Got (Safe) Milk? Chinese Consumers' Valuation for Select Food Safety Attributes

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Introduction

With rising income, the diet of urban Chinese consumers has changed drastically over the past twenty years. Since China's emergence into the global economy, consumers have shifted consumption away from grains, pulses and carbohydrates towards higher quality calories such as animal proteins and aquaculture products. Although sluggish at first, milk demand in urban China has shown remarkable growth in the past decade. Increased demand for dairy in China has been driven by mutually reinforcing factors including rising incomes, government promotion of dairy products, changing urban lifestyles and the development of more sophisticated marketing channels (Fuller et al., 2006). As a result, China's dairy production has surged from just over 10 million metric tons in 2001 to an expected production level of nearly 48 million metric tons by 2013 (Woolsey et al., 2010). Most notably has been the rise in demand for ultra-high temperature pasteurized (UHT) milk among urban consumers in recent years (Fuller et al., 2006; Wang et al., 2008). Sales value of UHT milk has increased significantly from $4.8 billion in 2005 to $7.3 billion in 2009 (Woolsey et al., 2010).

Amidst several food safety incidents, China's increasing demand for milk products is raising new concerns regarding milk production, the effectiveness of government certification, and the integrity of China's leading milk companies. Food safety in China has become an important domestic food issue. Concerns over food safety in Chinese domestic markets emerged and received global attention starting in 2003 following a string of incidents involving food poisonings and fraudulent products (Wang et al., 2008). Adulteration of dairy products in China has been linked to the deaths of four children and has sickened more than 53,000 people, according to the World Health Organization. Recent findings of adulterated dairy products include 26 metric tons of contaminated product in Shanxi province in August 2010; 76 metric tons in Qinghai province in July, 2010; and 165 metric tons in Ningxia Hui Autonomous Region province in February 2010 (Woolsey et al., 2010). The Chinese milk-related food safety incidents have affected trade flows from China. In the height of the milk scare over a dozen Asian and African countries banned Chinese dairy imports fearing that lethal melamine-tainted milk had made its way into their domestic market. Some countries extended the ban to include products derived from milk produced in China.

China's food safety problems stem in large part from loose regulations and a fragmented food sector. Chinese milk production technology is extremely heterogeneous, ranging from farmers in remote, mountainous villages with or two dairy cows to state of the art dairy facilities with hundreds of cows (Fueller et al., 2006). In recent years, the dairy industry in china has consolidated to a few national companies, most notably Yili, Mengniu and Sanlu and over 700 smaller companies that cater to regional markets (Fuller et al., 2006; Wang et al., 2008; Xiu and

Klein, 2010). Investments from multinational dairy based companies has added to the industry's growth and fuelled the development of a highly modern processing sector which obtains its raw materials from millions of small farmers, many of which operate unsupervised.

Recent polls show food safety concerns at an all time high for Chinese consumers. As a result, China's government has approved a series of tougher food safety laws and regulations which include an array of national standards, certification systems, and requirements for use of quality and safety management systems (Wang et al., 2008; Ramzy, 2009). As a result, UHT milk in China is known to carry multiple labels and logos indicating that the product has met various safety-related certifications such as "Green Food," "HACCP," "China Top Brand," etc. (Bai et al., 2007; Wang et al., 2008). On June 1st, 2009, China's new Food Safety Law (which shifted focus away from food sanitation towards food safety) went into effect replacing the Food Sanitation Law that had been in effect since 1995 (Xiu and Klein, 2010). Although touted as a tough approach to alleviating food safety issues, it is unclear whether these government efforts will improve the safety of the Chinese food supply and improve the country's image to its trading partners.

Previous research on Chinese consumer demand for milk safety attributes has found that consumers consider a product's shelf life as the most important safety-related factor in food purchasing decisions, followed by the product's brand and various food product certifications (Wang et al., 2008). It is important to note these product qualities are credence attributes; characteristics that consumers cannot discern before, during or even after consuming the product. Experience attributes such as color, taste and flavor were ranked lowest in terms of factors considered when making purchasing decisions. A study conducted by Zhang et al (2010) found consumers ranked brand and purchase venue as the first two most important safety indicators in their fluid milk purchases. While previous research has identified the primary consumer determinants of food safety in China, little focus has been given to estimating the economic value that consumers place on various verification entities and product safety attributes.

The recent Chinese milk safety incidents have arisen from asymmetric information between consumers and suppliers of milk products. Product brand as well as quality and safety certification, are examples of mechanisms used to help bridge the information gap between market players and reduce inefficiencies that arise from information asymmetries. It is important for Chinese public health officials and product marketers to understand consumer awareness of food safety issues and their preferences over safety and quality attributes (Wang et al., 2008). As one of China's fastest growing food markets, UHT milk serves as an outlet for milk companies to develop brand equity and regain consumer's trust.

The goal of this study is to provide an economics assessment of Chinese consumer preferences for food safety verification attributes in UHT milk. In this study, we use a choice experiment approach to evaluate Chinese consumers' willingness-to-pay for select food safety attributes, and

take into account consumer preference heterogeneity using a random parameters logit (RPL) and a latent class model (LCM).

Theoretical Framework

The theoretical framework of this study is based on a Lancastrian approach to consumer utility. In a break from conventional theory, Lancaster proposed that a good, per se, does not gives rise to utility, rather it is the characteristics or attributes of the good from which consumers obtain utility. Lancaster proposed that goods can posses multiple attributes which can be shared by various goods and that goods in aggregate can possess characteristics different from individual goods (Lancaster, 1966). In the present context, UHT milk can be viewed as a collection of its food safety informational attributes, such as the certifications it carries, its brand, etc. Following the Lancastrian approach to utility, a consumer with preferences over the product attributes will choose the bundle of attributes that maximizes his/her utility subject to a budget constraint.

Experimental Design

Choice experiments allow for the evaluation of tradeoffs among alternatives by replicating real-life purchasing situations and allowing evaluation of multiple attributes (Lusk et al., 2003). Various studies have documented the advantages of using choice experiments over other revealed preference experimental methods, including its conformity to Lancaster's approach to consumer theory (Lusk and Schroeder, 2004; Carlsson et al., 2007). Furthermore, several studies have found no statistically significant difference between results obtained from choice experiment data and revealed preference data (Adamowicz et al., 1998, Carlsson et al., 2001). This study uses a choice experiment approach to estimate consumer willingness-to-pay for UHT milk attributes.

Information from a food safety pilot study conducted in 2008 along with results from a milk-specific survey administered in 2005 (see Wang et al., 2008) were used to identify relevant food safety informational attributes to evaluate. Five, two-level, safety attributes were selected to be included in the choice experiment: price, brand, shelf-life, government certification and third-party certification. The inclusion of product price as an attributes allows for the calculation of tradeoffs between the other attributes in monetary terms, yielding a willingness-to-pay measure for the subsequent attributes. Brand was selected as an attribute because it is often an indicator of quality and safety in China (Wang et al., 2008). Shelf life was identified as the predominant factor influencing milk purchasing decisions. The current government system, as well as a proposed third party assurance program, was selected to measure consumer preferences for various safety certification mechanisms. Detailed description of the selected attributes is presented in Table 1.

A fractional factorial experimental design with 16 choice scenarios was used to estimate the necessary effects. Specifically, the OPTEX procedure in SAS was used to obtain a D-optimal

choice design by minimizing the inverse of the Fisher information matrix. Each survey respondent was presented with the same 16 choice sets featuring two hypothetical UHT milk products and a "no purchase" option to better simulate milk purchasing decision situation.

The survey design was reviewed by economists in both the U.S. and China as well as industry representatives and adjusted accordingly to better elicit consumer preferences. The choice experiment survey was administered in seven major Chinese cities: Beijing, Chengdu, Hohhot, Nanjing, Shanghai, Wuhan, and Xi'an. Chinese college students were hired and trained as enumerators to administer the survey between June and August 2009. In an attempt to better simulate a milk purchasing situation, experimental subjects were selected at random in supermarkets and convenience stores, where actual milk purchasing decisions take place. Approximately 60 valid consumer surveys were obtained at each of the abovementioned cities, yielding a statistical sample of 6,720 observations (7 cities x 60 observations x 16 choice sets).

Data

Expert advice was sought in each city in order to obtain a representative sample of urban Chinese consumers. Approximately 39% of observations were obtained from convenience stores, 44% from domestic supermarkets and 17% from international supermarkets. As shown in Table 2, about half of the survey participants were female. Roughly 70% of consumers reported a monthly household income less than 6,000 RMB and over 80% consumed milk on a weekly basis. Over 60% of surveyed consumers had at least an undergraduate education. As noted in a previous study, a large share of educated customers in the market is especially important in food safety research because consumers are better equipped to assess product safety if the safety and quality information is presented (Ubilava and Foster, 2009 and Antle, 2001). It is important to note that because our study focuses solely on urban consumers, results should not be taken as representative of all Chinese consumers.

Econometric Methods

The 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 [ε_{nit}]. The utility of alternative *i* can be specified as

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

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

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

Unlike the traditional logit model where consumers are assumed to be homogeneous, heterogeneity in consumer preferences for food safety informational attributes is measured using RPL and LCM. RPL and LCM are being increasingly used in applied economic research as two alternative approaches to account for differences in consumer preferences (Tonsor et al., 2009).

Random Parameters Logit

The random parameters logit is regarded as a highly flexible model that can approximate any random utility model and 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 random utility model takes the form of

$$V_{nit} = \beta' x_{nit} \tag{3}$$

where β' 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

$$P_{nit} = \int \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} f(\beta) d\beta \tag{4}$$

where we can specify the distribution of the random parameter $f(.)$. If the parameters are fixed at β_c (non-random), the distribution collapses, i.e. $f(\beta_c)$ =1 for $\beta = \beta_c$, and 0 otherwise.

Latent Class Model

Alternatively, heterogeneity in preferences can be assumed to occur discretely using a latent class approach where the *N* individuals are sorted into a number of, *S*, latent classes, each composed of homogeneous consumers (Boxall and Adamowicz, 2002). In the latent class model, $f(\beta)$ is discrete taking *S* distinct values (Train, 2003). The probability that individual *n* selects option *i* in a given choice situation *t* unconditional on the class is represented by

$$P_{nit} = \sum_{s=1}^{S} \frac{\exp(\beta_s' x_{nit})}{\sum_j \exp(\beta_s' x_{njt})} R_{ns} \tag{5}$$

where β_s is the specific parameter vector for class *s*, and R_{ns} is the probability that consumer n falls into class s. This probability can be modeled as in the following (Ouma et al., 2007):

$$R_{ns} = \frac{\exp(\theta_s' z_n)}{\sum_r \exp(\theta_r' z_n)} \tag{6}$$

where z_n is a set of observable characteristics that affect the class membership for consumer *n*, and θ_s is the parameter vector for consumers in class *s*.

Estimation

Both the random parameters and latent class model specifications were estimated using NLOGIT version 4.0. In the mixed logit model, we hypothesize that the product-specific parameters are random and follow a normal distribution. For modeling purposes we treat price and the constant terms as fixed (see Ubilava and Foster, 2009). The random parameters model was estimated using 1,000 Halton draws. In the LCM, three classes were identified as optimal using both the Akaike and Bayesian Information Criterion. Introducing class membership covariates (i.e. consumer demographics and attitudinal information) failed to improve the model's statistical performance. This is not necessarily surprising as various studies implementing LCM have found observable consumer characteristics to be poor indicators of food preferences (Tonsor et al., 2009; Nilsson et al., 2006). Random parameters and latent class model estimates are presented in Table 3.

The estimated model coefficients are not conveniently interpretable in economic terms given the non-cardinal nature of utility. Therefore, these coefficients are transformed into WTP values using the following calculation:

$$WTP = -2\beta_k/\beta_p \quad (7)$$

Where β_k is the estimated parameter of the k^{th} attribute, and β_p is the estimated price coefficient. In this analysis, the WTP calculation is multiplied by two due to our use of effects coding (Lusk et al., 2003). Because we are interested in the statistical significance of these estimates, standard errors were estimated using the delta method. The estimated mean WTP and their corresponding standard errors for the attributes in each model are presented in Table 4.

Results and Findings

Coefficients from the RPL model indicate that consumers obtain utility from both government and private certification. In addition, consumers gained utility from a product with a national brand relative to a regional brand. Interestingly, model results show that consumers obtained negative utility from UHT milk with a shelf-life longer than 3 month relative to UHT milk with a shorter shelf-life. UHT milk in China is primarily sold in two types of packages: a plastic package is typically used for UHT milk with a shorter shelf-life and a carton package is reserved for UHT milk with a longer shelf-life. Our result indicates that Chinese consumers prefer shorter shelf life UHT milk relative to the longer shelf life product. We attribute this finding to consumers perceiving milk products of shorter shelf-life to be more "fresh" than their long shelf-life counterparts. Furthermore, we believe that consumers prefer the more versatile plastic packaging associated with shorter-shelf life UHT milk.

The left-hand side of Table 4 shows that when consumer heterogeneity is modeled continuously as in the RPL model, consumers have a higher WTP for government certification (3.55 RMB),

followed by the product's brand (2.03 RMB), private certification (1.69 RMB) and last a negative WTP for UHT milk with a shelf life greater than 3 months (-0.64 RMB).[1] The WTP results regarding the two types of certification evaluated is expected given the current situation in China. Because there currently is no third party certification program in place, and all of the quality and safety inspections are performed by government. As a result, the government certification program received the highest WTP from consumers. This finding parallels a similar result from a study that evaluated various safety certification attributes in urban China (Ortega et al., 2011). Brand information received the second highest WTP out of the selected attributes. In China, brand is often a good indicator of product safety and quality. A study conducted in 2005 found that when consumers were asked about their preferences for milk company brands, respondents overwhelmingly chose the two largest dairies in China: Yili and Mengniu (Wang et al., 2008). The proposed third-party quality assurance program received the third highest WTP, indicating that despite not being currently available, this type of certification is positively valued by urban consumers. The negative WTP value for a longer shelf-life product indicates that consumers do not positively value longer shelf life UHT milk in monetary terms.

Results from the RPL model in Table 3 assert the authors' hypothesis of preference heterogeneity among urban consumers. All standard deviation coefficients were significant at the .01 level. It is worth noting that while having received the highest WTP, government certification had the most of variation or heterogeneity of all the evaluated attributes. This type of heterogeneity can also be found across the three classes of the latent class model.

Table 3 shows the probability of a consumer falling into any of the three latent classes to be 67.5%, 13.8% and 18.7% respectively. LCM results for the first class shows that this group of consumers has the largest ratio of the "no-purchase" coefficient relative to price, indicating that this group of consumers (67.5%) value UHT as a commodity. Because we hypothesize that this group represents an urban consumer who enjoys consuming UHT milk, we refer to them as "Milk Lovers." The second latent class is significantly different from the first in that they obtain the most utility from government certification relative to the other attributes. Consequently, their willingness to pay for government certification is over three times greater than the first group; this characteristic leads us to call consumers in this class as "Certification Conscious." The third class of consumers is characterized as receiving the least amount of utility from shelf life. Because we believe that Chinese consumer perceive shelf life to be an indicator of the freshness of the product, we refer to these consumers as "Freshness Conscious."

Implications and Conclusions

This study evaluates Chinese consumers' WTP for select food safety and quality attributes. Using the distributions obtained surrounding the mean WTP values from the RPL model results, the percent of consumers that would be willing to pay more than a specified amount for an

[1] We note the importance of interpreting this WTP value relative to UHT milk with a shelf-life less than 3 months.

attribute can be determined. Table 5 shows the percent of consumers with total WTP greater than pre-specified values. For example, 0.00%, 99.58%, 15.02% and 53.78% of consumers have a WTP greater than $3.00 for longer shelf-life, government certification, private certification and national brand, respectively. This information will be beneficial to government officials, policy makers and industry in assessing the profitability of implementing and providing certain food quality and safety attributes.

This is one of the first applied economic studies conducted specifically on UHT milk in China. While UHT milk is known for having a higher shelf-life than pasteurize milk, the UHT milk market in China is segmented into lower shelf-life and longer shelf-life milk given the various packing used in the Chinese milk sector. Our study finds that consumers prefer the lower shelf-life UHT milk relative to the longer shelf-life product. Evaluated in a food safety and quality context, we find that consumer find lower shelf-life UHT milk to be of higher quality because it is perceived to be fresher than the longer shelf-life product. This finding should send a signal to milk companies in China that consumers directly relate packaging and shelf-life to product quality and safety.

Our research has found that with respect to UHT milk, consumers have the highest value for government certification followed by a national brand. This result updates research conducted prior to the melamine incidents which indicated that consumer did not prefer certification programs over other milk safety attributes (Zhang et al., 2010). The recent milk-safety incidents that affected various nationally recognized brands in China has sparked consumer interest in government certification efforts especially as they pertain to the monitoring and supervision of branded firms and products. In 2000, the Chinese government established an "Inspection Exemption" program in order to reduce the burden and costs of monitoring dairy and milk processing companies (Zhang et al., 2010). As evident in the wake of the milk safety incidents which mostly affected companies under the inspection exemption program, stricter government supervision of national milk companies firms will provide the most value to urban consumers. Our findings suggest that a comprehensive government certification program which applies to all milk companies in China will effectively convey information to consumers and reduce information asymmetries. This study also found that a third party non-government certification program is also positively valued by consumers and if implemented will generate competition and potentially eliminate some of the inefficiencies that arise from a government monopoly on food safety and quality assurance.

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References

Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics*, *80*(1), 64-75.

Antle, J. (2001). Economic Analysis of Food Safety. In : Gardner, B.L. Rausser, G.C. (Eds.) Marketing Distribution and Consumers, Handbook of Agricultural Economics and Management 41, 179-192.

Bai, J., Wahl, T., McCluskey, J. (2008). Fluid Milk Consumption in Urban Qingdao, China. *The Australian Journal of Agricultural and Resource Economics,* 52:133-147.

Bai, L., Ma, C., Gong, S., Yan, Y. (2007). Food Safety Assurance Systems in China. *Food Control*, 18(5): 480-484.

Boxall, P. C., Adamowicz, W. L., 2002. Understanding Heterogeneous Preferences in Random Utility Models: A Latent Class Approach. *Environmental and Resource Economics*, *23*(4), 421-446.

Carlsson, F., & Martinsson, P. (2001). Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments?: Application to the Valuation of the Environment. *Journal of Environmental Economics and Management*, 41(2), 179-192.

Carlsson, F., Frykblom, P., & Lagerkvist, C. (2007). Preferences with and without prices - does the price attribute affect behavior in stated preference surveys? *Environmental & Resource Economics*, *38*(2): 155-164.

Fuller, F., Huang, J., Ma, H., Rozelle, S. (2006) Got Milk? The Rapid Rise of China's Dairy Sector and Its Future Prospects. *Food Policy*, 31: 201-215.

Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy,*74: 132-157.

Lusk, J.L., Schroeder, T.C. (2004). Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks. *American Journal of Agricultural Economics,* 86: 467-482.

Lusk, J. L., Roosen, J., and Fox, J. (2003). Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States. *American Journal of Agricultural Economics,* 85:16–29.

McFadden, D., Train, K. (2000). Mixed MNL models for discrete response. *Journal of Applied Econometrics*, *15*(5), 447-470.

Nilsson, T., Foster, K., Lusk, J. L., (2006). Marketing Opportunities for Certified Pork Chops.

Canadian Journal of Agricultural Economics, 54(4), 567-583.

Ouma, E., Abdulai, A., Drucker, A. (2007). Measuring Heterogeneous Preferences for Cattle Traits among Cattle-Keeping Households in East Africa. *American Journal of Agricultural Economics*, *89*(4), 1005-1019.

Ortega, D., Wang, H., Wu, L., Olynk, N. (2011). Modeling Heterogeneity in Consumer Preferences for Select Food Safety Attributes in China. *Food Policy.* doi:10.1016/j.foodpol.2010.11.030

Ramzy, A. (2009). Will China's new food-safety laws work? *Time,* March 3, 2009. http://www.time.com/time/world/article/0,8599,1882711,00.html

The New York Times (2008). Asian and African states ban China milk products. Asia Pacific Section. Retrieved from http://www.nytimes.com/2008/09/24/world/asia/24iht-milkbox.1.16440371.html?_r=1

Train, K. E. (2003). Discrete Choice Methods with Simulation. Cambridge Books. Cambridge University Press.

Tonsor, G. T., Olynk, N., Wolf, C. (2009). Consumer Preferences for Animal Welfare Attributes: The Case of Gestation Crates. *Journal of Agricultural and Applied Economics*, *41*(03): 713-730.

Ubilava, D., Foster, K. (2009). Quality certification vs. product traceability: Consumer preferences for informational attributes of pork in Georgia. *Food Policy,* 34(3): 305-310.

Wang, Z., Mao, Y., Gale, F. (2008). Chinese Consumer Demand for Safety Attributes in Milk Products. *Food Policy*, 33: 27-36.

Woolsey, M., Zhang, J., Zhang S. (2010). People's Republic of China Dairy and Products Annual. GAIN Report. USDA Foreign Agricultural Service. Report Number CH10058.

Xiu, C., Klein K. (2010). Melamine in Milk Products in China: Examining the Factors that lead to Deliberate Use of the Contaminant. *Food Policy,* 35: 463-470.

Zhang, C., Bai, J., Lohmar, B., Huang, J. (2010). How do Consumers Determine the Safety of Milk in Beijing, China? *China Economic Review*. 21: S45-S54.

Table 1. Food Safety Informational Attributes Used in Choice Experiment

Attribute	Levels	Description
Price (*PRICE*)	1.5 and 2.0	Price in RMB† per 200~250 ml of UHT milk.
Shelf Life *(SHELF)*	More than 3 Months, Less than 3 months	Describes the shelf life and packaging of the product.
Government Certification (*GOV*)	Yes, No	If present (i.e. 'Yes'), the product carries a certification issued by the government assuring that the product was inspected for safety
Private Certification (*PRIV*)	Yes, No	If present (i.e. 'Yes'), the product carries a certification issued by a private, third party (non-governmental) body assuring that the product was inspected for safety
Brand *(BRAND)*	National Brand, Regional Brand	Describes the scope of the brand of the product

† Chinese Renminbi (RMB). In June 2009, 1 RMB = 0.1463 US Dollars.

Table 2. Descriptive Statistics

Variable	Definition	Value
Sample Size (N)	Total participants	429
Gender	Male	47.55%
	Female	52.45%
Age	Average age in years	34.38
Educational Attainment	Primary	4.66%
	Secondary	30.07%
	Undergraduate	52.45%
	Graduate/Professional	12.82%
Monthly Household Income	< 2,000 RMB	16.32%
	2,000-3,999 RMB	30.77%
	4,000-5,999RMB	20.98%
	6,000-7,999 RMB	10.49%
	8,000-9,999 RMB	9.32%
	10,000-11,999 RMB	5.36%
	12,000-13,999 RMB	3.26%
	> 14,000 RMB	3.50%
Milk Consumption Frequency	Once a day	36.60%
	2-5 times per week	36.13%
	Once per week	10.26%
	Twice a month	8.39%
	Once per month	4.20%
	Less than 1 per month	4.43%

Table 3. Parameters for Two Choice Models

	Random Parameter Model			Latent Class Model								
				Class1			Class 2			Class 3		
Variable				*"Milk Lovers "*			*"Certification Conscious"*			*"Brand Conscious"*		
PRICE	-0.545	(0.087)	***	-0.352	(0.099)	***	-0.587	(0.266)	**	-0.303	(0.151)	**
SHELF	-0.174	(0.030)	***	-0.088	(0.029)	***	0.080	(0.072)		-0.662	(0.034)	***
GOV	0.967	(0.045)	***	0.489	(0.026)	***	2.809	(0.108)	***	1.297	(0.045)	***
PRIV	0.462	(0.027)	***	0.330	(0.021)	***	1.114	(0.087)	***	0.649	(0.040)	***
BRAND	0.554	(0.035)	***	0.447	(0.023)	***	0.690	(0.060)	***	0.508	(0.039)	***
STDEV (SHELF)	0.369	(0.038)	***									
STDEV (GOV)	0.712	(0.042)	***									
STDEV (PRIV)	0.317	(0.032)	***									
STDEV (BRAND)	0.536	(0.035)	***									
No Purchase	-1.654	(0.156)	***	-2.720	(0.190)	***	-0.628	(0.472)		0.959	(0.268)	***
Membership Probability				0.675			0.138			0.187		

Notes: Presented models (log likelihoods of -5,576 and -4,952 respectively) were estimated using NLOGIT 4.0. Standard errors are presented in parentheses. *, **,*** denotes statistical significance at the .10, .05 and .01 levels respectively.

Table 4. Consumer Willingness to Pay (WTP) for Food Safety Verification Attributes

				Latent Class Model								
	Random Parameters Model			Class 1			Class 2			Class 3		
Attribute				*"Milk Lovers "*			*"Certification Conscious"*			*"Freshness Conscious"*		
SHELF	-0.64	(0.14)	***	-0.50	(0.18)	***	0.27	(0.26)		-4.37	(2.22)	**
GOV	3.55	(0.59)	***	2.78	(0.77)	***	9.58	(4.37)	**	8.56	(4.31)	**
PRIV	1.69	(0.29)	***	1.87	(0.56)	***	3.80	(1.72)	**	4.28	(2.19)	*
BRAND	2.03	(0.36)	***	2.53	(0.76)	***	2.35	(1.18)	**	3.35	(1.77)	*

Table 5. Percent of Consumers with Willingness to Pay (WTP) Greater than Specific Increments for Food Safety Verification Attributes

Consumer WTP (RMB)	-1.00	-0.50	0.00	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
Attribute	Percent (%) of Consumers Willing to Pay More than the Above-Stated WTP												
SHELF	99.43	16.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GOV	100.00	100.00	100.00	100.00	100.00	99.98	99.58	96.30	82.50	53.27	22.06	5.24	0.67
PRIV	100.00	100.00	100.00	100.00	99.08	74.55	15.02	0.32	0.00	0.00	0.00	0.00	0.00
BRAND	100.00	100.00	100.00	100.00	99.78	92.93	53.78	10.02	0.40	0.00	0.00	0.00	0.00