Modeling Heterogeneity in Consumer Preferences for Select Food Safety Attributes in China

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Abstract

Food safety issues often arise from problems of asymmetric information between consumers and suppliers with regards to product-specific attributes. Severe food safety scandals were observed recently in China that not only caused direct economic and life loss but also created distrust in the Chinese food system domestically as well as internationally. While much attention has focused on the problems plaguing the Chinese government's food inspection system, little research has been dedicated to analyze consumers' concerns over food safety. In this paper we measure consumer preferences for select food safety attributes in pork and take their food safety risk perceptions into account. Several choice experiment models, including latent class and random parameters logit, are constructed to capture heterogeneity in consumer preferences. A statistical sample of 6,720 observations is obtained from a choice experiment administered in seven major Chinese metropolitan cities. Our results suggest that Chinese consumers have the highest willingness-to-pay for a government certification program, followed by a traceability system, third party certification and a product-specific information label. The results of this study call upon the direct involvement of the Chinese government in the food safety system. A more strict monitoring system will not only improve consumer welfare in the short-run but also restore consumers' trust leading to a social welfare increase in the long run.

1. Introduction

Throughout much of the second half of the last century, China's centrally planned, autarkic, economy made it an insignificant player in the global trading system. Today, having gone from a sleeping giant to the fastest growing economy, China is considered the poster-child for economic growth. Many economists have called China's emergence a "positive economic shock," unleashing a consumer base and workforce of nearly 1.3 billion people into the global market. However, China's rapid growth and development hasn't occurred without setbacks and challenges. A series of globally recognized food safety scandals have brought increased awareness to China's inefficient food certification and inspection system. As a result, China's role in the world export market has suffered as various countries have rejected a significant portion of its food exports for failing to meet rigorous food safety standards. Moreover,

heighted public concern over the safety of China's food supply has raised questions regarding consumer confidence on the existing government-run food inspection system.

Many of China's food safety problems can be traced back to the farm level as some farmers still rely heavily on the use of highly toxic pesticides to cope with various production problems (Calvin et al., 2006). The use of antibiotics in the livestock sector has also lead to a series of public health concerns focused upon the rise of new antibiotic-resistant bacteria strains. China's highly fragmented food supply chain composed of millions of small farmers, traders, and retailers, many of which operate unsupervised, poses the greatest challenge to the implementation of a comprehensive and effective domestic food safety system.

In an effort to maintain the food supply of the world's second largest economy safe, China's government has approved a series of tougher food safety laws and regulations (Ramzy, 2009). Although publicized as a tough approach to remedying food safety concerns, it is unclear whether this latest effort will make China's food safer and improve the country's image to its agricultural trading partners. While much attention has focused on the problems plaguing China's food quality and inspection system, little research has been dedicated to analyzing consumers' concerns over food safety and their preferences for various food safety assurance programs.

Food safety issues often arise from problems of asymmetric information between consumers and suppliers of food with regards to product-specific attributes or characteristics. Third-party certification and traceability networks are examples of systems used to help bridge the information gap between market players and reduce inefficiencies that arise from asymmetric information. In China, an additional challenge lies in the inherent structure of the governing bodies which oversee food safety and quality. Unlike many developed countries, China's food safety is regulated by several government entities with different and sometimes overlapping responsibilities (Calvin et al., 2006). As a result, consumers don't have a comprehensive food safety and quality system on which to base their purchasing decisions.

An assessment of Chinese consumer preferences for food safety informational attributes will aid policy makers draft and implement more effective food safety regulations, restoring consumer confidence and reinstating China as a leading exporter of safe food products worldwide. In this study, a choice experiment approach is used to estimate Chinese consumers' willingness-to-pay (WTP) for select food safety attributes in pork. Specifically, we evaluate a product traceability system, the current government-run certification program, a proposed third-party (non government-controlled) certification program and a product-specific information label.

Although news coverage of the recent food safety incidents in China has broadened our understanding of the issues plaguing China's domestic food supply, research that analyzes the current situation from a consumer perspective is in its infant stage (see Brown et al., 2002 and Wang et al., 2008). Moreover, research that analyzes consumers' attitudes and perceptions

toward the current government controlled food safety assurance system and other such programs in China is missing from the economic literature. Due to the delicate intricacies of conducting an economic evaluation of such programs in China, most of the literature available on consumer food safety research focuses on other foreign consumers. Recently, Ubilava and Foster (2009) conducted a consumer study in the Republic of Georgia to measure consumer preference for informational attributes that will aid producers better manage their supply decisions in the midst of post-war reconstruction. Hayes et al. (1995) valued food safety of U.S. consumers using an experimental auction markets approach that incorporated food safety risk levels. For a detailed documentation of food safety research we refer readers to Grunert (2005).

While the use of choice experiments to study consumer behavior has increased in recent years (Ouma et al., 2007; Nilsson et al., 2006; Tonsor et al., 2009; Lusk et al., 2004), little use of this approach has been applied to study the Chinese consumer. The objective of this research is to assess Chinese consumer preferences for select food safety information attributes. Specifically, we use a choice experiment approach, examine the preference heterogeneity using a random parameters logit (RPL) and latent class model (LCM), and take into account consumer's food safety risk perceptions as assessed through survey analysis.

2. Theoretical Framework and Econometric Modeling

The theoretical framework of this research is rooted in the Lancastrian approach to consumer theory. A break from the traditional view that utility is derived from a good, Lancaster proposed that a good per se does not give utility to the consumer. Rather, a good possesses characteristics, and these characteristics give rise to utility. Furthermore, Lancaster generalized that goods can posses multiple characteristics which can be shared by multiple goods and that goods in aggregate can possess characteristics different from those pertaining to the goods separately (Lancaster, 1966). In the present context, pork, the good of interest, can be viewed as a collection of its food safety informational attributes such as the certifications it possesses, traceability systems it belongs to and labels it carries, etc. Following Lancaster, a consumer with preferences over each of the aforementioned characteristics will choose the bundle of attributes of the good that maximizes his/her utility subject to a budget constraint.

Choice experiments closely simulate real-world purchasing decisions where a consumer has to select a product from a set of options. Several studies have documented the advantages of using choice experiments over other revealed preference experimental methods, including its conformity to random utility theory and Lancaster's approach to consumer theory (Lusk et al., 2004; Carlsson et al., 2007). In addition, various studies have found no statistically significant difference between the results obtained from choice experiment (stated preference) data and those from actual (revealed preference) data (Adamowicz et al., 1998, Carlsson et al., 2001).

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*.

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

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

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).

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

$$V_{nit} = \beta' x_{nit} \quad (3)$$

where β' is a vector of random parameters with mean $\bar{\gamma}$ and variance-covariance η_n 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

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

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 β =β_c, and 0 otherwise.

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 logit 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

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

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):

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

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.

2.1.The Choice Experiment and Data Description

In order to identify relevant food safety informational attributes, a pilot study was conducted in 2008 as part of a previous research project in which consumers where interviewed regarding food safety issues associated with pork. Five, two-level, food safety attributes were selected to be included in the choice experiment: price, a traceability system, government certification, third party certification, and a product-specific information label. Detailed information regarding the specific attributes and their levels are presented in Table 1.

A full factorial experimental design which includes all possible combinations of the 5 attributes at 2 levels, with 2 alternatives would require the use of $(2^5)^2$ or 1,024 choice sets. Since it is not practically feasible to work with this number of choice sets, a fractional factorial design was used. The OPTEX procedure in SAS was used to obtain a 16 choice scenario and D-optimal design that allowed for the estimation of all main and two-way interaction effects (See Figure 1 for sample choice set). The 16 simulated pork purchasing scenarios were incorporated into a consumer survey where data was also collected on consumers' socio-economic demographics, pork consumption habits and food safety risk perceptions. Chinese college students were hired and trained as enumerators to administer the survey in seven major Chinese cities (Beijing, Chengdu, Huhhot, Nanjing, Shanghai, Wuhan, and Xi'An)[1] between June and August 2009. In an attempt to better simulate a pork purchasing situation, experimental subjects were selected at random in grocery stores and markets, where actual 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).

Descriptive statistics of selected demographic variables for the survey sample are presented in Table 2. The mean age of consumers was 37.6 years. Over 50% of participants reported a monthly family income less than 6,000 RMB which is consistent with national urban statistics in China (China Statistical Yearbook, 2009). Near 80% of consumers surveyed reported that their household consumed pork at least 2-5 times per week, reflecting the fact that pork is considered a necessity in the Chinese diet (Ortega et al., 2009). The majority of consumers showed a high level of food safety concern, where the mean food safety risk perception (FSRP) score for the sample was 8.37; a FSRP value of 1 indicates no concern and a value of 10 for extreme concern.

[1] These cities are scattered in the north, west, north-west, east, south and central China.

2.2.Estimation and Willingness to Pay

The empirical model developed in this study is based on the choice experiment structure which contains the five aforementioned food safety informational attributes. We assume that these product-specific attributes interact with one another and therefore allow for two-way interaction terms. To model consumers' food safety concerns, we interact the informational attributes with the FSRP variable. An opt-out variable serves as a constant in our model to better represent consumer's utility obtained from pork. The data was effects coded to eliminate confounding effects between the constant and the attributes (Bech and Gyrd-Hansen, 2005). In the random parameters logit model we assume that the product-specific parameters are random and follow a normal distribution, however, for modeling purposes we treat the constant ('Opt Out'), price and the interactions terms as fixed (see Ubilava and Foster, 2009)

Both the random parameters and latent class model specifications were estimated using NLOGIT version 4.0. The random parameters model was estimated using 1,000 Halton draws for the simulations. In the LCM, four classes were identified as optimal using both the Akaike and Bayesian Information Criterion. Consumer income was introduced as a covariate in the LCM model. Estimates of the RPL parameter means and LCM are reported in Table 3.

The parameter estimates from both models, as reported, provide little economic information given the non-cardinal nature of utility. Consequently, these results are used to obtain a WTP measure, which is given by:

$$WTP = -2\Omega/\beta_p \qquad (7)$$

Where Ω is the partial derivative of utility with respect to the attribute of interest evaluated at the sample mean of the data, and β_p is the estimated price coefficient. Ninety-five percent confidence intervals for the WTP estimates were created using a parametric bootstrapping technique proposed by Krinsky and Robb (1986). More specifically, a distribution of 1,000 observations for each WTP estimate was simulated by drawing from a multivariate normal distribution parameterized with the coefficient and variance terms obtained from the models. This method produces analogous results to estimating a standard error using the delta method, however, it relaxes the assumption that WTP is symmetrically distributed (Hole, 2007). The estimated mean WTP and 95% confidence intervals for the attributes in each model are presented in Table 4.

3. Empirical Results

3.1. Heterogeneity in Consumer Preferences

Table 3 contains the results from the estimated utility functions. Coefficients from the RPL model indicate that, overall, consumers consider both the current government certification

program and a private non-government certification program to be valuable, and substitutable (significant negative value on the cross terms between government and private certification). In addition the results show that either a traceability system or a product-specific information label would add significant value to the existing government safety assurance program (Table 3). It is worth noting that while these two attributes do not increase consumers' utility significantly when provided alone,[2] they significantly increase it when provided together with the government certification program. This classifies these attributes as complements to government certification and to each other.

The left-hand side of Table 4 shows that when heterogeneity is modeled continuously as in the RPL, consumers show a higher WTP for government certification (10.63 RMB), followed by a traceability system (6.28 RMB), the proposed private safety assurance program (6.10 RMB) and a product-specific information label (4.27 RMB). These results are reasonable given the current situation in China. Currently, there is no private safety assurance program, and all the quality control programs are run by the government. Consumers' confidence in private entities is generally weak, as many of the food safety incidents were caused by profit-driven firm behavior. As a consequence, the government certification program received the highest WTP from consumers. WTP for the product traceability system ranked second amongst consumers. Recently in China, a number of modern slaughter houses have emerged and are establishing their reputation as safe and clean operations. As a result, consumers are starting to value this type of information. This can be observed today in many Chinese grocery stores where information on the origin of pork products is showcased. The product specific information label was the least valued by consumers. In general, this type of label is contingent upon information provided by producers and processors and little oversight is given to verify this type of information, making consumers skeptical.

The RPL and LCM results assert the authors' hypothesis that there is significant heterogeneity in consumer preferences for these food safety informational attributes in China. The RPL-specific results in Table 3 show significant standard deviation coefficients for all attributes. More specifically, consumers were found to be more heterogeneous in preferences for government safety assurance and the product-specific label. The statistical significance of the standard deviation coefficients of the attributes along with their magnitude indicates the strong presence of consumer heterogeneity.

The preference heterogeneity found in the RPL translates into significant differences amongst members of different classes in the LCM. Table 3 shows the probability that a randomly chosen respondent belongs to a given class is 38 %, 13%, 28% and 21% respectively. LCM results for the first latent class shows a relatively high price coefficient value (in absolute value terms) relative to the coefficients on the other attributes, indicating a group of consumers that is price sensitive. This class (38% of population) may represent a group of Chinese consumers who is

[2] The coefficient on both of these attributes are statistically significant at the 0.25 level.

relatively more concerned about price. Since members of this class, we hypothesis, base their pork-purchasing decision more on price, we refer to consumers in this group as “price conscious.” The second latent class is significantly different than the first in terms of their price sensitivity. The coefficients from the model reveal that consumers in this group obtain utility from either government or private certification as opposed to the traceability system or the product-specific label (which diminishes their utility). This leads us to refer to this second class of consumers (13% of population) as “Certification Conscious.” The third class (28% of population) is characterized by consumers who value pork as a commodity (the opt-out coefficient relative to price is negative and significant). This group of consumers, we hypothesize, represent a traditional Chinese shopper that enjoys having pork as part of their daily diet; we refer to this group of consumers as “Pork Lovers.” The fourth class (21% of population) is characterized by shoppers that have significant positive FSRP coefficients and a high willingness-to-pay for all attributes; we call members of this class “Worried Consumers.”

As mentioned earlier, we included income as a covariate in equation (6) of the LCM model to explore the economic characteristics of members in each class, and found that it significantly improved the performance of the model. The coefficient on income (which represents total household income) in the LCM revealed that wealthier consumers were less likely to belong to the “Price Conscious” (class 1) or “Pork Lovers” (class 3) group relative to those in class 4. This result is consistent with the fact that consumers in those two classes exhibit a lower WTP for the food safety informational attributes relative to the consumers in class 2 or class 4.

3.2.Food Safety Risk Perception Effects on Preferences and WTP

Taking the RPL as a representation of the distribution of consumer preferences for food safety attributes in China, we can discuss the impacts that consumers’ food safety risk concerns have on their preferences and WTP. The model results presented in Table 3 shows that food safety risk concern levels significantly affects consumer preference for all of the attributes under consideration. A significant positive coefficient on the FSRP variable crosses suggests that more concerned consumers get higher utility from the presence of food safety informational attributes. In more meaningful economic terms, this translates to higher WTP for each attribute.

Table 5 contains simulated WTP values for three consumers with different FSRP scores. Because in our sample consumers seldom reported a FSRP lower than 5, we choose Consumer A to represent a consumer with a FSRP score of 5 (meaning that he/she is moderately concerned), Consumer 2 represents the average consumer in our study and Consumer 3 represents an extremely concerned consumer with the highest FSRP score. From this sensitivity analysis it becomes clear that food safety risk concerns significantly affects consumer welfare and WTP for food safety informational attributes. A high level of food safety concern generates increased utility and WTP for the food safety informational attributes under discussion.

4. Implications & Conclusion

In this study, we use a choice experiment to analyze Chinese consumer preferences for food safety information. Our results show that Chinese consumers are very concerned about the safety of the pork they purchase and are willing to pay a high price to assure that their food is safe. The high level of concern regarding the safety of the pork supply can be linked to recent food safety incidents involving pork and dairy products, most notably the Clenbuterol contaminated pork and Melamine-tainted baby formula incidents. Although it might appear that Chinese consumers' confidence on the government is eroding, as reported in the wake of these scandals, our research found that consumers were less confident on non-government food safety control measures. This result indicates that there is a strong need for the Chinese government to provide adequate food safety and quality control.

It is worth noting that Chinese consumers in this study had a significant, positive WTP value for third-party food safety certification. Moreover, consumers perceived this non-government certification to be a substitute to the current government-run program. This result suggests that the implementation of a non-government food safety and quality certification program will potentially generate welfare gains for consumers. As a result, it is anticipated that the realization of such a program in China will generate competition and potentially eliminate some of the inefficiencies that arise from a government monopoly on food safety certification.

Consumer WTP for product traceability is significantly higher than their WTP for third party certification, or a product specific label. This result is promising for large Chinese agribusinesses such as the new slaughter facilities and packaging plants emerging outside urban centers that are trying to capitalize on consumers' need for additional safety assurance. In the pork market, this signals that good business and ethics will be rewarded and that the cost of providing high quality and safe food will be covered by consumers. Given that the pork retail price at the time of this study was around 10 RMB (and mostly certified by the government), the WTP figures derived in this study indicate that consumers are willing to pay additionally for food safety attributes. As a result, higher quality pork in terms of having additional safety attributes can be sold at higher prices in Chinese markets.

Although Chinese consumers are in general concerned about food safety, their willingness-to-pay a price premium to cover the cost of providing safety attributes is heterogeneous. Most Chinese consume pork as a staple food and are willing to pay a higher premium. As Chinese urban per capita income continues to increase at a very fast pace, more people will join this new higher income class and will be more willing to pay a higher price to obtain better food safety information. This should give the government and private sector confidence and an incentive to invest in quality control service for food safety.

Unlike in developed countries like the U.S. where it is mandated that food ingredients be labeled, China has not yet implemented such a policy. Although some processed foods have voluntarily started to use such labels, our results show that consumers do not quite trust this type of information, as private firms may not honestly list all ingredients, especially questionable

additives. In addition, our risk perception analysis found that consumers' willingness-to-pay for food safety information increases with their risk concern. As a result, the loss of utility from not having such attributes is higher for those with a high degree of concern. Restoring consumers trust on food provided in the marketplace is an issue that requires urgent attention in order to reduce society's overall transaction cost in the economy.

The results of this study call upon the direct involvement of the Chinese government in the food safety system. A more strict monitoring system via certification is necessary. If realized, such government efforts will provide higher welfare to consumers in the short-run and will restore consumers' trust increasing social welfare in the long run.

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Table 1. Food Safety Informational Attributes Used in Choice Experiment

Attribute	*Levels*	*Description*
Price (*PRICE*)	8 and 12	Price expressed in RMB[†] per kilogram of pork
Traceability System (*TRACE*)	Binary	The product carries information regarding its origin (producer and location)
Government Certification (*GOV*)	Binary	The product carries a certification issued by the government assuring that the product was inspected for safety
Private Certification (*PRIV*)	Binary	The product carries a certification issued by a private, third party (non-governmental) body assuring that the product was inspected for safety
Product Information Label (*LABEL*)	Binary	The product carries a label with additive information

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

Table 2. Socio-Demographic Statistics

Sample size (persons)	420
Age(mean ± st.dev.)	37.6 ± 13.4
Gender (percent)	
Male	47.6
Female	52.4
Education (percent)	
Primary School	6.0
Secondary School	38.8
Undergraduate	46.4
Graduate/Professional	8.8
Household size (mean ± st.dev.)	3.3 ± 0.9
Household monthly income (percent)	
< 2,000RMB	10.5
2,000-3,999 RMB	31.4
4,000-5,999 RMB	24.7
6,000-7,999 RMB	13.8
8,000-9,999 RMB	10.9
10,000-11,999 RMB	5.0
12,000-13,999 RMB	1.7
>14,000 RMB	2.0
Household weekly pork consumption (percent)	
< 1kg	22.1
1-1.5 kg	21.0
1.5-2 kg	19.5
2-2.5 kg	9.1
2.5-3 kg	8.3
3-3.5 kg	7.6
3.5-4 kg	4.3
>4 kg	8.1
Pork consumption frequency (percent)	
Once a day or more	33.6
2-5 times a week	45.4
Once per week	10.0
Once every two weeks	6.0
Once per month or less	5.0
Food Safety Risk Perception (FSRP) Score (mean ± st.dev.)	8.4 ±2.2

Table 3. RPL and LCM Results

	Random Parameters Model			Latent Class Model											
				Class 1 *"Price Conscious"*			Class 2 *"Certification Conscious"*			Class 3 *"Pork Lovers"*			Class 4 *"Worried Consumers"*		
	Coef.		S.E.	Coef.		S.E	Coef.		S.E	Coef.		S.E.	Coef.		S.E.
PRICE	-0.165	***	0.012	-0.430	***	0.040	-0.148	***	0.031	-0.060	***	0.010	-0.150	***	0.028
TRACE	0.121		0.110	-0.050		0.230	0.019		0.732	-0.260	***	0.100	1.058	***	0.285
GOV	0.353	**	0.150	0.608	***	0.210	2.953	***	0.774	-0.060		0.100	0.200		0.225
PRIV	0.230	**	0.109	0.158		0.200	2.889	***	0.872	-0.070		0.090	-0.460	*	0.284
LABEL	-0.183		0.152	-0.160		0.250	-11.035	***	0.605	0.122		0.110	-0.210		0.241
GOV x TRACE	0.008		0.048	0.193		0.170	-0.394	**	0.183	0.131	**	0.060	-0.550	***	0.130
GOV x PRIV	-0.155	**	0.047	-0.010		0.130	-0.743	***	0.242	-0.140	**	0.060	-0.230	*	0.126
GOV x LABEL	0.171	**	0.054	0.191		0.180	0.692	***	0.189	-0.180	***	0.070	0.117		0.138
PRIV x TRACE	-0.048		0.047	-0.030		0.130	-0.378	**	0.167	-0.060		0.060	-0.190		0.133
PRIV x LABEL	0.010		0.045	0.043		0.130	0.467	***	0.155	-0.070		0.050	0.175		0.118
LABEL x TRAC	0.154	***	0.049	0.464	***	0.170	0.446	***	0.140	-0.030		0.060	0.102		0.130
RISK x TRACE	0.043	***	0.012	0.094	***	0.020	0.088		0.081	0.040	***	0.010	0.046	**	0.022
RISK x GOV	0.061	***	0.017	0.058	***	0.020	-0.126	*	0.077	0.047	***	0.010	0.201	***	0.016
RISK x PRIV	0.040	***	0.012	0.078	***	0.020	-0.171	**	0.089	0.038	***	0.010	0.152	***	0.025
RISK x LABEL	0.050	***	0.017	0.057	***	0.020	1.088	***	0.065	-0.010		0.010	0.149	***	0.021
STDEV(TRACE)	0.285	***	0.037												
STDEV(GOV)	0.581	***	0.037												
STDEV(PRIV)	0.296	***	0.035												
STDEV(LABEL)	0.606	***	0.036												
Opt Out	-2.116	***	0.156	-7.500	***	0.530	1.095	***	0.410	-1.480	***	0.130	-0.200		0.469
Income	NA			-0.220	**	0.090	0.088		0.113	-0.240	**	0.100	--		
Class Probabilities				0.383			0.129			0.281			0.208		

Note: *, **, *** denotes significance at the .10, .05 and .01 levels.

Table 4. Willingness To Pay, Mean [95% Confidence Interval]

	Random Parameters Model		Latent Class Model							
			Class 1		Class 2		Class 3		Class 4	
			"Price Conscious"		*"Certification Conscious"*		*"Pork Lovers"*		*"Worried Consumers"*	
TRACE	6.28	[5.22, 7.56]	4.42	[3.49, 5.49]	8.97	[4.30, 16.05]	3.06	[0.89, 5.53]	17.39	[11.69, 25.99]
GOV	10.63	[8.85, 12.74]	5.67	[4.47, 7.05]	24.58	[15.77, 39.29]	10.22	[6.53, 16.23]	23.55	[16.20, 34.92]
PRIV	6.10	[4.95, 7.44]	3.77	[2.73, 4.97]	17.11	[10.32, 28.23]	5.91	[3.29, 9.99]	10.44	[6.35, 16.65]
LABEL	4.27	[3.09, 5.56]	2.60	[1.50, 3.78]	-19.40	[-34.16, -12.22]	-3.13	[-6.04, -0.56]	16.46	[10.92, 24.68]

Table 5. Food Safety Risk and Willingness to Pay, Mean [95% Confidence Interval]

	Consumer A (FSRP Score= 5) *"Moderately Concerned"*		Consumer B (FSRP Score= 8.4) *"Highly Concerned"*		Consumer C (FSRP Score= 10) *"Extremely Concerned"*	
TRACE	4.56	[3.09, 6.08]	6.28	[5.22, 7.56]	7.12	[5.89, 8.62]
GOV	8.11	[6.14, 10.35]	10.63	[8.85, 12.74]	11.88	[9.85, 14.23]
PRIV	4.49	[3.20, 6.05]	6.10	[4.95, 7.44]	6.90	[5.55, 8.38]
LABEL	2.18	[0.54, 4.00]	4.27	[3.09, 5.56]	5.25	[3.86, 6.78]

Figure 1. Sample Choice Set

	Alternative 1	Alternative 2	Alternative 3
Price	12 RMB/kg	8 RMB/kg	I would not purchase pork
Traceability System	Yes	No	
Government Certification	Yes	Yes	
Private Certification	Yes	No	
Product Information Label	No	No	
I Would Purchase:	□	□	□