外代购  其他

11. 对于奶粉的品牌, 您会倾向于选择 (可多选):

原装进口  中国生产或包装的国外品牌  国内大企业品牌  其他品牌  无所谓

12. 您现在一般从哪里了解儿童奶粉信息 (可多选):

电视广告  网络  杂志报纸  超市促销  公益活动  医生护士  亲友  其他

13. 您喜欢购买什么形式的包装的奶粉 (可多选):

罐装  袋装  盒装  无所谓

14. 您是宝宝的:

妈妈  爸爸  爷爷  奶奶  外公  外婆  其他

15. 您们家一般由谁决定购买什么品牌的奶粉 (可多选):

宝宝的妈妈  宝宝的爸爸  爷爷  奶奶  外公  外婆  不固定  其他

16. 您家宝宝主要由谁带 (可多选):

宝宝的爸妈 爷爷奶奶 外公外婆 托儿所 保姆 其他

17. 您的教育程度是:

小学 初中 高中 大专 本科 研究生及以上

18. 您的家庭按年龄分组的人口:

◎6岁以下: ①\_\_\_ ②\_\_\_ ③\_\_\_

◎6-18岁: 0\_\_\_ ①\_\_\_ ②\_\_\_ ③\_\_\_

◎18岁以上: ①\_\_\_ ②\_\_\_ ③\_\_\_ ④\_\_\_ ⑤\_\_\_

19. 您的职业:

政府部门 其他事业单位 中国企业 外资企业 个体经营 退休 其他

20. 您家拥有几套房产:◎没有 1套 2套 3套 4套 4套以上

21. 家里是否拥有汽车: 有 没有

22. 您出生于哪一年(请填写):\_\_\_\_\_

23. 你们家 2014 年的家庭总收入:

2万元以下 2-4万 4-6万 6-8万 8-10万 10-12万

12-14万 14-16万 16-18万 18-20万 20-22万 22-24万 24万以上

24. 你们家的居住地属于:

直辖市或省会城市 其他大中城市 县城或小城市 集镇 农村

25. 对于下列表中的每一个奶粉要素或特性，请您根据它对于您选购奶粉的重要性选项：

	很不重要	不重要	一般	重要	很重要
①奶粉价格	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
②原装进口或国产	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
③奶粉有机认证	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
④质量和安全信誉	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑤包装	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑥品牌	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑦基本营养成分	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑧添加成分*	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\*添加成分例如 DHA, **Error! Reference source not found.**-乳清蛋白, **Error! Reference source not found.**-胡萝卜素, 益生元, Omega3 等等。

以上的奶粉要素中，哪一个对您选购奶粉最为重要？ ①\_\_\_ ②\_\_\_ ③\_\_\_ ④\_\_\_ ⑤\_\_\_  
⑥\_\_\_ ⑦\_\_\_ ⑧\_\_\_

以上的奶粉要素中，哪一个对您选购奶粉最为不重要？ ①\_\_\_ ②\_\_\_ ③\_\_\_ ④\_\_\_ ⑤\_\_\_  
⑥\_\_\_ ⑦\_\_\_ ⑧\_\_\_

26. 您如何评价不同国家生产的奶粉 (1 = 很不好, 2 = 不好, 3 = 一般, 4 = 好, 5 = 很好):

	中国	美国	新西兰	澳大利亚	法国	德国
质量	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
安全性	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
包装	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
营养	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
性价比	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
总体排名:	ABCDEF	ABCDEF	ABCDEF	ABCDEF	ABCDEF	ABCDEF

(A=相对最好, B=相对第二,……, F=相对最差)

### 奶粉选择实验

下面假设有 16 对不同的奶粉, 他们的区别在于价格、产地、是否为有机认证奶粉、以及品牌的质量安全信誉。这些区别的定义是:

**价格:** 900 克罐装奶粉的价格为 200 元, 275 元或 350 元。

**产地:** 中国, 美国, 或澳大利亚

**有机认证:** 政府权威机构认证的有机奶粉 (鲜奶和奶粉的生产严格按照有机农业标准, 不使用任何激素、转基因物质、合成香精等)。

**品牌质量和安全信誉:** “优秀”的定义是超越政府的质量和标准并且过去 10 年以来从未发生过因为质量或安全问题而被曝光、罚款、下架或召回; “良好”的定义是达到政府的质量和标准。

下面有 16 种情况的奶粉组合, 对于每个表中的两种奶粉, 请您注意他们的区别, 然后设身处地考虑如果您面对这两种奶粉, 您会购买第一种奶粉 (A), 购买第二种奶粉 (B), 或者两种都不买。完成第一个表的选项后对第二个表进行选项, 依次完成 16 个表中的选项。当您面对每一个表中的奶粉进行选项时, 请只考虑该表中的两种奶粉。

表 1

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	275 元	
产地	美国	澳大利亚	
有机认证	有	无	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 2

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	275 元	350 元	
产地	美国	澳大利亚	
有机认证	有	无	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 3

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	350 元	
产地	澳大利亚	中国	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 4

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	350 元	200 元	
产地	中国	美国	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 5

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	275 元	350 元	
产地	美国	中国	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 6

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	275 元	
产地	美国	澳大利亚	
有机认证	无	有	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 7

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	275 元	350 元	
产地	美国	中国	
有机认证	无	有	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 8

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	350 元	
产地	中国	澳大利亚	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 9

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	275 元	
产地	澳大利亚	中国	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 10

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	350 元	200 元	
产地	美国	中国	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 11

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	200 元	350 元	
产地	中国	美国	
有机认证	无	有	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 12

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	275 元	200 元	
产地	中国	澳大利亚	
有机认证	有	无	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 13

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	350 元	200 元	
产地	美国	中国	
有机认证	无	有	
品牌信誉	良好	优秀	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 14

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	275 元	350 元	
产地	澳大利亚	美国	
有机认证	有	无	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 15

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	350 元	275 元	
产地	美国	澳大利亚	
有机认证	有	无	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

表 16

	<u>奶粉 A</u>	<u>奶粉 B</u>	
价格	350 元	275 元	
产地	澳大利亚	美国	
有机认证	有	无	
品牌信誉	优秀	良好	
我的选择	<input type="checkbox"/> 购买 A	<input type="checkbox"/> 购买 B	<input type="checkbox"/> 两个都不买

奶粉均为 900 克罐装

## **B. Survey for Baby Formula (English)**

**Place:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **NUMBER:** \_\_\_\_\_

Dear Parents:

Hope everything is going well with you!

To better understand baby formula consumption and parent views and suggestions on the baby formula market, we have designed this questionnaire. If your family has children who drink baby formula currently or in the last 2-3 years, please help by completing the anonymous questionnaire. The collected data is only for statistical research. Questionnaire takes about 10-15minutes to complete. Please answer each question according to your actual situation. If you have questions, please call or send an e-mail to the provided phone numbers or email address.

Thanks very much for your support of this study. I wish you all the best!

June 2015

1. How old is your baby?

0-6 months  6-12 months  1-2 years  2-3 years  3-4 years  4-5years

More than 5 years

2. What is the gender of your baby?  Male  Female

3. When did your baby begin to drink baby formula?

0-3months  3-6months  6-12months  1-2years  2-3years  3-4years  4-5years

4. What is the ratio that your baby drinks breast milk and baby formula?

Only breast milk  Mainly breast milk  Mainly baby formula  Only baby formula

5. Where did you get the information for your brand selection for the first time you bought baby formula? (choose one or more)

- TV advertisement
- Internet
- Magazines and newspapers
- Supermarket promotions
- Charitable activities
- Doctors and nurses recommendation
- Friend recommendation
- Others

6. How many brands of baby formula have you already purchased?

- 1
- 2-3
- 4-5
- 6-7
- 8-9
- 10-15
- More than 15

7. If you have changed baby formula brands, what are the main reasons? (choose one or more)

- Baby does not like taste
- Baby does not feel well
- Price change
- Other brand promotional activities
- Friend recommendation
- Doctors and nurses recommendation
- Others

8. How much do you spend on baby formula per month?

- Less than 100 yuan
- 100-275 yuan
- 201-275 yuan
- 301-400 yuan
- 401-500 yuan
- 501-600 yuan
- 601-700 yuan
- 701-800 yuan
- 801-900 yuan
- 901-1000 yuan
- 1001-1500 yuan
- More than 1500 yuan

9. How often do you generally buy baby formula?

- Weekly
- Every two weeks
- Monthly
- Every two months
- Longer than two months
- Varies

10. Where do you normally buy baby formula? (choose one or more)

- Supermarkets
- Maternal and child supplies stores
- Internet
- Overseas Shopping
- Others

11. For baby formula brands, which will you tend to choose? (choose one or more)

- Imported
- Chinese production or packaging of foreign brands

Large domestic enterprises brands  Other brands  I do not care.

12. Where do you generally receive information about your baby formula? (choose one or more)

TV advertisement  Internet  Magazines and newspapers  Supermarket promotions  
 Charitable activities  Doctors and nurses  Friends  Others

13. What packaging of baby formula do you generally like to purchase? (choose one or more)

Can  Bag  Box  It does not matter

14. What is your relationship to your baby?

Mother  Father  Grandfather  Grandmother  Grandfather (mother's side)  
 Grandmother (mother's side)  Others

15. Who decides what brand of baby formula to buy in your family? (choose one or more)

Baby's mother  Baby's father  Grandfather  Grandmother  Grandfather  
(mother's side)  Grandmother (mother's side)  It depends  Others

16. Who mainly takes care of your baby? (choose one or more)

Baby's parents  Grandparents  Grandparents (mother's side)  Baby-sitter  
 The nursery  Others

17. What is your education level?

Primary school  Junior high school  Senior middle school  College  
 Undergraduate  Graduate and above

18. How many people are there in your family according to the age groups?

Less than 6 years old: ①\_\_\_ ②\_\_\_ ③\_\_\_

6-18 years old: 0\_\_\_ ①\_\_\_ ②\_\_\_ ③\_\_\_

© More than 18 years old: ①\_\_ ②\_\_ ③\_\_ ④\_\_ ⑤\_\_

19. What is your occupation?

- © Work for the Government © Other institutions © Chinese companies  
© Foreign companies © Self-employed © Retired © Other

20. How many houses or apartments do you own?

- © None © 1 © 2 © 3 © 4 © More than 4

21. Does your family own a car? © yes © no

22. Which year were you born? \_\_\_\_\_

23. What was your family's total household income in 2014?

- © Less than 20,000 © 20,000-40,000 © 40,000-60,000 © 60,000-80,000  
© 80,000-100,000 © 100,000-120,000 © 120,000-140,000 © 140,000-160,000  
© 160,000-180,000 © 180,000-200,000 © 200,000-220,000 © 220,000-240,000  
© More than 240,000

24. Where do you live now?

- © Municipal or provincial cities © Other cities © Small cities © Town © Countryside

25. For each of the following baby formula attributes, please select the importance level.

	Not very important	Not important	Fair	Important	Very important
① price	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
② Imported or domestic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
③ Organic Certification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
④ Quality and safety reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑤ Package	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑥ Brand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑦ Basic nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
⑧ Additional ingredients *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\*e.g. DHA, **Error! Reference source not found.**- whey protein, **Error! Reference source not found.**- carotene, prebiotics, Omega3

Among the above attributes, which is the most important one for you? ①\_\_\_ ②\_\_\_ ③\_\_\_  
④\_\_\_ ⑤\_\_\_ ⑥\_\_\_ ⑦\_\_\_ ⑧\_\_\_

Among the above attributes, which is the least important one for you? ①\_\_\_ ②\_\_\_ ③\_\_\_  
④\_\_\_ ⑤\_\_\_ ⑥\_\_\_ ⑦\_\_\_ ⑧\_\_\_

26. What is your evaluation of baby formula produced in different countries?

(1 = not very good, 2 = not good, 3 = fair, 4 = good, 5 = very good):

	China	United States	New Zealand	Australia	France	Germany
Quality	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Safety	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Packaging	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Nutrition	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Price	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Overall Ranking:	ABCDEF	ABCDEF	ABCDEF	ABCDEF	ABCDEF	ABCDEF

(A=Best, B=Second best....., F=worst)

**Milk powder choice experiment**

There are 16 pairs of different baby formulas in the following 16 tables. They are different in price, product origin, organic certification, and brand reputation in quality and safety. These differences are defined:

**Price:** The price for canned baby formula per 900grams is 200 yuan, 275 yuan or 350 yuan.

**Product origin:** China, USA, or Australia

**Organic:** Government certified organic baby formula (fresh milk and baby formula production in strict accordance with organic farming standards, do not use any hormones, genetically modified materials, synthetic flavors, etc.).

**Brand quality and safety reputation:** "Excellent" means that products exceed the quality and safety standards and there has never been any reported quality or safety problem, penalty or recall in the past 10 years; "Good" means the products meet the government's quality and safety standards.

Here are 16 combinations of baby formula, in the following 16 tables. Please recognize the difference between the two baby formula in each table, and then make yourself consider if you are facing both, then finally decide to either buy: the first baby formula(A), the second one (B), or neither. Please complete the tables one by one until finishing all the 16 options. When making a choice within a table, only use the information provided within that table (do not use information provided in other tables to inform that decision).

Table 1

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	275yuan	
Origin	USA	Australia	
Organic	Yes	No	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table 2

	<u>Product A</u>	<u>Product B</u>	
Price	275yuan	350yuan	
Origin	USA	Australia	
Organic	Yes	No	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table3

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	350yuan	
Origin	Australia	China	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table4

	<u>Product A</u>	<u>Product B</u>	
Price	350yuan	200yuan	
Origin	China	USA	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table5

	<u>Product A</u>	<u>Product B</u>	
Price	275yuan	350yuan	
Origin	USA	China	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table6

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	275yuan	
Origin	USA	Australia	
Organic	No	Yes	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table7

	<u>Product A</u>	<u>Product B</u>	
Price	275yuan	350yuan	
Origin	USA	China	
Organic	No	Yes	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table8

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	350yuan	
Origin	China	Australia	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table9

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	275yuan	
Origin	Australia	China	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table10

	<u>Product A</u>	<u>Product B</u>	
Price	350yuan	200yuan	
Origin	USA	China	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table11

	<u>Product A</u>	<u>Product B</u>	
Price	200yuan	350yuan	
Origin	China	USA	
Organic	No	Yes	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table12

	<u>Product A</u>	<u>Product B</u>	
Price	275yuan	200yuan	
Origin	China	Australia	
Organic	Yes	No	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table13

	<u>Product A</u>	<u>Product B</u>	
Price	350yuan	200yuan	
Origin	USA	China	
Organic	No	Yes	
Brands	Good	Excellent	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table14

	<u>Product A</u>	<u>Product B</u>	
Price	275yuan	350yuan	
Origin	Australia	USA	
Organic	Yes	No	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table15

	<u>Product A</u>	<u>Product B</u>	
Price	350yuan	275yuan	
Origin	USA	Australia	
Organic	Yes	No	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned

Table16

	<u>Product A</u>	<u>Product B</u>	
Price	350yuan	275yuan	
Origin	Australia	USA	
Organic	Yes	No	
Brands	Excellent	Good	
<b>My choice</b>	<input type="checkbox"/> Buy A	<input type="checkbox"/> Buy B	<input type="checkbox"/> Neither

900g canned