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WILLINGNESS TO PAY FOR IMPLEMENTING HACCP SYSTEMS IN CHINA'S SMALL AND MEDIUM-SIZED FOOD ENTERPRISES

Shaosheng Jin
China Academy for Rural Development (CARD), School of Management, Zhejiang University, 866 Yuhangtang Rd, Hangzhou 310058, China, E-mail:ssjin@zju.edu.cn

Haiyue Guo
Department of Agricultural Economics and Management, School of Management, Zhejiang University, China

Feiying Mao
School of Agricultural Economics and Rural Development, Renmin University of China, China

Lin Zhou
Institute of Food and Nutrition Development, Ministry of Agriculture, China

Guangyan Cheng
Institute of Food and Nutrition Development, Ministry of Agriculture, China

Abstract

In China, a large number of small and medium-sized food enterprises (food SMEs) rarely adopt the hazard analysis and critical control points (HACCP) system, which results in a low product quality. Some local governments have encouraged food SMEs to implement HACCP systems through financial subsidies, but because of an incomplete understanding of the willingness to pay (WTP) for implementing HACCP systems in food SMEs, relevant policies have not enhanced the adoption rate of HACCP systems. Based on our questionnaire survey data of 132 food SMEs in China's Henan, Guangdong, and Zhejiang provinces, this study estimates Chinese food SMEs' WTP for implementing HACCP systems by a double bounded dichotomous choice contingent valuation method (CVM). According to the estimated results, the WTP for implementing HACCP systems under the log-logistic model is approximately 115,714 Chinese RMB (113,149 Chinese RMB for the log-normal model).

Keywords: *Contingent valuation; hazard analysis and critical control point (HACCP); small and medium enterprises; willingness to pay, China*
JEL Codes: D22; Q13; Q18

1. Introduction

China's food safety problems mainly occur in small and medium-sized food enterprises (food SMEs), and the quality and safety management level of food SMEs plays a significant role in China's overall food safety. In 2007, there were 448,000 food production and processing enterprises in China. These comprised 26,000 enterprises above the designated size[i], with a market share of 72%, 69,000 enterprises below the designated size and having

more than 10 people, with a market share of 18.7%, and 353,000 small enterprises and workshops having fewer than 10 people, with a product market share of 9.3% (Information Office of the State Council, 2007). Compared to enterprises above the designated size, food processing enterprises below that size have a lower market share, but they comprise more than 95% of the total number of food processing enterprises and have a major impact on China's food safety level. In 2007, China's General Administration of Quality Supervision issued an announcement declaring that large-scale production enterprises have better product quality and that food SMEs fall behind in micro-organisms and food additives control and have more problems with product quality[ii]. China's food industry has not fundamentally changed in those enterprises having small, dispersed, and low-level layouts and with a low level of scale and intensification. Small and micro-enterprises and small workshops still occupy more than 90% of the number of enterprises in the industry. Food safety incidents have often occurred in these enterprises and the food safety guarantee level has lagged far behind the requirements of the consumers (the National Development and Reform Commission and the Ministry of Industry and Informatization, 2011). Therefore, a good resolution of food SMEs' quality and safety management problems can significantly reduce the rate of occurrence of food safety accidents, which is of great importance to the enhancement of China's overall food safety guarantee level.

Although China has established a food quality safety market access system, which applies a "QS" (Quality Safety) tag on food products that have passed the relevant tests, Walker, Prichard, and Forsythe (2003) indicated that end-product testing alone is unable to assure food safety. The hazard analysis and critical control point system (HACCP) is the most internationally authoritative food safety and quality guarantee system based on production process control (Ehiri & Morris, 1996; Berends & Knapen, 1999 ; Herath & Henson, 2010), but it has been adopted by only a small proportion of China's food SMEs (Jin, Zhou, & Ye, 2008). HACCP was introduced to food enterprises by the Chinese government in the 1990s to enhance the safety of food. In March 2002, the Certification and Accreditation Administration released announcement No.3 of the Management Regulations on Hazard Analysis and Critical Control Point Management System Certification for Food Manufacturing Enterprises. This announcement motivated all food enterprises to establish and implement an HACCP system so as to enhance their business quality management level. In 2002, China's General Administration of Quality Supervision, Inspection and Quarantine introduced the Product Catalog to Review HACCP Systems for Health Registry, which regulated that food enterprises involved in the production and export of canned food, aquatic products, meat and meat products, frozen vegetables, fruit and vegetable juice, and quick-frozen instant food containing meat or aquatic products must have HACCP certification. This largely requires China's food enterprises to introduce an HACCP system to guarantee food safety, but in China, food enterprises that have introduced an HACCP system are mostly large-scale enterprises with a higher level of management and technology; a large number of food SMEs rarely adopt an HACCP system (Jin et al., 2008).

The Chinese Government has not yet made it mandatory for all food enterprises to adopt an HACCP system. However, in order to ensure food quality and safety, the government is actively promoting the need for food SMEs to establish HACCP systems and providing the necessary support for food SMEs in policy, technology, information, and finance to enhance their awareness, and the benefits, of implementing an HACCP system. Many local governments have introduced subsidy policies for implementing an HACCP system. For example, in Zhejiang Province, the Hangzhou Municipal Government grants a maximum of 50,000 Chinese RMB[iii] for each item to food production enterprises with HACCP systems and good manipulation practice (GMP) systems; the Wuhan Municipal Government in Hubei Province provides a one-time 10,000 Chinese RMB [iv] grant to the city-level leading

agricultural enterprises with new HACCP system certifications. Similar subsidies are one of the effective ways to help food SMEs to overcome financial difficulties in the implementation of an HACCP system, but there is a wide gap among local government subsidies. Some local government subsidized amounts are so insufficient that they cannot provide a strong stimulus, and some subsidized amounts are so high that they result in government financial waste. Therefore, current subsidies have not had the effect of enhancing the adoption rates of HACCP systems by food SMEs.

In the above context, we believe it is necessary to study the food SMEs' willingness to pay (WTP) for an HACCP system, to understand the gap between the food SMEs' WTP and the HACCP system's actual cost, and to formulate effective policies for food SMEs to adopt an HACCP system. The study, which is based on the data from 132 food SMEs in China's Henan, Guangdong, and Zhejiang provinces, uses a double bounded dichotomous choice contingent valuation method (CVM). It is aimed at estimating China's food SMEs' WTP for an HACCP system. Our research represents the first attempt to address the issue of WTP for implementing HACCP systems in China's food SMEs.

2. Previous Research

From the 1990s, and especially in recent years, food safety incidents have frequently occurred, so there have been a great number of studies attempting to understand the adoption of HACCP systems by food enterprises (Segerson, 1999; Henson & Holt, 2000; Ollinger & Moore, 2009; Semos & Kontogeorgos, 2007; Jin et al., 2008; Wang, Yuan, & Gale, 2009; Herath & Henson, 2010).

Several cost-benefit analyses, mainly based on case studies, have been conducted to analyze the economic benefits to food enterprises through the adoption of an HACCP system (Maldonado et al., 2005; Wang et al., 2009). The costs of implementing an HACCP system can be divided into initial costs and follow-up operation costs. These include training, infrastructure construction, certification, testing, recording, and document and system management costs. Follow-up operation costs also include indirect expenses resulting from the production flow slowing down as a consequence of implementing an HACCP system (Ollinger & Moore, 2009; Wang et al., 2009). The implementation of an HACCP system can bring significant benefits to enterprises (Semos & Kontogeorgo, 2007), mainly in four aspects: reducing the quantity of waste and defective products, reducing customer complaints, improving food hygiene, and increasing market share (Khatri & Collins, 2007; Maldonado et al., 2005; Wang, Wen, Yang & Zheng, 2006).

Motivations and incentives for food processing enterprises to adopt HACCP systems are also explored (Segerson, 1999; Henson & Holt, 2000). Four important aspects are as follows. (1) The government policy requirements: microorganisms, such as bacteria, are difficult to measure and control, so many countries have introduced relevant policies for implementing HACCP systems, some of which are mandatory and some voluntary (Jayasinghe - Mudalige & Henson, 2006; Khatri & Collins, 2007); promotion of the implementation of HACCP systems through policies that are favorable in terms of reducing the cost of government regulation (Unnevehr & Jensen, 1999). (2) The need for enterprises to seek internal efficiency: implementing HACCP systems can improve the quality of the products, the processes, and the management (Semos & Kontogeorgos, 2007; Wang et al., 2006), can help to improve internal production and management efficiency, and can promote the voluntary adoption of an HACCP system. According to a survey of 482 Chinese food processing enterprises conducted by Wang et al. (2006), the two most important reasons for more than 80% of enterprises to adopt HACCP systems are the improvement in the quality and safety of products and in the management level. It is thus clear that seeking internal efficiency is one of the main purposes of food processing enterprises when implementing an HACCP

system. (3) Market and commercial pressures; in order to meet consumers' growing awareness of food safety (Herath & Henson, 2010), many food processing enterprises implement an HACCP system to enhance their reputation and to give them a more favorable competitive position in their markets, especially international markets (Maldonado et al., 2005; Griffith, 2006; Khatri & Collins, 2007). (4) Pressure from distributors; a study shows that many enterprises adopt an HACCP system because of pressure on them from distributors (Holleran, Bredahl, & Zaibet, 1999; Henson & Holt, 2000; Fouayzi, Caswell, & Hooker, 2006; Jayasinghe - Mudalige & Henson, 2006).

Although a lot of studies have shown that there are many positive incentives acting on enterprises, food enterprises still have many obstacles in implementing HACCP systems, such as difficulties in training, human resources, program planning, knowledge, ability, and management responsibilities (Semos & Kontogeorgos, 2007; Herath & Henson, 2010). These difficulties could be divided into the following two categories. (1) The enterprises' own infrastructure shortcomings: the lack of a basic sanitation system is a common barrier for food enterprises to implement an HACCP system. Basic sanitation systems include GMP and sanitary standard operating procedures (SSOP). If a food enterprise has not yet established such a system, it must build the basic system before implementing an HACCP system. This will require enterprises to increase investment, purchase equipment, adjust the production layout, and carry out relevant staff training (Khatri & Collins, 2007; Wang et al., 2009). In addition, a study by Jin et al. (2008) showed that managers with low education levels and limited knowledge about HACCP systems were one of the main factors hindering the implementation of HACCP systems by Chinese food enterprises. (2) Technical obstacles; as there is still no widely applicable standard available internationally for HACCP systems, enterprises' investment in this aspect varies considerably (Griffith, 2006; Khatri & Collins, 2007). The implementation and operation of HACCP systems also requires staff with professional skills, so corporate staff need to be trained (Griffith, 2006; Khatri & Collins, 2007; Semos & Kontogeorgos, 2007), which results in enormous costs. Maldonado et al. (2005) indicated that the lack of employee training was a key issue hindering the implementation of HACCCP systems by enterprises. In addition to the basic training of staff, insufficient experts and a shortage of management skills are common barriers for food processing enterprises in implementing HACCP systems (Semos & Kontogeorgos, 2007; Taylor & Kane, 2005).

The available literature reflects an underemphasis on analyses of the adoption by food SMEs of HACCP systems. The limited existing studies found that when implementing HACCP systems, food SMEs do face the obstacles mentioned above, which ultimately result in financial burdens on those enterprises (Walker et al., 2003; Taylor & Kane, 2005; Dora, Kumar, Goubergen, Molnar & Gellynck, 2013). With respect to China, researchers have reached a consensus on the need for financial support for food SMEs to help implement HACCP systems (Jin et al., 2008). However, the existing studies have not systematically analyzed how much food SMEs are willing to pay for implementing HACCP systems, and thus financial subsidy policies are difficult to formulate.

3. Method and Data

3.1. Method

To elicit the WTP for implementing HACCP systems in China’s food SMEs, we utilize a double bounded dichotomous choice CVM, which was proposed by Hanemann, Loomis, and Kanninen (1991) and has been extensively used in WTP studies (e.g. Krishna & Qaim, 2007; Sanjuán, 2012; Zaikin & McCluskey, 2013). Due to the hypothetical nature of CVM, criticisms have been made that subjects tend to over-state the amount of money they are

willing to pay compared to the elicitation using a non-hypothetical methodology, such as an auction experiment. We employ the CVM rather than a non-hypothetical methodology in our study because we could not actually conduct an HACCP system implementation for the food SMEs that participated[v].

Existing studies indicate that implementing an HACCP system will bring costs for food enterprises, mainly comprising initial costs and follow-up operation costs (Ollinger & Moore, 2009; Wang et al., 2009). Because follow-up operation costs vary greatly between enterprises and are much more difficult to identify, this study only estimates the WTP for initial costs with CVM. During the survey, we made two queries of respondents with the double bounded dichotomous choice method[vi]. We first prompt an initial bid B_i of the willingness to pay for implementing an HACCP system and ask if a respondent agrees to pay that amount, and we then follow up, with the next question being based on the respondent's answer. If the respondent answers "yes" to the initial cost amount, then the second bid will be higher than the initial amount B_i, recorded as B_i^u; we continue to ask whether the food business manager agrees to pay for the relevant amount; otherwise, the bid amount will be set lower than the initial amount B_i, recorded as B_i^d, and we ask whether the respondent agrees to this amount. Hanemann et al. (1991) showed that the double bounded dichotomous choice CVM is more statistically efficient than a single bounded approach.

In order to improve the accuracy of estimation, bid amounts in this study were based on the cost analysis results from Wang et al. (2006) of China's 428 food enterprises adopting HACCP systems, as well as the pre-survey of some food SMEs in Zhejiang Province. We have developed the following four groups of bid amounts (Unit: Chinese RMB), B_i, B_i^u and B_i^d: Group 1 (100,000, 150,000, 50,000) (At the time of this study, 1 US dollar was roughly 6.45 Chinese RMB.), Group 2 (150,000, 200,000, 100,000), Group 3 (200,000, 250,000, 150,000), and Group 4 (250,000, 300,000, 200,000), with respectively different designs of the survey questionnaire. In the case of the questionnaire with the bid prices (B, B_u, B_d) of (200,000, 250,000, 150,000), respectively, specific questions are as follows:

In order to implement an HACCP system, enterprises need to pay for certain amounts of initial cost (including training, infrastructure construction, and certification costs). Do you think your organization would be willing to pay the cost of 200,000 Chinese RMB?

A. Yes ➔ Please continue to answer question A

B. No ➔ Please continue to answer question B

Question A: Only ask the following question to a respondent answering "willing to pay" to the last question: If the costs increase to 250,000 Chinese RMB, do you believe that your organization would be willing to pay? A. Yes B. No

Question B: Only ask the following question to a respondent answering "unwilling to pay" to the last question: If the costs increase to 150,000 Chinese RMB, do you believe that your organization would be willing to pay? A. Yes B. No

Based on the above questions, the answers of the interviewees have four possible results (Figure 1):

1) Answering "yes" twice, expressed as π^{yy};

2) Answering "yes" firstly and "no" secondly, expressed as π^{yn};

3) Answering "no" firstly and "yes" secondly, expressed as π^{ny};

4) Answering "no" twice, expressed as π^{nn}.

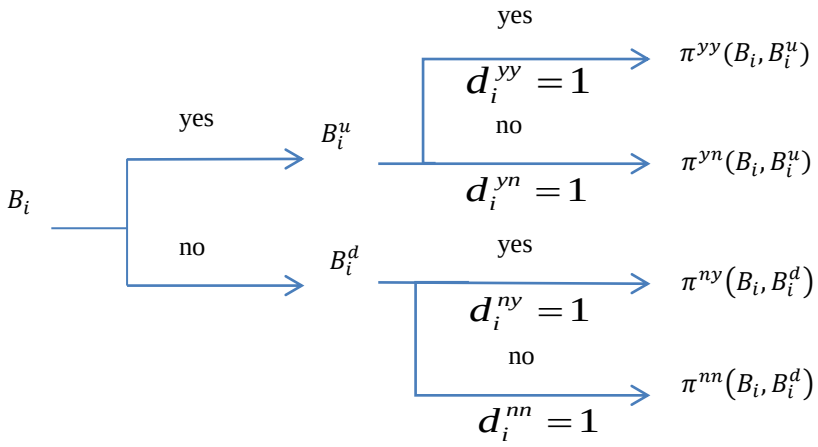


Figure 1. Possible Results of the Double Bounded Dichotomous Choice Method

The study estimated food SMEs' WTP based on the agreed probabilities of the respondent's two responses to the bid amounts for adopting an HACCP system. The probability of the above four possible results can be expressed as:

$$\pi^{yy}(B_i, B_i^u) = P(WTP_i \geq B_i^u) = 1 - F(B_i^u; \theta) \quad (1)$$
$$\pi^{yn}(B_i, B_i^u) = P(B_i \leq WTP_i < B_i^u) = F(B_i^u; \theta) - F(B_i; \theta) \quad (2)$$
$$\pi^{ny}(B_i, B_i^d) = P(B_i^d \leq WTP_i < B_i) = F(B_i; \theta) - F(B_i^d; \theta) \quad (3)$$
$$\pi^{nn}(B_i, B_i^d) = P(WTP_i < B_i^d) = F(B_i^d; \theta) \quad (4)$$

where WTP_i represents the amount of WTP for implementing an HACCP system; $F(\cdot;\theta)$ is a probability distribution function with parameter θ.
The log-likelihood function can be written as

$$lnL(\theta) = \sum_{i=1}^{N}\{d^{yy} ln\pi^{yy}(B_i, B_i^u) + d^{yn} ln\pi^{yn}(B_i, B_i^u) + d^{ny} ln\pi^{ny}(B_i, B_i^d) + d^{nn} ln\pi^{nn}(B_i, B_i^d)\} \quad (5)$$

where d^{yy}, d^{yn}, d^{ny}, d^{nn} are dummy variables representing that the value will be 1 if the corresponding result appears in the above four results, otherwise the value will be 0; N represents observation number (or sample number).
Generally, $F(B;\theta)$ can be expressed as follows:

$$F(B)=F(\alpha+\beta_{bid} lnB) \quad (6)$$

where α represents constant term, β_{bid} is the parameter of *lnB*, which is the natural logarithm of bid price *B*. The constant term α and parameter β_{bid} can be estimated simultaneously by the maximum likelihood method. Usually, $F(B;\theta)$ is assumed to have a form of a logistic distribution or a normal distribution, which corresponds to a log-logistic model or a log-normal model of *B*.

3.2. Data

As food enterprise level data are not publicly available, we collected data through a questionnaire survey. During questionnaire development, we randomly selected

representatives of food SMEs in Zhejiang Province to conduct deep interviews that were strongly pertinent and would provide the basis and guarantee for the questionnaire design. Two food enterprises with different sizes and types of business were deeply interviewed. The first enterprise surveyed is a small nuts and non-staple food processing enterprise in Zhuji City, Zhejiang Province, that mainly manufactures and processes domestic-oriented melon seeds, Chinese Torreya nuts, and raisins. The second enterprise surveyed is a medium-sized flavoring enterprise in Yiwu City, Zhejiang Province, that mainly manufactures chicken extract, spices, composite seasoning, and sauce seasoning. A final questionnaire was formed after a small-scale pre-investigation in Hangzhou City, Zhejiang Province. The final questionnaire mainly consists of two parts; in addition to the above questions relating to food SMEs' WTP, the questionnaire also seeks information on their main business, corporate property, market strategy, and other areas of basic information.

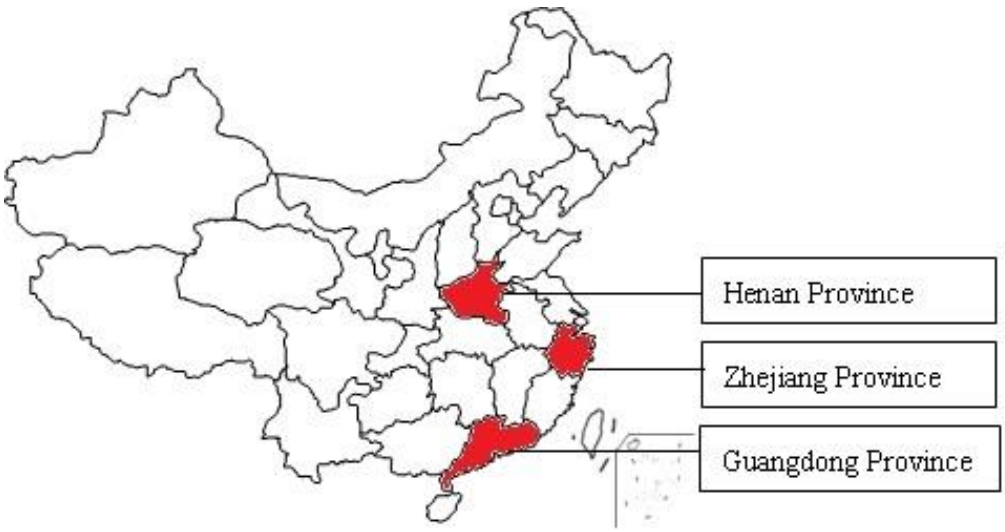


Figure 2. The Provinces Selected For Sampling

The survey was conducted between June and December 2011 and the survey sample was from Henan, Guangdong, and Zhejiang provinces (Figure 2). The list of food processing enterprises in each province was provided by the training center of the China Entry-exit Inspection and Quarantine Association (Henan Province), Shenzhen Academy of Metrology and Quality Inspection (Guangdong Province), and Zhejiang Association of Small and Medium-sized Enterprises (Zhejiang Province). Face to face interviews were conducted with managers of the food enterprises. About 200 questionnaires were issued and 171 questionnaires were collected. Because there are food SMEs, micro-enterprises, and large food processing enterprises included in the data collected, we selected our food SMEs using the number of staff members as an indicator according to the standard proposed by National Bureau of Statistics, China[vii]. We identified 132 questionnaires as effective samples for follow-up analysis. The average number of staff members in the sample enterprises is 238.06; the minimum number is 20 and the maximum number is 836.

4. Statistical Results

4.1. Basic Statistical Characteristics of Sample Enterprises

The basic statistical characteristics of the sample enterprises in the study are shown in Table 1. The sample food SMEs are characterized by the following:

(1) The main business classification shows that there are 20 fruit and vegetable processing enterprises (15.2%) and 40 meat-processing enterprises (30.3%). There are 63 other food processing enterprises (including nuts, grain, oil, cakes, tea, and other food processing enterprises), representing 47.0%; the sample also includes 10 aquatic processing enterprises, accounting for 7.6% of the sample.

(2) Our sample mostly comprises private and cooperative shareholding enterprises, including 79 private enterprises, accounting for 61.2%, and 31 cooperative shareholding enterprises, representing 24.0%. There are only 7 state-owned enterprises, accounting for 5.4% of the sample.

(3) The market strategy classification shows that 55.0% of the enterprises surveyed are based on domestic sales, 32.6% are based on domestic and export sales, and 12.4% are based on export sales. We can see that at present, China's food SMEs mainly focus on domestic food consumption markets.

(4) The risk classification shows that 46.8% of the enterprises surveyed have never faced food safety risks, 42.1% of the enterprises have experienced food safety issues but with small levels of risk and loss, and only 11.1% of the enterprises have experienced great food safety risks and losses. Food SMEs in China have generally had a good food safety experience but more than half of the enterprises have faced related problems, so potential food safety problem should not be overlooked.

Table 1. Statistics of Corporate Characteristic Variables

Variable	Classification indicators	Quantity of enterprises	Percentage
Main Business	Fruit and vegetable processing	20	15.2%
	Meat processing	40	30.3%
	Aquatic products processing	10	7.6%
	Others	62	47.0%
Type of enterprises	State-owned enterprises	7	5.4%
	Private enterprises	79	61.2%
	Joint-venture enterprises	31	24.0%
	Foreign investment enterprises	12	9.3%
Market strategy	Domestic market	71	55.0%
	Both domestic and foreign markets	42	32.6%
	Foreign Market	16	12.4%
Risk experience	Never experiencing risks	59	46.8%
	Small risk loss	53	42.1%
	Large risk loss	14	11.1%

Data Source: Authors ' calculations.

4.2. Statistical Characteristics of Sample Enterprise Managers

Table 2 shows the classification of enterprise managers in our sample. They are primarily 31-50 years old (67.4%); 31.1% of them are below 30 years old. This may be because food

SMEs tend to be established by young people. University degrees are held by 58.8% of the sample enterprise managers; two enterprises have managers with a master's degree or above. There are 71.2% of enterprise managers with a food industry professional knowledge background.

Table 2. Statistics of Managers' Characteristic Variables

Variable	Classification indicators	Quantity of enterprises	Percentage %
Age	30 years old or below	41	31.1%
	31-40 years old	44	33.3%
	41-50 years old	45	34.1%
	50 years old or above	2	1.5%
Academic qualifications	High school degree or below	54	41.2%
	University or college	75	57.3%
	Master's degree or above	2	1.5%
Professional knowledge-background in food industries	No	38	28.8%
	Yes	94	71.2%

Data source: Authors' calculations.

4.3 Distribution of Sample Enterprises' Answers to WTP

As mentioned previously, the study has designed four groups of bid prices with initial bid prices of 100,000 Chinese RMB, 150,000 Chinese RMB, 200,000 Chinese RMB, and 250,000 Chinese RMB and 50 questionnaires were issued for each group of bid prices. The corresponding valid sample volumes are 39, 32, 32, and 29. Apart from the slightly higher sample volume in the No.1 group, the overall volume is reasonably balanced. Details of the answers to the four groups of bid prices are shown in Table 3.

Table 3. Distribution of Sample Enterprises' Answers to WTP

No.	Initial Bid	Higher Bid	Lower Bid	Yes - Yes	Yes - No	No - Yes	No - No	Total
1	100,000	150,000	50,000	10 (25.6%)	9 (23.1%)	9 (23.1%)	11 (28.2%)	39
2	150,000	200,000	100,000	8 (25.0%)	4 (12.5%)	6 (18.8%)	14 (43.7%)	32
3	200,000	250,000	150,000	4 (12.5%)	4 (12.5%)	8 (25.0%)	16 (50%)	32
4	250,000	300,000	200,000	3 (10.3%)	5 (17.2%)	4 (13.8%)	17 (58.6%)	29

Note: The values in brackets are row percentages.
Data Source: Authors ' calculations.

Table 3 shows that the acceptance probability of the initial bid price's minimum value of 100,000 Chinese RMB is 48.7%, which indicates that the remaining 51.3% of the respondents' WTP is less than 100,000 Chinese RMB. The acceptance probability of the initial bid price's maximum value of 250,000 Chinese RMB is 27.6%, which indicates that 27.6% of the respondents' WTP is more than 250,000 Chinese RMB. The second bid price is expanded to range from 50,000 Chinese RMB to 300,000 Chinese RMB; this produces an

acceptance probability of 71.8% and 10.3%, respectively. After the second inquiry, more respondents' WTP falls into the bid price range.

4.4. Estimation Result of WTP for Implementing an HACCP System

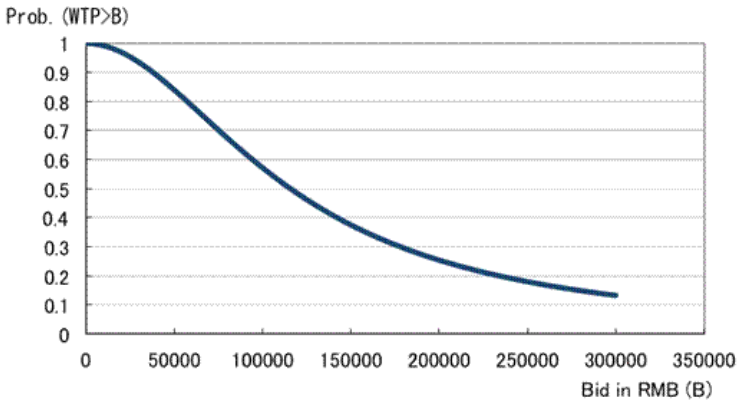
This research employed both log-logistic and log-normal models to estimate the coefficients of bidding. Table 4 displays the estimation results of equation (5). The chi-square tests for the log-logistic and log-normal models are 318.855 and 318.071, respectively, and are significant at 0.01 levels, which indicate a good fit to the data. The results suggest that there was a negative and statistically significant relationship between the bid and the possibility of a yes response from the food SME managers.

Table 4. Estimation Results of Equation (5)

	Log-logistic model			Log-normal model		
Variable	Coefficient	Std. Error	P value	Coefficient	Std. Error	P value
Constant	22.523***	2.742	0.000	13.589***	1.547	0.000
Bid	-1.932***	0.234	0.000	-1.168***	0.132	0.000
χ^2	349.645***			349.058***		
N	132			132		

Notes: Asterisks indicate significance levels: ***Significant at 0.01
Data Source: Authors ' calculations.

According to the estimation results of the log-logistic model, we simulated the possibility of acceptance with different amounts of the initial bid, which is calculated by $F(B)=F(\alpha+\beta_{bid} lnB)$. The result is depicted in Figure 3, which is a decline curve. As mentioned previously, the possibility of acceptance for implementation of an HACCP system is negatively related to the bid value. Almost all of the SMEs will introduce an HACCP system when the bid is 0. The possibility decreased to around 10% when the initial bid increased to 300,000 Chinese RMB.



Data Source: Authors ' calculations.

Figure 3. Possibility of Acceptance

Based on the results presented above, we can estimate the WTP of food SMEs. Theoretically, the WTP is the amount of either the mean or median of the distribution. The mean can be obtained by $WTP_{mean} = E(B) = \int_0^{\infty}[1 - F(B)]dB$, and WTP_{median} is the bid amount corresponding to Prob.=0.5. According to Hanemann (1984), the mean is sensitive to the distribution and thus will be easily affected by unusual observations. The estimate of the median of the distribution is more stable than the estimate of the mean, and thus WTP_{median} is calculated to represent the WTP of food SMEs[viii]. The confidence intervals of the WTP_{median} point estimation were obtained using a Monte Carlo simulation technique, which is proposed in Krinsky and Robb (1986). Table 5 presents the estimates of WTP for implementing an HACCP system. The WTP is 115,714 Chinese RMB with a 90% confidence interval [100,588, 133,115] Chinese RMB in the Log-logistic model and 113,149 Chinese RMB with a 90% confidence interval [98,353, 130,171] Chinese RMB in the log-normal model. Generally, the WTP of Chinese food SMEs is roughly 115,000 Chinese RMB.

Table 5. Estimates of WTP for Implementing an HACCP System (Chinese RMB)

	Log-logistic model	Log-normal model
WTP Point Estimation	115,714	113,149
90% Confidence Interval	100,588—133,115	98,353—130,171

Data Source: Authors ' calculations.

5. Conclusion and Implications

Based on the questionnaire survey data of 132 food SMEs in China's Henan, Guangdong, and Zhejiang provinces, this study is aimed at estimating the WTP for HACCP systems by a double bounded dichotomous choice CVM and providing references for the government to assist with the formulation of relevant policies.

This study applies a double bounded dichotomous choice method to ascertain food SMEs' WTP for an HACCP system. We found a significant negative correlation between the probability of food SMEs' WTP and the bid price. According to the estimated results, the amount under the assumption of a logistic distribution is about 115,714 Chinese RMB (113,149 Chinese RMB for a normal distribution), which is lower than the actual cost for adopting the system. This may be because food SMEs lack knowledge of HACCP systems and the economic efficiency of the system is not looked upon favorably (Dora et al., 2013). In order to promote food SMEs to adopt HACCP systems, local governments have developed related talent training, established HACCP resource centers, and provided technical advice and guidance for food SMEs. Furthermore, local governments may estimate the costs of food SMEs in implementing HACCP systems and then determine the gap between the costs and their WTP. To effectively alleviate the financial burden, financial support, such as financial subsidies or policy-based loans for food SMEs implementing HACCP systems, may be determined based on the gap. In addition, as noted by Jin et al. (2008), food SMEs in China have a low proportion of technicians and the prerequisite conditions for implementing HACCP systems, such as GMP and SSOP, which may cause a greater gap between the estimated costs for implementing HACCP systems and the amount of WTP for implementing them. In such cases, local governments may guide food SMEs to lay the foundations for implementing an HACCP system by encouraging them to implement GMP and SSOP first and then consider implementing a system.

As this is the first attempt to address this question in China, our results should be used with caution for the following reasons. Firstly, the results of this study are based on surveys of China's eastern and central provinces, which can only represent the SMEs' WTP for adopting HACCP systems in these provinces. It is necessary to further test the robustness of

our results with data from other regions (e.g. Chinese western regions). Secondly, the amount of WTP involved in the study refers only to initial costs, which include training costs, infrastructure construction costs, and certification costs and exclude follow-up operation costs. Large amount of follow-up operation costs may be required in operating an HACCP system. For example, according to the results of a study by Wang et al. (2006), operating an HACCP system will cost 920,300 Chinese RMB annually[ix] for general food enterprises. Although for food SMEs the follow-up operation costs are lower, it is very likely to become another significant challenge for food SMEs (Maldonado et al., 2005).

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[i] Food enterprises above the designated size refer to state-owned industrial enterprises practicing independent accounting and those that are non-stated-owned generating annual sales of at least 5 million Chinese RMB (the standard increased to 20 million Chinese RMB from 2011).

[ii] Data source: China's National Product Quality Supervision Sampling Inspection Announcement http://www.xfzj.gov.cn/old/dispnews.asp?id=5286

[iii] Data source: Hangzhou Municipal Government; information available at: http://www.hzjingwei.gov.cn/hzjingwei2/09jingwei/zczx/zczx-list.asp?id=1378

[iv] Data source: Agricultural Bureau of Wuhan City; information available at : http://www.wuhanagri.gov.cn/town/Wenzhang.asp?NewsID=14062&siteTown=6

[v] As a popular valuation methodology in both environmental economics and agricultural economics, a number of means have been suggested to mitigate the hypothetical bias referred to in the existing literature. One way is to use a cheap talk script before willingness-to-pay questions are raised (Cummings & Taylor 1999; Lusk, 2003; Brummett, Nayga, & Wu, 2007), or to incorporate the degree of certainty of willingness-to-pay questions by a follow-up certainty question (Li & Mattson, 1995; Loomis & Ekstrand, 1997; Johannesson, Liljas, & Johansson, 1998). An alternative method named inferred valuation was recommended by Lusk & Norwood (2009). However, in our study, we followed the first suggestion during our data collection.

[vi] Given that some managers may not understand the HACCP system, prior to asking whether they would agree to pay the relevant amount, we have described the HACCP system as follows: HACCP, namely Hazard Analysis and Critical Control Point, refers to a scientific and systematic methodology for the identification, assessment, and control of potential hazards affecting food safety, ranging from raw materials to final products, so as to improve the quality and safety of food.

[vii] According to Statistics on Division Methods of Large, Medium, Small and Micro-sized Enterprises formulated by the National Bureau of Statistics, China's industrial enterprises are divided into large, medium, small and micro-sized enterprises based on a practitioners indicator and an operating income indicator. Specific criteria are as follows:

Indicator	Unit	Large-sized	Medium-sized	Small-sized	Micro-sized
Staff (X)	Number	X≥1000	300≤X＜1000	20≤X＜300	X＜20
Revenue (Y)	10^4 Chinese RMB	Y≥40,000	2000≤Y＜40,000	300≤Y＜2000	Y＜300

[viii] The estimated result in the log-logistic model shows that for WTP_{mean} the average number is 82,000 Chinese RMB, the WTP_{median} is 115,700 Chinese RMB, and the balance is 33,700 Chinese RMB. The WTP_{median} is higher than the average number WTP_{mean} because there are a few extreme values demonstrating a very low willingness to pay that reduce the estimated mean. In this case, a description of the willingness distribution center with the median not affected by extreme values is more representative (Hanemann, 1984).

[ix] This amount excludes costs for developing dedicated sales channels and allocating professional sales personnel after enterprises implement an HACCP system.