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# Evaluating the impact of government subsidies on traceable pork market share based on market simulation: The case of Wuxi, China

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**In this study, choice-based conjoint (CBC) analysis combined with multivariate logistic regression model was used to investigate the Chinese consumers' willingness to pay (WTP) for traceable pork hindquarters with different levels of attributes. High, medium and low-level traceable pork profiles were constructed, and the market share of traceable pork hindquarters was simulated under different types of government subsidies. The results showed that traceability information was the most preferred attribute for consumers. With increased government subsidies, the market share of the different levels of traceable pork hindquarters all increased accordingly. A government subsidy percentage of 3% was concluded to be the best choice for traceable pork hindquarters considering government subsidies and market share elasticity.**

**Key words:** Consumers' willingness to pay, the traceable pork, choice-based conjoint, market simulation, government subsidies.

## INTRODUCTION

Food safety risks have been further highlighted by the occurrence of emerging food safety incidents in China in the 21st century, with the rapid economic development, especially with the deterioration of the agro-ecological environment and increased industrial pollution. A total of 227,386 food safety incidents, that occurred in 31 provincial-level administrative regions in mainland China, were reported from 2005 to 2014, with an average of approximately 62.3 incidents per day, which has seriously affected social stability (Wu et al., 2015). It is urgent to take some measures like implementing food traceability systems to reduce food safety risks, which are essentially caused by asymmetric information (Sarig et al., 2003). Food traceability systems are able to monitor the process of food production and distribution by generating a reliable continuous flow of safety information in the supply chain, and to identify the root cause as well as recall related products through traceability (Regattieri et

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al., 2007). It is therefore considered to be one of the effective measures for fundamental prevention of food safety risks (van Rijswijk et al., 2008). Moreover, market failure that usually arises from asymmetric information may be improved by food labels of traceability, safety information, quality certification, and other credence attributes that were sufficiently and effectively disclosed to consumers through a delivery mechanism (Ortega et al., 2013). To learn from international experience, China began to construct pork and vegetable-focused food traceability systems since 2000 (Liu, 2015). However, to date, little progress has been made in developing the traceable food market in China.

Based on the theory of co-governance, food safety is characterized by inseparable utility, non-rivalrous consumption, and non-excludable benefits. Therefore, food safety possesses the characteristics of public goods (Edwards, 2001; Skelcher et al., 2004). The occurrence of food quality and safety incidents can cause public health damage, and even pose a huge threat to social and political stability; therefore, food safety risks are a public crisis (Grøn, 2007; Krueathep, 2008). Preventing food safety risks is, therefore, an obligatory fundamental responsibility of the government. In fact, it has been pointed out that information asymmetry of the food safety between producers and consumers often leads to “market failure” (Antle, 1996).

Thus, government intervention is required to effectively solve the “market failure”. In this context, the aim of this study was to investigate the Chinese consumers’ willingness to pay (WTP) for traceable pork hindquarters with different levels of attributes and to examine differences in the marginal utility of traceable food consumption and market share of traceable food with different government subsidy percentages. The results of this study may offer useful reference for the government to promote the construction of traceable food market in China.

## LITERATURE REVIEW

The major methods used to estimate consumers’ WTP are contingent valuation method (CVM), experimental auction, and conjoint analysis. CVM was the first method used to estimate consumers’ WTP. It is simple and flexible in operation and low-cost (Boccaletti and Nardella, 2000). CVM is also commonly used in research on consumers' WTP for traceable food (Hobbs et al., 2005; Angulo et al., 2005). However, CVM can only examine the impact of changes in a single attribute on consumer preferences (Reddy and Bush, 1998). Hence, its design procedure is not able to provide consumers with complete details of relevant alternatives, making it difficult for consumers to make an accurate choice in comparison (Stevens et al., 2000), and thus resulting in bias (Boxall et al., 1996). The experimental auction is the current tool of choice for investigating consumer preferences. It directly obtains consumers’ WTP for different types of food with different safety attributes or different attribute combinations based on consumers’ bids for such attributes or combinations by setting different types of food with different safety attributes or different attribute combinations and simulating a real purchase environment (Lee et al., 2011). However, the experimental auction is complicated to operate, difficult to explain to the participants, and high-cost, and requires different auction mechanisms for different experimental environments (Jaeger et al., 2004). In particular, the experimental design is demanding and complex due to the need to avoid possible endowment, learning, and anchoring effects during the experiment. Therefore, very few studies have analyzed consumer preferences for traceable food in China using the experimental auction.

Joint analysis allows consumers to score, rank, or select from a series of product profiles by decomposition, and thereby calculates consumers' part-worth utilities (Green and Srinivasan, 1978), which solves the difficulty in CVM. Product profiles are formed by random combinations of different levels of product attributes, among which, product attributes are used to define product characteristics from the perspective of meeting consumer demand (Becker, 2000), and levels refer to the different values of the product attribute (Kotler, 2001). With the continuous development of joint analysis software, CBC analysis allows consumers to directly select from product profiles with different combinations of different levels of product attributes, which is superior to the rating and scoring in traditional conjoint analysis. Therefore, CBC can reduce the judgment errors of respondents, and can more accurately elicit consumers’ real purchase intention (Huber, 2005). Thereby, CBC analysis has become the most popular joint analysis method. In addition, CBC analysis is based on the random utility theory and has a mature microeconomic foundation (Ben-Akiva and Lerman, 1985). It also allows estimation of consumers' part-worth utilities for different attribute levels, and effective market simulation (Johnson and Orme, 1996).

The scientificity of the CBC analysis has also been confirmed by existing studies (Lusk et al., 2004; Ubilava and Foster, 2009; Ortega et al., 2011), and thus is widely used by researchers. Recent typical studies that examined consumer preferences using the CBC analysis are summarized below. Loureiro and Umberger (2007) investigated US consumers’ WTP for selected attributes of beef, including price, quality and safety certification, country of origin labeling, traceability information, and found that consumers were most concerned about quality and safety certification in the purchase of beef. Abidoye et al. (2011) estimated US consumers’ WTP for traceable beef with 10 different attributes, and reported the highest WTP for grass-fed and US-origin beef with traceability information. In the investigation of Georgia consumers'

WTP for selected attributes of pork, including traceability information, quality certification and appearance, Ubilava and Foster (2009) found that consumers had the highest WTP for appearance, followed by traceability information and quality certification. These researchers suggested a substitutional relationship between traceability information and quality certification. Ortega et al. (2011) assessed Chinese consumers' WTP for selected attributes of pork, including price, government certification, third-party certification, traceability information, and product labeling, and suggested the highest WTP for government certification, followed by third-party certification, traceability information, and product labeling. In estimating Chinese consumers' WTP for selected attributes of pork, including price, certification, brand, and farm quality and safety assurance, Zhang et al. (2013) reported the highest WTP for government certification, followed by corporate brand, farm quality and safety assurance, and third-party certification, and that consumers with higher risk perception had a higher WTP for the above safety attributes.

Compared with ordinary food, the production of traceable food containing multi-attribute safety information must be associated with additional costs, which will be ultimately transferred through the market mechanism and reflected in the market price of traceable food (Buhr, 2003; Bechini et al., 2008). Based on existing research, consumers' incomes and the relatively high price of food with safety attributes are the main factors restricting their purchases under budgetary constraints. Zhao et al. (2010) suggested that consumers' WTP for traceable food was mainly affected by the price. They reported that 95% of consumers were willing to buy traceable food without consideration of price, while the number of consumers who were willing to buy traceable food was substantially decreased if the higher price was taken into account. For consumers who were not willing to buy traceable food, distrust in traceability information and higher price were the main factors affecting consumer behavior. These consumers believed that it was the responsibility of food producers and suppliers to implement traceability, and were thus unwilling to pay a premium. Similar conclusions were also reached by Lichtenberg et al. (2008) and Hou (2011). Zhang et al. (2012) assessed consumers' WTP for traceability in Nanjing, China, and found that income was the most important factor affecting consumers' WTP for traceable food. The study found that the higher the income, the more likely the consumer was to buy traceable food, and the greater WTP for traceability. This finding of Zhang et al. (2012) was supported by Giraud and Amblard (2003).

Zhou and Wu (2008) suggested that, compared with ordinary food, the higher market price of traceable food may be beyond the paying capacity of a considerable part of low-income consumer groups in China, which curbed consumer demand. Here arises the problem. If most consumers have insufficient WTP for traceable food, it will be difficult to form an effective market demand for traceable food, and producers are therefore unlikely to provide necessary and sufficient traceable food due to consideration of their own economic interests (Shang et al., 2012). An important way to change this situation is to increase consumers' income in order to promote the improvement of consumers' WTP (Jehle and Reny, 2011; Wu et al., 2012). However, there is a large wealth gap in China. The national Gini coefficient was 0.469 in 2014 in China, and it has gone beyond the international warning line for 10 successive years. Moreover, the Gini coefficient of China has actually been underestimated which may be not lower than 0.5. In fact, China should be one of the highly unequal countries in the world and one of the 17 countries with a Gini coefficient higher than 0.5 among the 111 countries around the world (Li, 2015). Income distribution reform has become an area of difficulty in future reform for China, and will be a long process. In particular, it is difficult to quickly improve the income of a large, low-income population in the short term. In essence, income determines consumption, and the traceable food market share, in turn, depends on consumer demand. Without the market demand of the large, low-income population, traceable food is difficult to spread in the Chinese food market. Therefore, the major question is: can the government reduce the market price of traceable food through subsidy policy instruments in order to gradually spread traceable food in China?

Indeed, numerous studies have been conducted on developing the traceable food market by the government through subsidy policy instruments. Golan et al. (2004) indicated that financial and technical support from the government helped reduce enterprise costs and motivated enterprises to invest in implementing food traceability systems. Tonsor and Schroeder (2006) investigated the traceability system in the Australian beef industry and found that an important reason for the successful implementation of food traceability systems was the financial support of the state government.

Schulz and Tonsor (2010) suggested that the willingness and behavior of cow producers to invest in implementing food traceability systems in the United States were greatly affected by government support and other policy instruments. Based on dynamic modeling for the implementation of food traceability systems in multiple food enterprises under government intervention, Wu et al. (2015) determined the stability conditions for implementing government-expected food traceability systems in multiple food enterprises using the discrete-time linear stability theory and algebraic graph theory. The study results suggested that selective direct government subsidies to traceable food manufacturers would play a significant role in reducing the traceable food market price and fostering the traceable food market.

Therefore, in view of the higher market price of traceable food compared with ordinary food, Chinese

consumers' relatively low WTP for traceable food, and the difficulty to substantially increase individual and family income of consumers in the short term, a reasonable mechanism for sharing the additional production costs of traceable food should be explored and developed. This mechanism should be based on the functional positioning of government, enterprises, and consumers in the traceable food systems. Subsidy should undoubtedly be an important policy choice for the Chinese government in developing traceable food market. The government should reduce the additional production costs of traceable food by subsidizing food manufacturers or through other appropriate subsidy methods, in order to motivate the production of traceable food with different levels and combinations of safety attributes. On the other hand, the government can provide direct subsidies to consumers to reduce the market price of traceable food, thereby increasing consumers' WTP. Unfortunately, few studies have been conducted to investigate government subsidies and consumers' WTP for traceable food based on current situation in China. Although Wu et al. (2015) investigated the policy instrument of providing direct government subsidies to traceable food manufacturers, the scientificity of their findings remains to be further verified, as simulation research, rather than empirical research, was performed.

The goal of this study was to investigate the impact of government subsidies on the traceable food market based on the current situation of Chinese traceable food market, in order to provide decision-making references for the government to implement proactive policies on traceable food production and consumption.

## METHODOLOGY

### Theoretical modeling

The CBC analysis is based on Lancaster's consumer demand theory and random utility theory (Ben-Akiva and Lerman, 1985). Lancaster (1966) held the opinion that the utility that consumers obtained from a good was not derived from the good itself, but from intrinsic attributes of the good, and that consumers would choose an attribute combination to maximize utility under given budgetary constraints. Make Unik the utility obtained by consumer in choosing traceable pork profile from subset m in task C under choice situation k, and then Unik includes two parts: the deterministic part Vnik and the stochastic part εnik, that is,

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

Only when $U_{\mathrm{nik}} > U_{\mathrm{njk}}$, that is, $V_{\mathrm{nik}} - V_{\mathrm{njk}} > \varepsilon_{\mathrm{njk}} - \varepsilon_{\mathrm{nik}}$ is true for any $j \neq i$, consumer $n$ will choose traceable pork profile $i$. The probability for consumer $n$ choosing traceable pork profile $i$ is as follows:

$$\mathrm{P}_{\mathrm{nik}} = prob(V_{\mathrm{nik}} - V_{\mathrm{njk}} > \varepsilon_{\mathrm{njk}} - \varepsilon_{\mathrm{nik}}; \forall j \neq i) \quad (2)$$

In this study, $V_{\mathrm{nik}}$ is the linear function of pork traceability information, appearance, price, and government subsidies:

$$V_{nik} = \beta_n^{'} X_{ni} \quad (3)$$

where $\beta_n'$ is the part-worth vector for consumer $n$, and $X_{ni}$ is the attribute vector of traceable pork profile $i$.

If it is assumed that $\varepsilon_{nik}$ follows type I extreme value distribution, then the probability for consumer $n$ choosing attribute $i$ under condition $k$ is as follows:

$$\mathrm{P}_{nik} = \frac{e^{V_{nik}}}{\sum_{j \in C} \mathrm{P}_{nik}} \quad (4)$$

A multivariate logistic regression was performed on Equation (4).

### Subjects

The main reasons for taking traceable pork as an example are explained as follows. Meat is a globally consumed basic food, with global consumption increasing more than 13% over the past decade. As one of the most popular meats, the consumption of pork also increased by 10.71%. In fact, China is a large consumer and producer of pork. Pork production was 56.71 million tons in 2014 in China, accounting for 66.4% of the national meat production. At the same time, 92,000 tons of pork was exported from China in 2014, with a value of approximately USD 425 million. Therefore, pork safety in China not only relates to the health and safety of Chinese consumers, but also affects the safety of pork markets worldwide to some extent. Moreover, pork is the most commonly consumed meat in China.

Wu et al. (2015) reported that meat and meat products were a food category that caused the largest number of food safety incidents over the past decade in China (Figure 1). Besides, the earliest pilot implementation of traceability system in China was for pork. Beginning in 2010, the Chinese Ministry of Commerce and Ministry of Finance implemented a pork traceability system in 58 pilot cities in five batches. However, the construction of government-led food traceability systems has been ineffective as revealed by years of practice. Therefore, in this study, consumer preferences and demands for traceable food with different levels of safety information were examined as a starting point, taking traceable pork as a typical example, by using a choice-based conjoint (CBC) analysis combined with a multivariate logistic regression model for market simulation. On this basis, the acceptable traceable food market plans for different groups of consumers under different government subsidies were evaluated by introducing government subsidies as a variable, and the solutions to "market failure" and "government failure" in the traceable food market were discussed, in order to provide effective policy advices for promoting the construction of traceable food market systems in China.

For data collection in the present study, a random sampling method was employed. The questionnaire survey was conducted in large supermarkets in Wuxi, Jiangsu Province, China, including Qingqi Road Outlet of RT-Mart in Binhu District, Zhenghe Outlet of Tesco in Huishan District, Xinguang Outlet of Vanguard in New

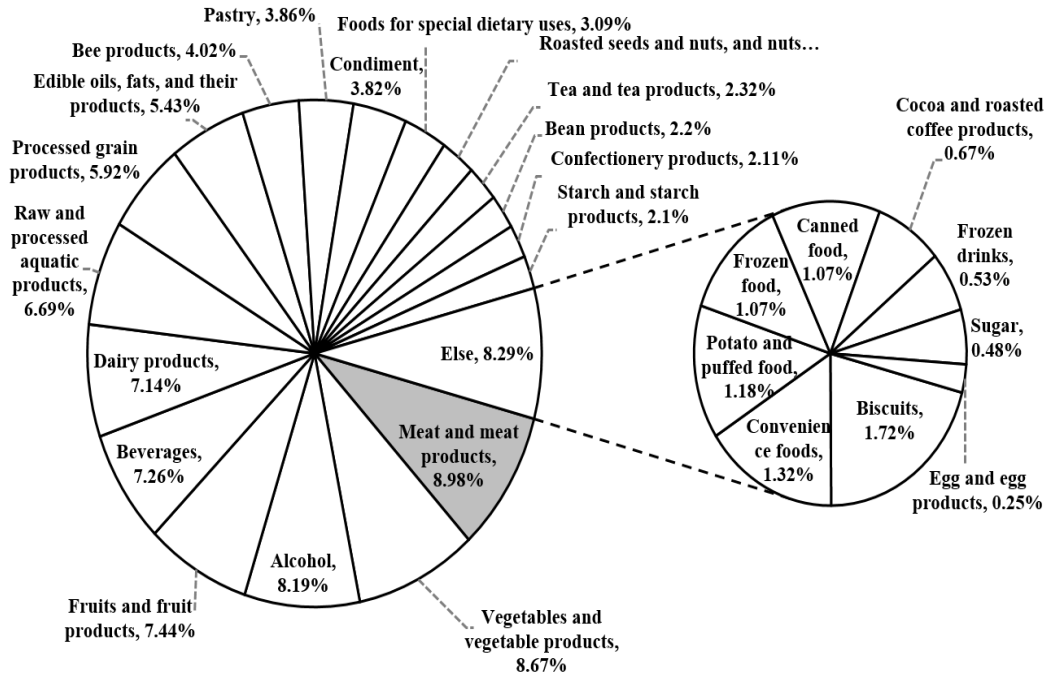


**Figure 1.** Food categories involved in food safety incidents in mainland China from 2005 to 2014. Note: A total of 227,386 food safety incidents, that occurred in 31 provincial-level administrative regions in mainland China, were reported from 2005 to 2014. Figure 1 shows the percentages of the total food safety incidents for different food categories. Source: own.

District, and Columbus Outlet of Carrefour in Chong'an District, mainly during 8:00 to 10:00 am and 16:00 to 18:00 pm (shopping rush hour for household food) every day in July, 2013. The trained interviewers chose the third consumer coming into their view as the respondent, in order to ensure the randomness of the survey sample (Wu et al., 2012b). The respondents were interviewed face-to-face by the interviewers. The sample was composed of 462 consumers, and the sampling distribution of this study basically matched the distribution of the population. In total, 426 questionnaires were collected, including 410 (96.24%) valid questionnaires, providing a total of 4,100 valid observations. It should be noted that the instrument used in the survey was adopted from proven results of the author's previous research with some necessary modifications (Wu et al., 2012a).

### Setting of different attributes and levels for traceable pork

Firstly, Golan et al. (2004) and Pouliot and Sumner (2012) suggested that traceable food safety information was reflected in three dimensions, including total amount of information records (breadth), stages covered by forward or backward traceability (depth), and accuracy of food identification (precision). Mature traceability systems have been established in developed countries, with clear technical requirements for the three dimensions. At present, related Chinese research is more focused on the depth of supply chain stages of the food traceability system. In this study, the traceability information attribute was set at three levels: farming information, slaughter information, and transportation information, based on existing research worldwide and the analyses of major safety risks throughout the Chinese pork supply chain system (Lin et al., 2008; Jiang et al., 2009; Trienekens and Wognum, 2013).

Secondly, in order to effectively eliminate the influence of other pork quality characteristics on consumer choice, and considering the fact that pork hindquarters are commonly consumed in China (Wang et al., 2011), traceable pork hindquarters were selected in this study and prices were set accordingly. Wu et al. (2013) assessed the WTP for traceable pork with different levels of safety information in 2121 consumers from Liaoning, Hebei, Jiangsu, Gansu, and Yunnan provinces in China using a full-profile joint analysis and found that a premium of 20 - 30% was acceptable to consumers. According to a field survey in China Resources Vanguard, Tianhui, and other supermarkets in Wuxi City, Jiangsu Province, China, the price of ordinary pork hindquarters was set at 13 yuan/500 g. Based on the findings of Wu et al. (2012) on the market price of pork hindquarters with different levels of traceability information, four price levels were set as shown in Table 1.

Thirdly, and most importantly, additional production costs that arise from the production of traceable pork should not be completely covered by government subsidies. As beneficiaries of improved pork quality and safety, consumers should bear part of the additional costs. Government subsidies for the additional production costs were reflected by subsidizing the traceable pork market price in this study, as it was difficult to accurately calculate the additional costs. The maximum limit for the government subsidies on traceable pork market price was set at 7%. This is because when a subsidy of over 7% is provided, the market price of the same level of traceable pork will be lower than that of the same type of ordinary pork, which is obviously unreasonable. In other words, the traceable pork market price with government subsidies (X) must be higher than the ordinary pork price, that is, $14 \times (1\text{-}X) > 13$. Moreover, in order to further investigate the impact of government subsidies on consumers' WTP and the market share of traceable pork, comparisons were made with a government subsidy

**Table 1.** Attribute and level settings of the traceable pork hindquarters.

| Attributes | Levels (Abbreviation) |
|---|---|
| Traceability information | 1. No traceability information (NOTRACE)<br>2. Traceability information covering farming (LOTRACE)<br>3. Traceability information covering farming and slaughter (METRACE)<br>4. Traceability information covering farming, slaughter, and transportation (HITRACE) |
| Price | 1. 13 yuan/500 g (PRICE1)<br>2. 14 yuan/500 g (PRICE2)<br>3. 15 yuan/500 g (PRICE3)<br>4. 16 yuan/500 g (PRICE4) |
| Subsidy | 1. No subsidy (NOSUBSIDY)<br>2. A subsidy of over 3% (LOSUBSIDY)<br>3. A subsidy of over 7% (HISUBSIDY) |
| Appearance | 1. Fresh-looking (FRESH1)<br>2. Passable-looking (FRESH2)<br>3. Bad-looking but edible (FRESH3) |

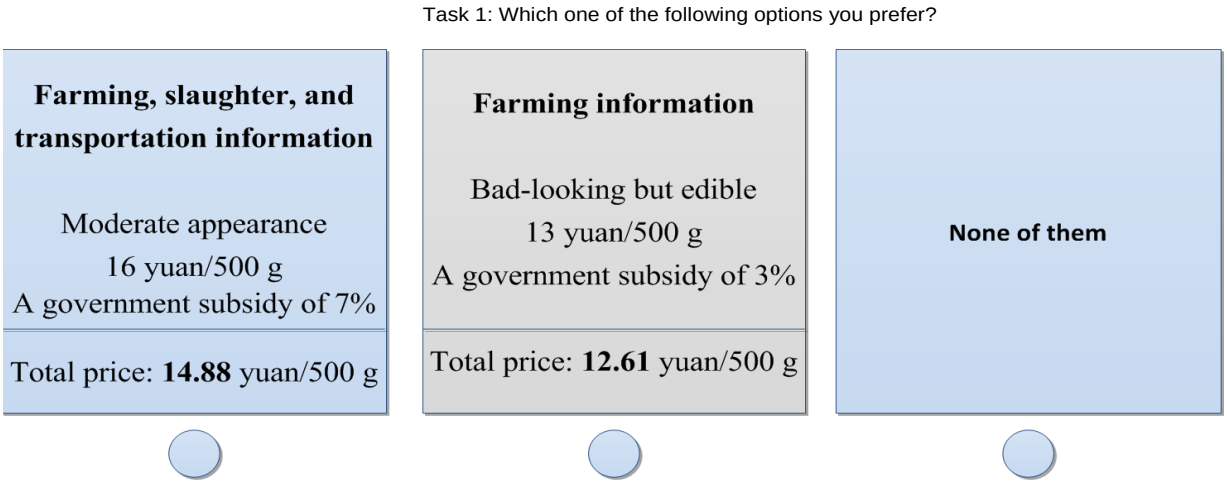


**Figure 2.** A sample CBC task card.

of 3%.

In addition, appearance is an intuitive criterion for consumers in judging pork quality, and is also an important factor influencing consumers' WTP (Hartmann et al., 2013). Therefore, appearance was included as an attribute to investigate WTP for traceable pork, and three levels, i.e., fresh-looking, moderate, and bad-looking but edible, were set. Based on the earlier considerations, the attributes and levels of traceable pork hindquarters were finally set as shown in Table 1.

The earlier mentioned attributes and levels of traceable pork safety could constitute a total of 4×3×4×3=144 possible product profiles. After removing the profiles with government subsidies but no traceability information (3×4×2=24), consumers would need to make choice for 120×119=14,280 sets of product profiles. In general, consumers will become fatigued after making 15 to 20 choices (Rossi et al., 1996). In view of this, 20 questionnaires were designed using the CBC module of the Sawtooth software and the Balanced Overlap method. Each questionnaire included 10 choice sets, and each choice set included two traceable pork profiles and an "opt-out" option (Figure 2), thus reducing the number of choice sets while ensuring the balanced distribution of attribute levels.

## RESULTS AND DISCUSSION

### Sample characteristics

Sample characteristics analyzed from the 410 valid questionnaires were shown in Table 2. Most respondents were female (61.95%), which is consistent with the fact that women are the major family food buyer in China. Of

**Table 2.** Characteristics of respondents.

| Statistical characteristics | Group | Frequency | % |
|---|---|---|---|
| Gender | Male | 156 | 38.05 |
| | Female | 254 | 61.95 |
| Age | ≤25 | 80 | 19.51 |
| | 26-40 | 192 | 46.83 |
| | ≥41 | 138 | 33.66 |
| Education | Middle school or lower | 106 | 25.85 |
| | High school | 124 | 30.25 |
| | College or above | 180 | 43.90 |
| Household annual income (RMB) | 60, 000 | 218 | 53.18 |
| | 60, 000-150,000 | 150 | 36.59 |
| | >150, 000 | 42 | 10.23 |
| Child(ren) under the age of 18 | Yes | 196 | 47.80 |
| | No | 214 | 52.20 |
| The first consideration when you purchase food | Price | 48 | 11.71 |
| | Appearance | 54 | 13.17 |
| | Safety | 268 | 65.36 |
| | Nutrition | 40 | 9.76 |
| The most important traceability information you think | Farming information | 234 | 57.07 |
| | Slaughter information | 110 | 26.83 |
| | Transportation information | 66 | 16.10 |
| Whether you agree with direct government subsidies to traceable food market | Agree | 276 | 67.31 |
| | Do not care | 112 | 27.32 |
| | Disagree | 22 | 5.37 |

the respondents, 46.83% were aged 26 to 40 years. Most respondents were junior college graduates (43.90%) or senior or vocational high school graduates (30.25%). In total, 53.18% of respondents had a household income of 60,000 yuan or less. Overall, 65.36% of respondents first considered safety when purchasing pork. With regard to traceability information, 57.07% of respondents believed that farming information was the most important, which is mainly because most safety problems have occurred during the farming stage of the pork supply chain. Interestingly, 67.31% of respondents agreed that direct government subsidies should be provided for the traceable pork market price.

## CBC estimation

The results about utility value of different levels of attributes and the relative importance of attributes are shown in Table 3. Traceability information was the most important attribute for consumers when purchasing traceable pork, with an importance of 40.80%. As to the four different levels of traceability information, the maximum marginal utility of consumer purchase was 0.7500, when information of farming, slaughter, and transportation was displayed on the label; it was 0.4026 when only farming and slaughter information was displayed and -1.1132 and -0.0394, respectively, when no traceability information and only farming information was displayed. Obviously, the marginal utility of consumer purchase increased with higher level of traceability information. In other words, consumers were more willing to buy pork with a higher level of traceability information, which is consistent with the conclusion of Wu et al. (2014) that consumers had a higher WTP for pork hindquarters with complete traceability information. The relative importance of appearance accounted for 34.79%, second only to traceability information. The marginal utilities of consumer purchase for the three levels, fresh-looking, moderate, and bad-looking but edible, were

**Table 3.** Utility value of different levels of attributes and the relative importance of attributes.

| S/N | Attributes | Levels | Utility value | Standard deviation | T value | Relative importance (%) |
|---|---|---|---|---|---|---|
| 1 | Traceability information | NOTRACE | − 1.1132*** | 0.1295 | -8.5953 | 40.80 |
| | | LOTRACE | − 0.0394 | 0.0751 | -0.5242 | |
| | | MITRACE | 0.4026 *** | 0.0751 | 5.3629 | |
| | | HITRACE | 0.7500 *** | 0.0936 | 8.0167 | |
| 2 | Price | PRICE4 | − 0.1796* | 0.0993 | -1.8095 | 8.74 |
| | | PRICE3 | − 0.1474 ** | 0.0735 | -2.0069 | |
| | | PRICE2 | 0.1073 | 0.0697 | 1.5388 | |
| | | PRICE1 | 0.2197** | 0.0983 | 2.2357 | |
| 3 | Government subsidy | NOSUBSIDY | − 0.3802*** | 0.0798 | -4.7667 | 15.67 |
| | | LOSUBSIDY | 0.0447 | 0.0634 | 0.7048 | |
| | | HISUBSIDY | 0.3355*** | 0.0578 | 5.8017 | |
| 4 | appearance | FRESH3 | − 0.7707 *** | 0.0623 | -12.3749 | 34.79 |
| | | FRESH2 | − 0.0472 | 0.0521 | -0.9062 | |
| | | FRESH1 | 0.8179*** | 0.0537 | 15.2376 | |

The importance $I_i$ of the attribute $i$ was calculated as the range defined by the difference between the lowest and highest part-worth utilities of all levels of attribute $i$: $I_i = \{\max(a_{ij}) - \min(a_{ij})\}$. The greater the difference, the more importance the attribute had in the overall profile, and vice versa. The relative importance of an attribute is generally expressed as a percentage: $W_i = \frac{I_i}{\sum_{i=1}^{m} I_i} \times 100\%$, where $\sum_{i=1}^{m} I_i$ is the sum of the differences between the highest and lowest utilities of the different levels of all attributes. ***, **, and * denotes significance at the 1%, 5%, and 10% levels, respectively.

0.8179, -0.0472 and -0.7707, respectively. The better the appearance, the greater the marginal utility of consumer purchase. It might be that pork with a better appearance was more highly rated by consumers, as appearance is an intuitive criterion for consumer in judging pork quality. This is consistent with the conclusion of Grunert (1997) that the freshness of meat was an important attribute affecting consumers' evaluation of beef quality. The importance of government subsidies relative to consumer purchase was 15.67%. The marginal utility of consumer purchase was negative without government subsidies, and it was 0.0447 and 0.0578, respectively, with a government subsidy of 3 and 7%. The marginal utility of consumer purchase increased with the increase of government subsidy. This may be because government subsidies reduced the cost paid by consumers of pork with a better appearance. The higher the government subsidy, the lower the cost paid by consumers, and the higher the marginal utility of consumer purchase. Among the four key attributes of traceable pork, price had the lowest importance of 8.74%. The marginal utility of consumer purchase increased with the decrease of price, which is consistent with the theory of demand.

**Simulation of traceable pork market share with different government subsidies**

In related studies that employed the choice experiment, WTP was often calculated after the marginal effects of different levels of each attribute were estimated. Indeed, it is difficult for policy makers to develop a pricing strategy for a new product based on consumers' WTP for the attributes, as the price of the new product is not a simple sum of the WTP for each attribute. Moreover, this study relates to government subsidy. As this attribute also has a price effect, the conventional method to estimate WTP (the ratio of attribute marginal utility to price marginal utility) does not apply to this study. For these reasons, a market simulation was performed instead of a WTP estimation.

As there is no profile of traceable pork hindquarters universally accepted by manufacturers in China, possible profiles of traceable pork hindquarters were set based on ordinary pork hindquarters without traceability information, and presented to manufacturers to choose from. The changes in traceable pork hindquarters market share with different government subsidies were thereby assessed.

As shown in Table 4, the ordinary and traceable pork hindquarters were classified into low, medium, and high levels based on the different levels of traceability information, appearance, and price in the absence of government subsidies. For example, the traceable pork hindquarters profile with HITRACE, FRESH1 and PRICE4 was classified as the high-level traceable pork hindquarters.

Since all three levels of ordinary pork hindquarters already exist in the market, while the traceable pork hindquarters are virtual, the virtual traceable pork hindquarters profiles were added to the ordinary pork hindquarters to create seven different market scenarios of pork hindquarters. Based on the previously estimated marginal utility of the different levels of each attribute, market shares of the seven scenarios were estimated using the randomized first choice method of Huber et al. (1999), and the results are shown in Table 5.

As shown in Table 5, when all the earlier mentioned different types of pork hindquarters were sold in the market, the three levels of traceable pork hindquarters had the largest market share of 90.3%. The six other market scenarios in descending order of total market share of traceable pork hindquarters were as follows: marketing of high- and medium-level traceable pork hindquarters, with a total share of 87.83%; marketing of high- and low-level traceable pork hindquarters, with a total share of 87.02%; marketing of medium- and low-level traceable pork hindquarters, with a total share of 84.38%; and separate marketing of high-, medium-, and low-level traceable pork hindquarters, with a share of 81.37, 75.35 and 71.34%, respectively.

The estimated market shares of traceable pork hindquarters in the different market scenarios with government subsidies of 3 and 7% are shown in Tables 6 and 7. Comparison of Tables 5, 6, and 7 revealed that the ranking of market scenarios in order of the market share of traceable pork hindquarters was not affected by the offer of government subsidies. However, compared with ordinary pork, the market shares of traceable pork hindquarters in all scenarios were increased with the increase of government subsidies. Obviously, this is because share of consumer spending on traceable pork hindquarters was increased due to substitution and income effects, as the relative price of traceable pork hindquarters was decreased by government subsidies.

Undoubtedly, the higher government subsidies the better, from the mere perspective of promoting traceability systems to improve food safety. However, as government spending also faces resource constraints, the efficiency of government spending cannot be ignored. In this regard, the ratio of the market share increment of level-i traceable pork hindquarters to government subsidy increment was regarded as government subsidy and market share elasticity, and was used to judge the efficiency of government subsidies. The results of government subsidy and market share elasticity are shown in Table 8.

As shown in Table 8 for example, when a government subsidy of 3% was provided, the market shares of low-level, medium-level, high-level, and all levels of traceable pork was increased by -0.16, 0.08, 0.70 and 0.62%, respectively, with an increase of 1% in government subsidies. Comparison of changes in the overall market share of traceable pork between government subsidies of 3 and 7% indicated higher elasticity with a government subsidy of 3% in all scenarios. Therefore, a government subsidy of 3% is a better choice when considering the efficiency of government spending. This may be related to the small price elasticity of pork demand.

## Conclusion

In this study, four attributes, that is, traceability information, price, government subsidy, and appearance, were set at different levels for pork hindquarters, and consumer preferences for traceable pork hindquarters were examined using a CBC analysis combined with a multivariate logistic regression model. On this basis, high, medium- and low-level traceable pork profiles were created. Furthermore, the impact of different government subsidies on the market share of traceable pork hindquarters in different market scenarios was thereby simulated. Major conclusions are summarized below:

1. Among the four traceable pork attributes, traceability information was the most important attribute to consumers which is in a good accordance with the research of Hobbs et al. (2005). Consumers' preferred appearance was the second important attribute, which is consistent with the research conclusion of Grunert (1997), Loureiro and Umberger (2007) and Ortega et al. (2011). Among the four levels of traceability information, the inclusion of farming, slaughter, and transportation information had the highest marginal utility. The marginal utility decreased with lower level of traceability information, in full accord with random utility theory (Lancaster, 1966).

2. The marketing of all there levels traceable pork yielded the largest overall market share of traceable pork with different government subsidies. Moreover, the ranking of market scenarios in order of the overall market share of traceable pork hindquarters was not affected by the offer of government subsidies. However, compared with ordinary pork, the market shares of traceable pork hindquarters in all scenarios were increased with the increase of government subsidies, consistent with the long tail theory (Anderson, 2007).

3. A government subsidy of 3% was more efficient than that of 7% based on government subsidies and market share elasticity. This is because an increase of 1% in government subsidy led to a higher increase in the overall market share of traceable pork hindquarters when a government subsidy of 3% was provided.

**Table 4.** Product profiles of ordinary pork and traceable pork without government subsidies.

| Attribute level | Low-level ordinary pork | Medium-level ordinary pork | High-level ordinary pork | Low-level traceable pork | Medium-level traceable pork | High-level traceable pork |
|---|---|---|---|---|---|---|
| HITRACE | - | - | - | - | - | √ |
| MITRACE | - | - | - | - | √ | - |
| LOTRACE | - | - | - | √ | - | - |
| NOTRACE | √ | √ | √ | - | - | - |
| PRICE1 | √ | √ | √ | - | - | - |
| PRICE2 | - | - | - | √ | - | - |
| PRICE3 | - | - | - | - | √ | - |
| PRICE4 | - | - | - | - | - | √ |
| FRESH1 | - | - | √ | √ | √ | √ |
| FRESH2 | - | √ | - | - | - | - |
| FRESH3 | √ | - | - | - | - | - |

"√" refers to inclusion of specific attribute levels in a certain type of pork.

**Table 5.** The estimated market shares in the different market scenarios without government subsidies.

| Scheme* | Low- level ordinary pork | Medium- level ordinary pork | High- level ordinary pork | Low- level traceable pork | Medium- level traceable pork | High- level traceable pork | Total traceable pork market share |
|---|---|---|---|---|---|---|---|
| **1** | 0.97 | 3.16 | 5.51 | 22.48 | 28.03 | 39.85 | 90.36 |
| **2** | 1.16 | 3.72 | 7.28 | - | 36.20 | 51.63 | 87.83 |
| **3** | 1.23 | 3.97 | 7.78 | 31.50 | - | 55.53 | 87.02 |
| **4** | 1.44 | 4.60 | 9.57 | 37.78 | 46.60 | - | 84.38 |
| **5** | 1.55 | 5.22 | 11.86 | - | - | 81.37 | 81.37 |
| **6** | 1.91 | 6.41 | 16.33 | - | 75.35 | - | 75.35 |
| **7** | 2.16 | 7.33 | 19.17 | 71.34 | - | - | 71.34 |

* Government subsidies are not provided to ordinary pork.

Although only pork hindquarters were investigated as an example, the earlier mentioned conclusions provide definite policy implications on the construction of food traceability systems in China. First, the time is right for the establishment of food traceability systems in China, considering the huge potential market demand for traceable food. In practice, efforts should be focused on the establishment of multi-level traceable food market systems, thereby gradually promoting traceable food and developing emerging food markets, while meeting the different levels of consumer demand. Second, government subsidies help promote the construction of traceability systems in the early stage. However, a higher government subsidy is not necessarily better from the perspective of efficiency. The optimal level of government subsidies should be identified based

**Table 6.** The estimated market shares in the different market scenarios with a government subsidy of 3%.

| Scheme * | Low- level ordinary pork | Medium - level ordinary pork | High- level ordinary pork | Low- level traceable pork | Medium - level traceable pork | High- level traceable pork | Total traceable pork market share |
|---|---|---|---|---|---|---|---|
| **1** | 0.54 | 2.10 | 5.15 | 22.00 | 28.27 | 41.94 | 92.21 |
| **2** | 0.65 | 2.41 | 6.37 | - | 36.36 | 54.21 | 90.57 |
| **3** | 0.68 | 2.57 | 6.81 | 31.03 | - | 58.91 | 89.94 |
| **4** | 0.81 | 2.99 | 8.36 | 38.71 | 49.14 | - | 87.85 |
| **5** | 0.82 | 3.14 | 9.39 | - | - | 86.65 | 86.65 |
| **6** | 1.01 | 3.99 | 12.85 | - | 82.15 | - | 82.15 |
| **7** | 1.17 | 4.61 | 15.22 | 79.00 | - | - | 79.00 |

***** Government subsidies are not provided to ordinary pork.

**Table 7.** The estimated market shares in the different market scenarios with a government subsidy of 7%.

| Scheme * | Low-level ordinary pork | Medium- level ordinary pork | High- level ordinary pork | Low- level traceable pork | Medium - level traceable pork | High- level traceable pork | Total traceable pork market share |
|---|---|---|---|---|---|---|---|
| 1 | 0.42 | 1.63 | 3.74 | 22.48 | 28.90 | 42.84 | 94.21 |
| 2 | 0.50 | 1.85 | 4.54 | - | 37.41 | 55.71 | 93.11 |
| 3 | 0.54 | 1.98 | 4.88 | 31.97 | - | 60.63 | 92.60 |
| 4 | 0.62 | 2.28 | 5.89 | 34.69 | 56.52 | - | 91.22 |
| 5 | 0.64 | 2.48 | 6.93 | - | - | 89.95 | 89.95 |
| 6 | 0.86 | 3.17 | 9.72 | - | 86.26 | - | 86.26 |
| 7 | 0.97 | 3.75 | 11.60 | 83.68 | - | - | 83.68 |

***** Government subsidies are not provided to ordinary pork.

**Table 8.** The results of government subsidy and market share elasticity.

| Scheme | Government subsidy of 0-3% | | | | Government subsidy of 0-7% | | | |
|---|---|---|---|---|---|---|---|---|
| | Low- level traceable pork | Medium - level traceable pork | High- level traceable pork | Total | Low- level traceable pork | Medium - level traceable pork | High - level traceable pork | Total |
| **1** | -0.16 | 0.08 | 0.70 | 0.62 | 0.00 | 0.12 | 0.43 | 0.55 |
| **2** | - | 0.05 | 0.86 | 0.91 | - | 0.17 | 0.58 | 0.75 |
| **3** | -0.16 | - | 1.13 | 0.97 | 0.07 | - | 0.73 | 0.80 |
| **4** | 0.31 | 0.85 | - | 1.16 | -0.44 | 1.42 | - | 0.98 |
| **5** | - | - | 1.76 | 1.76 | - | - | 1.23 | 1.23 |
| **6** | - | 2.27 | - | 2.27 | - | 1.56 | - | 1.56 |
| **7** | 2.55 | - | - | 2.55 | 1.76 | - | - | 1.76 |

on government subsidy and market share elasticity, consistent with the long tail theory as well (Anderson, 2007).

This study may be limited in that the survey sample consisted of consumers from a single city in China. The earlier mentioned conclusions are inevitably subject to further verification because of the vast territory and many different types of cities in China. In future studies, multi-regional, multi-sample surveys covering different types of cities and villages should be conducted to investigate the impact of government subsidies on traceable food market, in order to provide a more accurate decision-making scheme for the Chinese government.

## Conflict of Interests

The authors have not declared any conflict of interests.

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### REFERENCES

Abidoye B, Bulut H, Lawrence J, Mennecke B, Townsend A (2011). U.S. consumers' valuation of quality attributes in beef products. J. Agric. Appl. Econ. 43(1):1-12.

Anderson C (2007). Calculating latent demand in the long tail. Paper presented at the meeting of Proceedings of the 13th ACM SIGKDD international conference on Knowledge discovery and data mining San Jose, California, USA.

Angulo A, Gil J, Tamburo L (2005). Food safety and consumers' willingness to pay for labelled beef in Spain. J. Food Prod. Mark. 11(3):89-105.

Antle J (1996). Efficient Food Safety Regulation in the Food Manufacturing Sector. Am. J. Agric. Econ. 78(5):1242-1247.

Bechini A, Cimino M, Marcelloni F, Tomasi A (2008). Patterns and technologies for enabling supply chain traceability through collaborative e-business. Inf. Softw. Technol. 50(4):342-359.

Becker T (2000). Consumer perception of fresh meat quality: A framework for analysis. Br. Food J. 102(3):158-176.

Ben-Akiva M, Lerman SR (1985). Discrete choice analysis. Cambridge, Mass: MIT Press.

Boccaletti S, Nardella M (2000). Consumer willingness to pay for pesticide-free fresh fruit and vegetables in Italy. Int. Food Agribus. Manage. Rev. 3(3):297-310.

Boxall P, Adamowicz W, Swait J, Williams M, Louviere J (1996). A comparison of stated preference methods for environmental valuation. Ecol. Econ. 18(3):243-253.

Buhr B (2003). Traceability and information technology in the meat supply chain: implications for firm organization and market structure. J. Food Distrib. Res. 34(3):13-26.

Edwards M (2001). Participatory Governance into the Future: Roles of the Government and Community Sectors. Austral. J. Public Adm. 60(3):78-88.

Giraud G, Amblard C (2003). What does traceability mean for beef meat consumer? Science des Aliments 23(1):40-46.

Golan E, Krissoff B, Kuchler F, Calvin L, Nelson K, Price G (2004). Traceability in the U.S. food supply: Economic theory and industry studies. United States Department of Agriculture, Economic Research Service.

Green PE, Srinivasan V (1978). Conjoint analysis in consumer research: issues and outlook. J. Conserv. Res. 5(2):103-123.

Grøn C (2007). Organic Contaminants from sewage sludge applied to agricultural Soils. False alarm regarding possible problems for food safety? Environ. Sci. Pollut. Res. 14(1):53-60.

Grunert KG (1997). What's in a steak? A cross-cultural study on the quality perception of beef? Food Qual. Prefer. 8(3):157-174.

Hartmann M, Heinen S, Melis S, Simons J (2013). Consumers' awareness of CSR in the German pork industry. Br. Food J. 115(1):124-141.

Hey C, Jacob K, Volkery A (2007). Better regulation by new governance hybrids? Governance models and the reform of European chemicals policy. J. Cleaner Prod. 15(18):1859-1874.

Hobbs J, Bailey D, Dickinson D, Haghiri M (2005). Traceability in the Canadian red meat sector: Do consumers care? Can. J. Agric. Econ. 53(1):47-65.

Hou X (2011). Analysis of consumers' willingness to pay for traceable fresh fruits in Shanghai city and countermeasures. Asian Agric. Res. 3(12):35-38.

Huber J, Orme B, Miller R (1999). Dealing with product similarity in conjoint simulations. Sawtooth Software Research Paper Series, Sequim, WA, Sawtooth Software Inc.

Huber J (2005). Conjoint analysis: how we got here and where we are (An Update). Sawtooth Software Research Paper Series, Sequim, WA.

Jaeger S, Lusk J, House L, Valli C, Moore M, Morrow B, Traill W (2004). The use of non-hypothetical experimental markets for measuring the acceptance of genetically modified foods. Food Qual. Prefer. 15(7-8):701-714.

Jehle GA, Reny PJ (2011). Advanced microeconomic theory. Addison-Wesley Series in Economics. Hampshire: Ashford Colour Press.

Jiang L, Pan Y, Xie J (2009). Determination of the Pork Safety Production Traceability System's Information Based on HACCP. J. Chinese I. Food Sci. Technol. 2:87-91.

Johnson RM, Orme BK (1996). How many questions should you ask in choice-based conjoint studies. Sawtooth Software Research Paper Series, Sequim, WA.

Krueathep W (2008). Collaborative network activities of Thai subnational governments: Current practices and future challenges. Int. Public Manage. Rev. 9(2):251-276.

Lancaster KJ (1966). A new approach to consumer theory. J. Polit. Eco. 74(2):132-157.

Lee J, Han D, Nayga R, Lim S (2011). Valuing traceability of imported beef in Korea: An experimental auction approach. Austr. J. Agric. Resour. Econ. 55(3):360-373.

Li S (2015). The Transformation and Reforms of Income Distribution Pattern of China. J. Beijing Technol. Bus. Univ. (Soc. Sci.) 30:1-6.

Lichtenberg L, Heidecke SJ, Becker T (2008). Traceability of meat: Consumers' associations and their willingness to pay. 12th Congress of the European Association of Agricultural Economists-EAAE.

Lin C, Xie R, Xu X (2008). Study of consumers' attention degree to pork supply chain security risk and access to information channel, based

on the investigation and analysis of the Shaoguan City. Guangdong Agric. Sci. 8:100-102.
Liu G, Chen H (2015). An empirical study of consumers' willingness to pay for traceable food in Beijing, Shanghai and Jinan of China. Afr. J. Bus. Manage. 9(3):96-102.
Loureiro ML, Umberger WJ (2007). A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. Food Pol. 32(4):496-514.
Lusk JL, Schroeder TC (2004). Are choice experiments incentive compatible? A test with quality differentiated beef steaks. Am. J. Agric. Econ. 86(2):467-482.
Ortega DL, Wang HH, Widmar NJO, Wu L (2013). Chinese producer behavior: Aquaculture farmers in southern China. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC.
Ortega D, Wang H, Wu L, Olynk N (2011). Modeling heterogeneity in consumer preferences for select food safety attributes in China. Food Pol. 36(2):318-324.
Pouliot S, Sumner D (2012). Traceability, recalls, industry reputation and product safety. Eur. Rev. Agric. Econ. 40(1):121-142.
Reddy VS, Bush RJ (1998). Measuring softwood lumber value: A conjoint analysis approach. For. Sci. 44(1):145-157.
Regattieri A, Gamberi M, Manzini R (2007). Traceability of food products: General framework and experimental evidence. J. Food Eng. 81(2):347-356.
Rossi PE, McCulloch RE, Allenby GM (1996). The value of purchase history data in target marketing. Mark. Sci. 15(4):321-40.
Sarig Y (2003). Traceability of Food Products. Int. Commission Agric. Eng. 5(12):2-17.
Schulz LL, Tonsor GT (2010). Cow-Calf producer preferences for voluntary traceability systems. J. Agric. Econ. 61(1):138-162.
Shang X, Qiao J, Li B (2012). Market prospect of traceability food based on empirical analysis on cognition and purchase intention of consumers. Resour. Dev. Mark. 28:589-592.
Skelcher M (2004). Governance arrangements and public service performance: Reviewing and reformulating the research agenda. Adv. Inst. Manage. Res. 3:23-24.
Stevens T, Belkner R, Dennis D, Kittredge D, Willis C (2000). Comparison of contingent valuation and conjoint analysis in ecosystem management. Ecol. Econ. 32(1): 63-74.
Tonsor GT, Schroeder TC (2006). Livestock identification: Lessons for the U.S. beef industry from the Australian system. J. Int. Food Agric. Mark. 18(3-4):103-118.
Trienekens J, Wognum N (2013). Requirements of supply chain management in differentiating European pork chains. Meat Sci. 95(3):719-726.
Kotler P (2012). Marketing Management. Beijing: China Renmin University Press.
Ubilava D, Foster K (2009). Quality certification vs. product traceability: Consumer preferences for informational attributes of pork in Georgia. Food Pol. 34(3):305-310.
van Rijswijk W, Frewer L, Menozzi D, Faioli G (2008). Consumer perceptions of traceability: A cross-national comparison of the associated benefits. Food Qual. Prefer. 19(5):452-464.
Wang H, Ni C, Xu, R (2011). On consumer's willingness to pay on food quality and label safety: A case study of pork consumption in Nanjing city. J. Nanjing Agric. Univ. 11:21-29.
Wu L, Bu F, Zhu D (2012a). Analysis of consumers' preferences to traceable pork with different quality safety information. Chin. Rural Econ. 10:13-23.
Wu L, Xu L, Zhu D, Wang X (2012b). Factors Affecting Consumer Willingness to Pay for Certified Traceable Food in Jiangsu Province of China. Can. J. Agric. Econ. 60(3):317-333.
Wu L, Wang S, Xu L (2013). The study of consumer demand in traceable food market: The case of traceable pork. J. Public .Manage. 10:119-128.
Wu L, Wang H, Liu X (2014). Consumers' Willingness to Pay for Pork of Combined Traceable Information Levels. China Popul. Resour. Environ. 24:35-42.
Wu L, Xu L, Yin S (2015). Introduction to 2015 China-Development Report on Food Safety. Beijing: Peking University Press.
Zhao R, Qiao J, Chen Y (2010). Influencing factors of consumer willingness-to-buy traceable foods: An analysis of survey data from two Chinese cities. Agric. Agric. Sci. Proc. 1:334-343.
Zhang C, Bai J, Wahl TI (2012). Consumers' willingness to pay for traceable pork, milk and cooking oil in Nanjing, China. Food Control 27(1):21-28.
Zhang Z, Qiao J, Huang S (2013). Consumer's food safety attribute preference behavior research based on the heterogeneity. J. Agrotechnol. Econ. 5:95-104.
Zhou Y, Wu L (2008). Willingness to pay (WTP) of urban consumer for low carbon agricultural products: case of low carbon pork. J. Agrotechnol. Econ. 8:4-12.