Consumer Preference and Demand for Traceable Food Attributes: A Choice-based Conjoint Analysis

Jiao Lu, Linhai Wu*, Shuxian Wang, Lingling Xu

Food Safety Research Base of Jiangsu Province (School of Business), Jiangnan University, NO.1800, Lihu Avenue, Wuxi, 214122, China, and Synergetic Innovation Center Of Food Safety and Nutrition, NO.1800, Lihu Avenue, Wuxi, 214122, China,

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* Linhai Wu (**Address:** 88-1401, Jian Kang Yi Cun, Wuxi, Jiangu, Province, China.

Post Code: 214031**;E-mail:** wlh6799@126.com)

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* Correspondence author: Linhai Wu, Tel: +86 051085327503; fax: +86 051085327503; E-mail: wlh6799@126.com

Abstract

The China market for traceable food has developed gradually over the past decade. This study surveyed 1380 consumers in seven pilot cities designated by the Chinese Ministry of Commerce for the construction of a meat and vegetable circulation traceability system. A choice-based conjoint analysis and multinomial logit model were used to study consumer preferences and demand for traceable pork attributes. The results demonstrated that certification of traceable information was the most important characteristic, followed by appearance and traceable information. Significant heterogeneity was observed in consumer preferences for the attributes of traceable pork. Consumers' preferences for traceable attributes were significantly influenced by age, income level, and education level. Based on these results, we suggest that the government should strengthen the promotion of scientific knowledge regarding traceability systems, and encourage and support the production of traceable food with different traceability levels and different certification types. Moreover, the development of food traceability systems should be combined with a labeling system for quality certification.

Keywords: *Traceable Pork, Attributes, Levels, Consumer Preference, Choice-based Conjoint Analysis*

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1. Introduction

China is a large consumer and producer of pork. The U.S. Department of Agriculture reported that, in 2014, China had a pork consumption of 57.169 million tons, which accounted for 52% of the global consumption, and a per capita pork consumption of 41.9 kilograms, which was approximately 4.6 times that of the average for the rest of the world.[1] However, the latest research indicated that 13,278 quality and safety incidents pertaining to pork and pork products were exposed by mainstream online public opinion in the Chinese mainland between 2005 and 2014. This represents an average of approximately 3.64 incidents per day. Moreover, the number of quality incidents regarding pork and pork products has increased year by year since 2005, and peaked at 2630 in 2011. With 2011 as a turning point, the number of incidents decreased starting in 2012 to 1005 in 2013, but increased again to 1831 in 2014. Furthermore, a large number of safety incidents occurred in the various stages throughout the supply chain of pork and pork products. Specifically, 5056, 4894, and 3328 incidents occurred in farming, slaughter and processing, and circulation and marketing, respectively, accounting for 38.08%, 36.86%, and 25.06% of the total incidents. The major incidents included the illegal use of clenbuterol in farming, unauthorized slaughter and water injection into pork in slaughter and processing, and selling seconds at best quality prices in circulation and marketing. The repeated pork safety incidents have significantly impacted consumer safety and social trust in the Chinese mainland.

The nature of food safety problems is information asymmetry (Smith et al., 2011). When information asymmetry widely exists between producers and consumers, consumers may make adverse selections due to an information disadvantage, which leads to inefficiency of market mechanisms. In general, consumers evaluate the quality of a product based on the characteristic information of product quality and safety, which reaches the consumers in the form of quality cues. This information is defined from the perspective of consumer demand as product attributes, which are classified into search, experience, and credence attributes (Becker, 2000). Search attributes are product characteristics that are directly observable to consumers prior to purchase or use (eg,

[1] Statistical data from the US Department of Agriculture, http://apps.fas.usda.gov/psdonline/

color, price, and ingredients). Experience attributes are product characteristics that are perceived by consumers during the use of the product (eg, taste, freshness, and tenderness). Credence attributes are those that cannot be verified even after normal use of the product (eg, hormone use, bovine spongiform encephalopathy (BSE) detection, way of farming, environment-friendly production, and animal welfare). Food traceability systems are able to generate a reliable continuous flow of safety information in the supply chain by integrating the above product attribute information. They can not only provide quality and safety information, such as the origin and manufacturing processes (Regattieri et al., 2007), but are also useful for monitoring food production and distribution, identifying food safety problems, and recalling defective food products. Therefore, food traceability systems have become an important tool for information exchange among each player in the food supply chain system and are considered an effective tool to ensure food quality and safety (Aung & Chang, 2014). In Europe, food traceability systems have been gradually developed since 1997 as an important measure to guarantee food quality and safety in response to BSE, dioxin contamination of livestock feed, and other food safety crises. In the United States, all companies have been required to develop product traceability systems since 2002. Traceability and tracking have also been introduced as mandatory requirements for all food sold in the EU since 2004. Since the occurrence of the melamine milk powder incident in 2008, a pilot meat and vegetable circulation traceability system has been developed by the Chinese Ministry of Commerce and deployed in 50 cities across the country in four batches. However, overall progress has been slow. According to the findings of Hobbs (2004) and the actual situation in China, possible important reasons are that consumers are skeptical about the ability of traceability systems to guarantee food safety, and that the extra production cost of traceable products is passed on to the market price, which exceeds consumers' affordability.

Due to the large consumption and high risks of meat and meat products (Korzen et al., 2011; Luukkanen et al., 2015), consumers' preferences and willingness to pay (WTP) for the experience and credence attributes of meat have been an ongoing focus in the field of consumer behavior around the world(Kehagia et al., 2007; Font-i-Furnols and

Guerrero, 2014), with a particular emphasis on traceability. Dickinson and Bailey (2002) assessed consumers' WTP for sandwiches containing beef and pork in Utah using a discrete choice experiment and including quality guarantee during production and traceability as attributes. The results revealed that consumers were willing to pay a premium for traceability, and a higher WTP was observed when traceability was combined with other quality and safety attributes. Similar conclusions were reached by Hobbs et al. (2005) in Canada, Dickinson and Bailey (2003) in the UK, and Zhang et al. (2012) and Wu et al. (2012; 2013) in China. Among all the quality and safety attributes, origin, price, and breeding and production system were shown to be important information affecting consumers' purchase of beef in Spain, Scotland, and the United States (Davidson et al., 2003; Mesías et al., 2005; Mennecke et al., 2007). Moreover, consumers believed that beef should be ideally locally produced, fed with a mixture of grass and grain, and traceable to the farm (Davidson et al., 2003). However, consumer preferences also differed among countries. Roosen et al. (2003) examined French, German, and British consumers' preferences for beef labeling and concluded that origin labeling was the most important factor influencing the purchasing choice of French and German consumers, while British consumers generally considered meat color, tenderness, and price to be more critical factors. More importantly, consumers had significantly increased trust in quality and safety guarantee information provided by government agencies or independent private certification companies (Hobbs et al., 2005). Christensen et al. (2003) investigated British and US consumers' preferences for beef certification, and found that US consumers had higher trust in certification by government agencies, while British consumers had higher trust in certification by independent private agencies. Both the studies on US consumers' preferences and WTP for attribute certification during pork and milk production by Olynk et al. (2010) and for beef attributes by Loureiro and Umberger (2007) also concluded that consumers had a higher WTP for farming environment, farming methods, use of antibiotics, and other attributes certified by the United States Department of Agriculture than those certified by industry associations, third-party certification bodies and consumer groups. Similar conclusions were also drawn by Ortega et al. (2011) and Zhang et al. (2013) when

investigating Chinese consumers' preferences for food safety attributes.

In addition, individual or social characteristics are another important factor affecting consumers' preferences for food quality and safety attributes. Among them, age, income, education level, and family size were the major factors that significantly affected consumers' preferences and WTP for traceable food (Angulo et al., 2007; Mennecke et al., 2007; Reicks et al., 2011; Zhang et al., 2012). Bu et al. (2013) found that consumers' preferences for traceability information differed by age; consumers aged 26-40 years preferred traceable pork containing farming and slaughter and processing information, while those aged 41-45 years preferred traceable pork containing farming, slaughter and processing, and refrigerated transport information; consumers with higher income and education levels had a higher preference for traceable pork with more complete information. It has also been reported that income and education levels were positively correlated with preferences for traceability in Chinese consumers (Zhang et al., 2012). Moreover, higher-income consumers had a higher preference for third-party certification, and higher-educated consumers attached more importance to certification by third-party bodies and industry associations (Bai et al., 2013). In addition, gender, age, occupation, marital status, family size, and purchase behavior were also significant factors affecting Chinese consumers' purchase of traceable food (Zhou et al., 2008; Wang et al., 2009; Zhang et al., 2012).

Consumers have certain knowledge of and WTP for food traceability, but have different preferences for different quality and safety attributes. In addition, it is generally believed that traceability systems alone are not able to solve the food market information asymmetry. Quality guarantee or certification is crucial to food quality and safety. The ideal solution is to combine the credence attributes with traceability. Although these studies have provided guidance and theoretical support for the food labeling policies in Western countries, the applicability of their conclusions to China should be further verified. Due to differences in consumer culture, the setting of food attributes and levels in these studies may not be suitable for China's national conditions. For example, with regard to the consumption of animal products, consumers from Western countries are very concerned about animal welfare, which, however, has not

been a widespread concern among Chinese consumers. Therefore, this study aimed to assess Chinese consumers' preferences and demand for the attributes of traceable pork, as a typical sample of traceable food, and thereby change the consumption concept through the implementation of relevant policies. The results of this study may provide important guidance for more effective development of food traceability systems in China.

2. Materials and methods

2.1. Research framework and experimental design

It is generally believed that the choice-based conjoint (CBC) analysis, though as a stated preference method developed based on the random utility theory, can provide estimation results consistent with the conclusions drawn by a revealed preference method (Adamowicz et al., 1994), and can also effectively avoid hypothetical bias (Carlsson & Martinsson, 2001; Hudson et al., 2003). Therefore, CBC has been widely employed to elicit consumer WTP and preferences.

Based on the framework of random utility theory, it is assumed in the CBC that consumer n chooses a profile that maximizes their utility in subset J. The observed utility can be divided into two parts, V and ε:

$$U_{in} = V_{in} + \varepsilon \tag{1}$$

$$V_{in} = \beta_i X_{in} \tag{2}$$

where U_{in} is the utility of consumer n choosing product profile i, ε_{in} is the random utility component which comprises unobservable individual characteristics, estimation errors, and unobserved attributes, V_{in} is the systematic or measurable utility, which is a function of X_{in} and β_i, and an unknown parameter vector to be estimated. X_{in} defines: (i) a matrix of attributes pertaining to product profile choice options; (ii) a matrix of characteristics that pertain to individuals; (iii) a matrix of interactions of attributes with individual characteristics;

or (iv) a vector of interactions of individual characteristics with the opt-out option (Louviere, 2011).

If A is defined as a subset of discrete choices, and J is the number of options in A, then consumer n will choose product profile i over option j if, and only if,

$$U_i > U_j, \quad j \neq i \in A \tag{3}$$

The probability that consumer n chooses product profile i is given by:

$$P_{in} = P\left[\left\{\varepsilon_{jn} - \varepsilon_{in}\right\} < \left\{V_{in} - V_{jn}\right\}\right], \quad j \neq i \tag{4}$$

In order to determine the choice probabilities in equation (4), assumptions must be made with regard to the distribution of the random components. The random components of CBC analysis follow an independent and identically distributed type I extreme-value distribution, which proved convenient for computational ease (McFadden, 1974). This distribution leads to the ordinary multinomial logit model (MNL):

$$P_{in} = \frac{e^{V_{in}}}{\sum_{j=1}^{J} e^{V_{jn}}}, \; j = 1, \ldots, J, \; j \neq i \tag{4}$$

It is unrealistic to conduct a full factorial design experiment that includes all possible combinations of attributes and levels. In this study, the full factorial design would include $4^4 = 256$ possible choice tasks according to the number of attributes and levels in Table 1. After removing the 48 combinations of no traceability information with certification, consumers would need to complete 208 choice tasks, which is infeasible. Therefore, a fractional factorial design was used in this study to ensure design orthogonality while maximizing the design efficiency. Ten different versions of questionnaires were designed using SSI Web 8.0. Each questionnaire comprised 12 choice tasks (Figure 1 is an example of choice task). Each choice task included two different traceable pork profiles and an “opt-out” option. Questions about the respondent's basic demographics, pork consumption behavior, and knowledge about and trust in traceable food and traceability systems, in addition to CBC choice tasks, were also included in the questionnaire.

Please insert Table 1 and Figure 1 about here

2.2. Data collection

Harbin, Heilongjiang Province, Jinan, Shandong Province, Wuxi, Jiangsu Province, Ningbo, Zhejiang Province, Zhengzhou, Henan Province, Changsha, Hunan Province, and Chengdu, Sichuan Province are the seven pilot cities designated by the Chinese Ministry of Commerce for construction of a meat and vegetable circulation traceability system. These cities are located in the northeast, eastern, central, south central and western regions of China, with different levels of economic development, living standards, and consumer cultures. In this study, the analysis of Chinese consumers' preferences for traceable pork attributes based on survey data from the seven cities provides representative results.

The survey was conducted in supermarkets, meat shops and farmer's markets with a large flow of customers. Experience has shown that these places are the most important channels for consumers to buy pork. The experiment was conducted by trained investigators through direct face to face interviews. In order to ensure the randomness of respondents, it was determined that the third consumer coming into view should be selected as the respondent (Wu et al., 2012). Prior to the survey, the specific meaning of the product profiles of traceable pork, as well as the attributes and levels, was explained in detail to the respondents. The interview began after the respondents fully understood the CBC tasks. Each interview took about 15-30 minutes.

The survey was conducted and completed in October 2013 in the above seven cities. In total, 210 questionnaires were distributed in each city, and 195, 198, 197, 202, 191, 193, and 204 valid questionnaires were returned from Harbin, Jinan, Wuxi, Ningbo, Zhengzhou, Changsha, and Chengdu, respectively, totaling 1380, representing a valid response rate of 93.88%. The sample size met the estimation accuracy requirement of CBC.

3. Results

3.1. Brief descriptive analysis

Most respondents in this study were female (51.59%), which is consistent with the

fact that women are the food buyers in most urban families in China. Moreover, most respondents were aged 26-40 years (37.68%) or 41-65 years (33.70%), had a senior high school or lower degree (48.70%) or a junior college or bachelor's degree (47.25%), had a family size of three (40.58%), and had a monthly income of 4000-5999 yuan (25.22%). In addition, 55.58% of the respondents had a child/children under the age of 18 years in the family.

With regard to pork purchasing behavior, 45.87% of the respondents' families purchased pork 2-5 times weekly, 44.78% of the respondents' families consumed 500-1000 g of pork weekly, and 69.06% of the respondents first considered food safety in the purchase of food. Although 59.93% of the respondents did not know about traceable food, 54.64% of the respondents believed that traceability information should be able to guard against pork safety risks after a brief introduction was given by the investigators. Overall, 45.87% of the respondents were dubious about the authenticity of traceability information. Over 40% of the respondents somewhat trusted in traceability information certified by the government (45.65%), domestic third-party agencies (44.06%), and international third party agencies (46.45%). In addition, 64.06% of the respondents regarded farming information as the most important traceability information (farming, slaughter, and circulation information).

3.2. Model results

The utilities for the attributes and attribute levels of traceable pork were estimated among all the respondents using the multinomial logit model in Sawtooth Software SSI Web 8.1.2. The estimation results are shown in Table 2. With regard to traceability information, "traceability information covering farming, slaughter and processing, and circulation and marketing" had the highest utility. The utility of consumers decreased with the decrease in traceable information. "Traceability information covering farming" and "no traceability information" had negative utilities. With regard to certification of traceable information, government certification was most preferred, followed by third-party certification, and international third-party certification. With regard to appearance, the highest consumer utility was assigned to "very fresh-looking", followed

by “fresh-looking”, while “passable-looking” and “bad-looking but edible” had negative utilities. With regard to price, consumer utility decreased with the increase in price, which is consistent with the theory of demand.

The relative importance of product attributes affects consumer choices, and is very important to the promotion of new products (Enneking et al., 2007). The relative importance of traceability information, certification of traceability information, appearance, and price can be calculated according to equations (5) and (6). For consumers, the greatest relative importance was attached to certification of traceability information (39.86%), followed by appearance (31.89%), traceability information (23.60%), and price (4.65%).

$$I_m = \{\max(\beta_m) - \min(\beta_m)\} \tag{5}$$

$$W_m = I_m \Big/ \sum_{m=1}^{p} I_r \tag{6}$$

where β_m is the utility of the levels of attribute m, I_m is the difference between the lowest and highest utilities of the levels of attribute m (or utility range), and W_m is the proportion of the utility range of attribute m in the utility range of all attributes.

Please insert Table 2 about here

Furthermore, the effects of individual characteristics, pork consumption habits, and other variables on consumer preferences were analyzed by a non-parametric test. As shown in Table 3, only age, education, and income had significant effects on the difference in preferences for attribute levels among the classified samples (at the α = 0.05 level). Therefore, the samples were classified by age, education, and income, and the utilities assigned by the classified samples to the attribute levels were estimated using the multinomial logit model. The detailed model results are displayed in Figures 2, 3 and 4.

Please insert Table 3 about here

As shown in Figure 2, utilities assigned by consumers aged over 65 years to “traceability information covering farming, slaughter and processing, and circulation and marketing” and “traceability information covering farming, and slaughter and

processing” were lower than those assigned by consumers in other age groups, and the opposite was true for “traceability information covering farming” and “no traceability information”. This indicated that the old consumer groups were not concerned about the specific content of traceability information. With regard to certification, consumers aged over 65 years had a significantly higher preference for “government certification” than consumers in other age groups; consumers aged 26-40 years most preferred “domestic third-party certification”; and “international third party certification” was assigned the highest utility by consumers aged 18-25 years. Consumers aged 26-40 years and 18-25 years had a higher preference for “very fresh-looking” and “fresh-looking” than consumers in other age groups, indicating that young consumers had a higher requirement for appearance than middle-aged and aged consumers. Consumers aged over 65 years were most sensitive to price, followed by those aged 26-40 years, and those aged 18-25 years. Consumers aged 26-40 years assigned higher utilities to “14 yuan” and “16 yuan” than to “12 yuan”. In these age groups, price may be associated with quality when making choices. However, a negative utility was assigned to “18 yuan” by such consumers.

Please insert Figure 2 about here

Education had a significant impact on consumer preferences for the levels of traceability information and traceability information certification (Figure 3). Specifically, consumers with higher education had higher preferences for “traceability information covering farming, slaughter and processing, and circulation and marketing”, “traceability information covering farming, and slaughter and processing”, and “international third-party certification”. Compared with consumers with other education levels, consumers with a master's degree or higher assigned a significantly higher utility to complete traceability information and also to “traceability information covering farming, and slaughter and processing”, and “traceability information covering farming”. Consumers with a master's degree or higher and those with a junior college or bachelor's degree had the highest preference for “international third-party certification”, followed by “government certification”; those with a senior high school or lower degree most preferred “government certification”, followed “domestic third-party certification” and

“international third-party certification”. Consumers with a senior high school or lower degree and those with a junior college or bachelor's degree assigned a lower utility to a higher price, which conforms to the utility theory. Consumers with a master's or higher degree had the highest preference for traceable pork sold at “14 yuan”.

Please insert Figure 3 about here

As shown in Figure 4, there was no significant difference in the preferences for the levels of traceability information among all income groups. In contrast, with regard to the certification of traceability information, consumers with a higher income had a higher preference for “international third-party certification”. Compared with other income groups, consumers with a household monthly income of more than 14,000 yuan most preferred “international third-party certification”, while low-income consumers most preferred “government certification”. Moreover, consumers with a higher income had a higher requirement for appearance. High-income consumers assigned a higher utility to a higher price, which can be possibly explained by the consumption concept that “a higher price represents a higher quality” for this category of consumers.

Please insert Figure 4 about here

4. Discussion and Conclusions

In this study, four attributes, traceability information, certification of traceability information, appearance, and price, were set for traceable pork at different levels. On this basis, consumer preferences and demand for the attributes of traceable pork were examined using the CBC analysis and the multinomial logit model based on a survey among 1380 consumers in seven pilot cities designated by the Chinese Ministry of Commerce for construction of a meat and vegetable circulation traceability system. The main conclusions are summarized as follows:

1. Consumers attached the greatest importance to certification of traceability information, followed by appearance, traceability information, and price. “Government certification”, “very fresh-looking”, and “traceability information covering farming, slaughter and processing, and circulation and marketing” were the most preferred levels of traceability information certification, appearance, and traceability information,

respectively. The conclusion drawn by this study that government certification was most preferred by consumers is similar to the findings of Loureiro and Umberger (2007) and Ortega et al. (2011). During the exploratory and preliminary construction of traceability systems in China, credible institutions are required for quality certification of traceable pork, because of the fact that consumers do not yet know about or trust in traceability information. In this instance, the government is undoubtedly the most credible institution.

2. Consumers had heterogeneous preferences for the attributes of traceable pork. Age, education, and income had a significant impact on consumer preferences for the attributes of traceable pork. Consumers aged over 65 years were not concerned about the specific content of traceability information, and had a significantly higher preference for “government certification” than consumers in other age groups. Consumers aged 26-40 years most preferred “domestic third-party certification”. “International third party certification” was assigned the highest utility by consumers aged 18-25 years. Consumers aged 26-40 years and 18-25 years had a higher requirement for appearance. Consumers with higher education had a higher preference for more complete traceability information and for “international third party certification”. These conclusions are consistent with the findings of Bai et al. (2013), and similar to the conclusion of Dimara and Skuras (2005) that consumers with higher education attached more importance to origin labeling, quality labeling, and traceability. In addition, consumers with a higher income had a higher preference for “international third-party certification”, while “government certification” was most preferred by consumers with a junior college or bachelor's degree and those with a low income.

The above findings provide three recommendations for the Chinese government in improving traceable food consumption policies. First, the government and social organizations should strengthen the promotion of scientific knowledge about traceability systems to improve the general public’s knowledge about traceability systems, in order to generate effective market demand. Second, the development of food traceability systems should be combined with a certification labeling system, great efforts should be devoted to enriching the content of traceability. A traceability

information certification system should be introduced in a timely manner, and the diversification of certification agencies should be promoted. Third, producers should be encouraged and supported to produce traceable food with different traceability levels and different certification types, in order to meet the diverse needs of consumers, thereby progressively promoting the construction of traceable food market systems.

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Table 1 Traceable pork attributes and level settings

Attribute	Level	Abbreviations	Description
Traceable pork attributes and level settings.	Traceability information covering farming, slaughter and processing, and circulation and marketing	FULL TRACE	Specific farming information covers pig farm, farming environment, feed, and veterinary drug; information of slaughter and processing covers slaughter time, and location of slaughter and processing; information of circulation and marketing, covers wholesaler, transportation, and carrier
	Traceability information covering farming, and slaughter and processing	PAR TRACE	
	Traceability information covering farming	MINI TRACE	
	No Traceability information	NO TRACE	
Quality certification	Government certification	GOV CERT	The products carried a certification label indicating pork quality testing by the government, or a domestic or international third party certification body. The testing involved inspection and quarantine, sensory testing, physical and chemical testing, and diseased pork detection. Harmful substances and veterinary drug residues sensory testing, physical and chemical testing, and diseased pork detection. Harmful substances and veterinary drug residues
	Domestic third-party certification	DOM THIRD CERT	
	International third-party certification	INT THIRD CERT	
	No certification	NO CERT	
Appearance	Very fresh-looking	FRESHNESS1	Consumers judge freshness of pork according to appearance, and color, etc.
	Fresh-looking	FRESHNESS2	
	Passable-looking	FRESHNESS3	
	Bad-looking but edible	FRESHNESS0	
Price	12 ¥[a]	PRICE1	The prices in RMB that respondents were willing to pay for 500 g of The prices in RMB that respondents were willing to pay for 500 g of
	14 ¥	PRICE2	
	16 ¥	PRICE3	
	18 ¥	PRICE4	

Note: [a] RMB symbol

Table 2 Regression results of Multinomial Logit model

Categories	Attributes	Utility value	Standard deviation(SD)	t Ratio
Traceability information	FULL TRACE	0.3056***	0.0242	12.6227
	PAR TRACE	0.1809***	0.0241	7.5164
	MINI TRACE	-0.0222	0.0254	-0.8742
	NO TRACE	-0.4643***	0.0533	-8.7131
Quality Certification	GOV CERT	0.3866***	0.0240	16.1362
	DOM CERT	0.2824***	0.0223	12.6666
	INT CERT	0.2447***	0.0234	10.4804
	NO CERT	-0.9136***	0.0454	-20.1309
Quality Certification	FRESHNESS1	0.4912***	0.0201	24.4240
	FRESHNESS2	0.4067***	0.0200	20.3642
	FRESHNESS3	-0.3487***	0.0201	-17.3646
	FRESHNESS0	-0.5491***	0.0207	-26.4738
Price	PRICE1	0.0768***	0.0203	3.7829
	PRICE2	0.0435**	0.0197	2.2084
	PRICE3	-0.0456**	0.0197	-2.3148
	PRICE4	-0.0747***	0.0202	-3.7085
	OPT-OUT	-1.0045***	0.0241	-41.6562
	Log-likelihood		-13816.8828	
	Consistent Akaike Info Criterion		27773.0573	
	Chi-Square		8752.2734	
	Relative Chi-Square		673.2518	

Note: Presented model was estimated using Sawtooth Software SSI Web8.1.2; ***,**, and*indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Please refer to Table 1 for the definitions of different levels, OPT-OUT is a no choice variable.

Table 3 Nonparametric test（*P-value*）

Variable	Task												Overall
	1	2	3	4	5	6	7	8	9	10	11	12	
Gender	0.282	0.295	0.239	0.413	0.179	0.033	0.332	0.237	0.367	0.286	0.229	0.354	0.362
Age	0.009	0.014	0.020	0.085	0.118	0.036	0.191	0.105	0.118	0.079	0.082	0.121	0.028
Marital status	0.302	0.253	0.915	0.211	0.317	0.146	0.189	0.861	0.449	0.452	0.209	0.143	0.224
Education	0.041	0.135	0.118	0.015	0.068	0.079	0.176	0.036	0.081	0.008	0.051	0.167	0.015
Child(ren) under the age of 18	0.149	0.198	0.263	0.219	0.264	0.282	0.306	0.420	0.393	0.354	0.336	0.323	0.307
Household size	0.208	0.418	0.324	0.290	0.165	0.207	0.194	0.436	0.332	0.292	0.215	0.266	0.432
Household monthly income(RMB)	0.109	0.018	0.023	0.052	0.085	0.035	0.033	0.135	0.113	0.004	0.012	0.159	0.027
Pork consumption frequency	0.573	0.782	0.712	0.544	0.611	0.540	0.515	0.668	0.671	0.502	0.678	0.728	0.757
Weekly household pork consumption	0.942	0.917	0.982	0.916	0.953	0.917	0.937	0.969	0.930	0.900	0.906	0.978	0.945

Note：Emphasize on statistical significance at the $p < 0.05$.

	Option 1	Option 2	Option 3
Traceability information	Traceability information covering farming, slaughter and processing, and circulation and marketing	Traceability information covering farming	NONE
Quality certification	International third-party certification	Government certification	
Appearance	Passable-looking	Very fresh-looking	
Price	14RMB/500g	16RMB/500g	
If you will purchase pork, which one would you choose?	☐	☐	☐

Figure 1. Sample CBC task

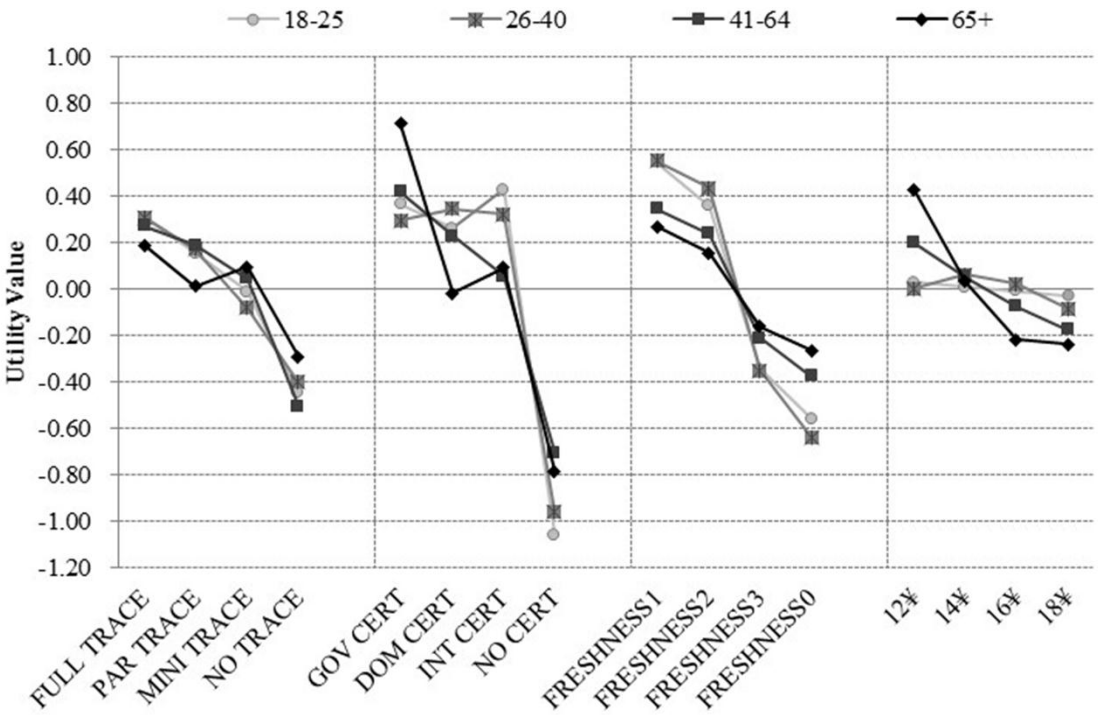

Figure 2. Consumer preference varying with age

Note: Please refer to Table 1 for the definitions of different levels.

¥RMB symbol

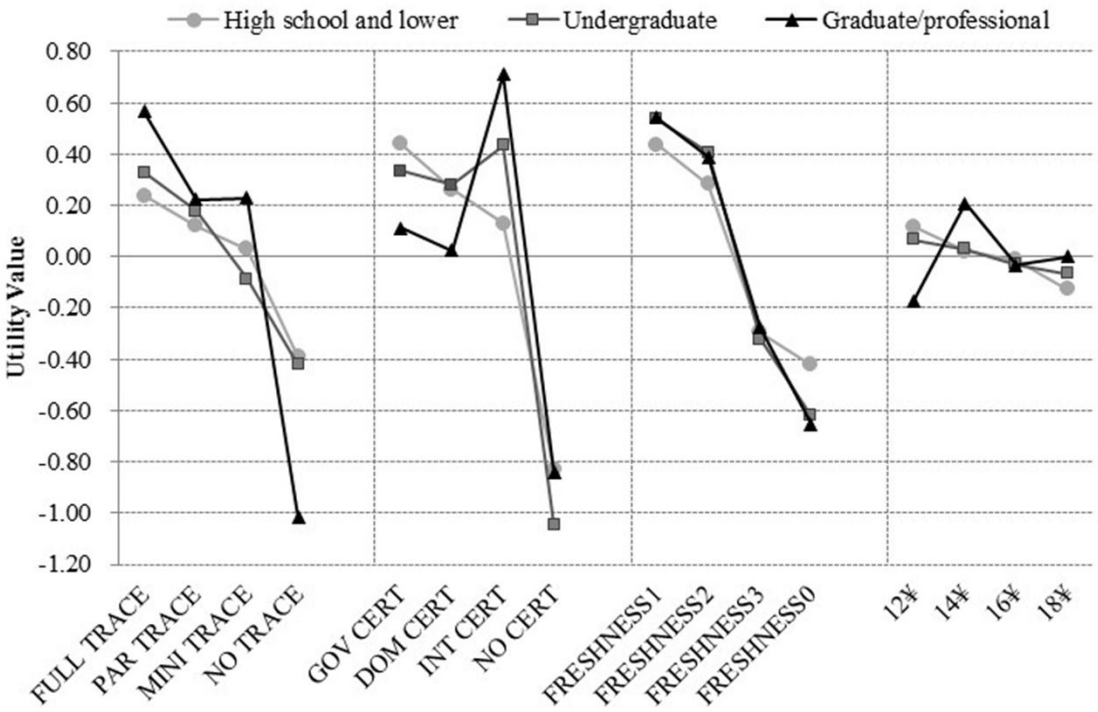

Figure 3. Consumer preference varying with education

Note：Please refer to Table 1 for the definitions of different levels.

¥RMB symbol.

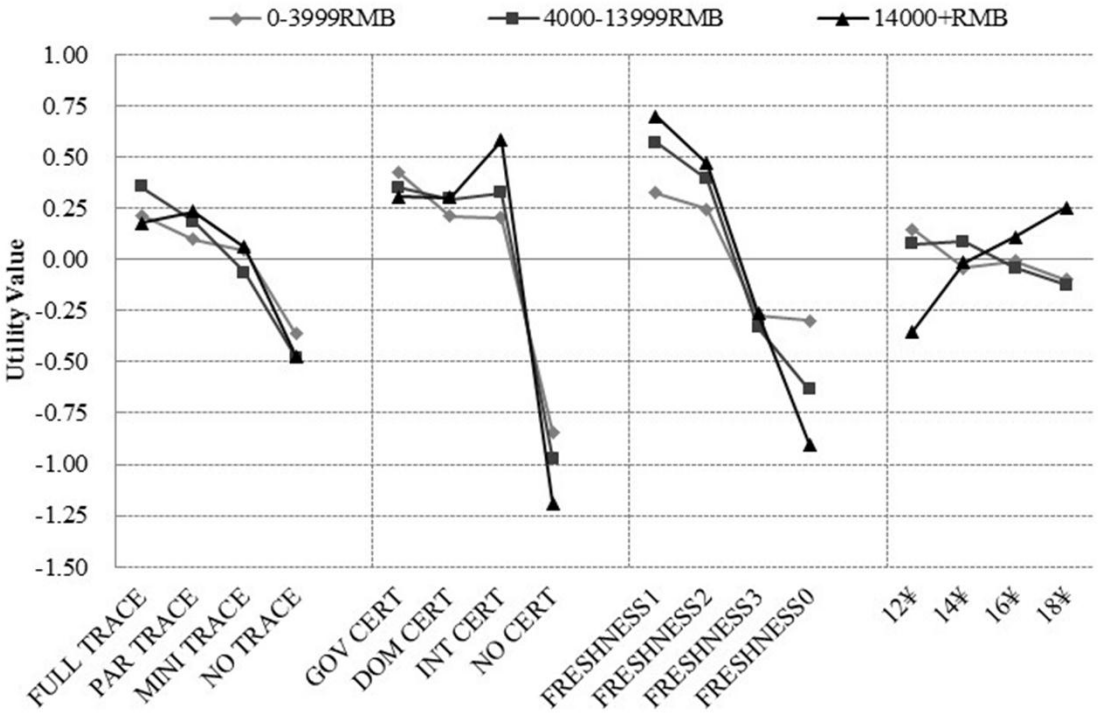

Figure 4. Consumer preference varying with Household monthly income (RMB)

Note: Please refer to Table 1 for the definitions of different levels.

¥RMB symbol