

# Consumers' cognition, preference and willingness to pay for safety-labeled foods

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**Abstract:** *The structural surplus of agricultural products and the improvement of people's living standards cause higher requirements for food quality and safety. So far researchers focus mainly on how to improve quality of agri-food on the basis of producers and governance while this paper intends to focus on the quality and safety of agri-food from the perspective of consumers, trying to find Chinese consumers' cognition, preference and willingness to pay for safety-labeled foods from different regions.*

**Keywords:** *safety-labeled food, cognition, WTP, logistic model*

## 1. Introduction

After more than 40 years of reform, opening up and development, China's agricultural and rural economy has developed rapidly, with income and living standards of urban and rural residents significantly improved. The relationship between supply and demand of agricultural products has changed significantly, from a long-term shortage to general total balance, and gradually from the seller's market to a buyer's market. The structural surplus of agricultural products and the improvement of people's living standards cause higher requirements for food quality and safety. Not only to the variety of food, rich nutrition, good taste, but also in the process of manufacture no use of food additives, preservatives, synthetic pigments and other harmful substances to human body. People pay attention to whether there are pesticide residues, heavy metal pollution, excessive bacteria and other problems in terms of health and safety.

However, due to the misuse of agricultural inputs, such as pesticides, veterinary drugs and fertilizers, as well as the continuous deterioration of agricultural ecological environment, unreasonable market access system and backward supervision means, the quality and safety of agricultural products are prominent, which has become a social problem of which people pay common concern. In recent years, food quality and safety crisis has broken out continuously, reflecting the severity and urgency of the food quality and safety problems. Among these food safety problems, the quality and safety problems of agricultural products are particularly prominent. With the development of modern society and economy, the pressure of population and the change of people's lifestyle have changed the supply and consumption mode of food, expanding the problem of food quality and safety, expanding to other countries in the world. The occurrence and spread of food insecurity incidents not only pose a threat to people's health, but also cause huge economic losses to consumers and food-related industries, leaving behind many social problems.

With the expansion of China's agricultural foreign trade, the quality and safety of agricultural products has become a problem restricting agricultural export. On the one hand, developed countries raise standards to set up technical barriers, on the other hand, the quality and safety level of China's agricultural products itself is not high, resulting in the phenomenon of export obstruction occurs repeatedly. It is mainly manifested in: firstly, the food quality is not high, early indica rice, northeast spring wheat, southern winter wheat and other food supplies are of poor quality, meanwhile the processing and transformation is difficult. Secondly, special product lacks, specially lack of wheat such as hard bread wheat, soft biscuit wheat, high-quality beer barley. Thirdly, the health and safety situation is relatively low, mainly because of pesticide residues exceed the standard, resulting in harmful ingredient residues in meat and aquatic products, posing a potential harm to the human body. Fourth, the existence of harmful substances in agricultural products affects food quality and people's health.

The issue of quality and safety of agricultural products has aroused the attention of all sectors of

society. Since the end of the 1990s, the agriculture governmental sector began to strengthen the quality and safety management of agricultural products. With the improvement of the basic quality and safety system of agricultural products and the implementation of various measures, the quality and safety level of agricultural products has been significantly improved. Since 1990, the Ministry of Agriculture began the green food safety certification work, and then launched the pollution-free food action plan to the beginning of 2001. Beijing, Tianjin, Shanghai, Shenzhen were taken the lead, and achieved remarkable results. Comprehensive implementation was taken subsequently in the nationwide, the pollution-free agricultural products certification work was carried out. The cooperation of government and enterprises make the understanding of safety-certified agricultural products rapidly promoted throughout the country.

So far most researches focus on how to improve the quality of agri-food so as to establish the quality and safety system. However, it is the consumers who determine the effectiveness of agri-food certification. There is still a certain gap in the establishment of a consumer-centered food safety system.

## **2. Literature Review**

### ***2.1 Consumers' cognition and attitude towards safety-labeled food***

So far most economics-based research focus on consumer psychological and market research. The United States and European scholars concentrate mainly on the quality of food in the consumer cognition, attitude, consumer behavior, laying a good foundation for corresponding research. <sup>[1]</sup>

Uncertain factors arise from all links of the whole agri-food supply chain, but some of the hazards are due to consumers' own lack of knowledge about food safety. Sockett (1995) point out many methods which consumers do not ever know to ensure food hygiene, accordingly, survey in 1986 and 1996 showed that most consumers knew about the harmful characteristics of food poisoning, but the knowledge was extremely limited (Raab, Woodburn, 1997). Williamson carried out a postal survey in the UK to find that consumers have very little knowledge of the type of food biological poisoning, the importance of correct food cooking methods and food cross-contamination. And even professionals related to the food industry lack basic common sense, Similarly (1997) conducted a survey on 100 food regulators in Oregon showing that 40% of them are unaware of the treatment after food poisoning.

Consumers' cognition of food quality and safety determines consumers' attitude, which further determines consumers' purchase behavior. Therefore the consumers cognition of safety agri-food matters most in consumer behavior research. A large part of the existing western research on consumer cognition focuses on consumers' basic cognition of the quality and safety of agri-food <sup>[2]</sup> Most of the current consumer cognition research in China focuses on certain food with special characteristics, such as three types of food (pollution-free, green and organic) which went through safety certification. Zhangtao, Zeng yinchu (2003) conducted a survey on 50 college students' consumption of "Green Food" labeled milk, with the result showing that ratio of "heard of and have purchased" present to be quite high. A survey by Guangzhou City statistic bureau (2002) shows that most of the citizens heard about Green Food while a number of them didn't know the labeling of Green Food though. Wang and Xue (2005) conducted a survey on consumer behavior in 12 marts, 1000 consumers Beijing City showing that Chinese citizens didn't tend to know much about Genetically Modified Food. Consumers' cognition on food quality and safety has greatly determined their attitude towards corresponding issues while attitude tends to be an important psychological behavior affecting and predicting consumer behavior (Kras, 1995). Smith and Rieth (2000) conducted a random sampling survey in Australia, Japan and the US, finding that the main food safety issues consumers pay attention to are microbial contamination, chemical residues and the use of food antibiotics. Although these food safety problems do not pose a real danger, these consumer-perceived safety problems do affect consumers' buying habits.

In summary, food safety problems concerned by East and West consumers differs, on one hand, different economic level leads; on the other hand cultural difference functions.

### ***2.2 Factors affecting consumer attitude and purchase behavior***

Consumers' awareness of the quality and safety of agri-food affect consumers' attitude. The cognition and attitude of consumers are related to consumers' demographic characteristics and socioeconomic factors. Finally, these influencing factors work together to form the specific purchase decision of consumers. The use experience after purchase make consumers form some new cognition and attention

attitude, which will then affect purchase decision at the next step. This is a dynamic process, and the role of the influencing factors used is uninterrupted and repeated [3].

Demographic factors and lifestyle have an important influence on consumer attitudes. Rieth's research (2000) showed that high-income consumers and consumers at senior age tend to pay less attention to food safety issues. Version (1999) conducted a survey of 320 meat buyers in Belgium to show that male consumers are more concerned about meat quality and safety than female consumers. Among men, consumers at senior age are more concerned about hormones and other harmful substances than those youth (under 30 years old). Large-scale coverage of food safety incidents by media messages influences consumer choices. Verbeke(1999)found that BSE had accelerated the existing decline in beef consumption. The study also showed that the effect of each bad news was equivalent to the effect of one good news. Smith (1998) examined the changes in consumer milk demand after the milk pollution crisis in Hawaii, finding that negative reports in the news media had a great impact on milk demand.

Food safety issues consumers concern vary with regional differences. Smith and Rieth (2000) found that consumers in different countries showing distinguished concern on food safety issues, Japanese consumers relatively concerned more about food safety than Australian consumers. Consumers' cognition is closely related to their own experience, if a consumer has once encountered food harm events, then he accumulates certain experience for next food consumption choice [4]. There are also other factors influencing consumers' cognition on food safety, that is rise of life level, amount of safety food issues, genetic engineering in agriculture and lack of risk education or relevant government regulations are not enough (Hennessy,1998).

### ***2.3 Consumers' willingness to pay***

Consumers' purchase behavior is composed with factors like consumer cognition, attitude and others. Most researchers conduct study on the willingness to pay while so far three methods applied, that is conjoint analysis, contingent valuation and experimental auction. Conjoint analysis is a method to evaluate consumer preferences which calculate preference parameters by asking consumers to assign a range of product profiles. Contingent valuation is a standard method which derives consumers' willingness to pay through direct investigation. Experimental auction is to simulate the market to estimate the willingness to pay. The western analysis of consumers' purchasing behavior, especially the willingness to pay is relatively comprehensive in both methodology and content. The research subjects mainly focus on the typical foods, such as vegetables, green food and genetically modified food [5].

## **3. Theoretical framework**

### ***3.1 Consumer behavioral theory***

The American Marketing Association defines consumer behavior to be the dynamic interactive process of perception, cognition, behavior and environmental factors, which is the behavioral basis for human beings to perform their trading functions in life. By this definition, we can understand it from several perspectives:

This definition emphasizes that consumer behavior is dynamic, meaning that consumers as individuals and consumers as groups and that society as a whole continuously evolve and change over time. Similarly, the study of consumption behavior is also an analysis of specific historical periods and in specific historical environments.

There has been plenty of research on consumer behavior of agri-food in the West while this study based on the rich theoretical basis and experience of the previous research.

### ***3.2 Consumer behavioral research of safety-labeled agri-food***

The consumer purchase process is divided into five parts: problem confirmation, information search, decision scheme evaluation, purchase decision and post-purchase behavior. That is, consumers have experienced a cyclical cycle from the cognition of agricultural products, the attitude towards safety of agri-food to the behavior of purchase and selection.

The psychological process of consumers has experienced the understanding process to form a preliminary understanding of the quality and safety of agricultural products, and then experienced the emotional process and process to form a preliminary attitude towards the quality and safety of agricultural

products. According to the study theory, consumer attitude tends to conform to the public before the cognition was formed. The attitudes formed thus are superficial, temporary, and changeable. With the deepening of learning, experience and understanding of consumer related problems, consumers' attitude will gradually change, and eventually form a new understanding.

Consumers' cognition and attitudes towards agricultural products are influenced not only by economic variables such as income and price, but also by sociological and psychological variables. Especially for the safety-certified agricultural products, whether consumers are willing to consume and how much they're willing to pay are closely related with consumers' gender, age, education level, living habits and family health conditions.

Economic variable: Consumers' income and the price of agricultural products are the economic factors that affect consumers' cognition, attitude and purchasing behavior of agricultural products. With the increase of income, Engel's coefficient gradually decreases, the price elasticity of food decreases, people become less sensitive to the price of food, and the impact of price and income on consumption decisions will decrease, while non-economic factors such as taste and health will rise to great importance. There are mutual substitution between ordinary agri-food and safety certified food, and the difference between prices will lead to different purchase combinations of consumers. Usually with the same quality, consumers tend to choose those with low prices. Consumer choices are more complex with differences in quality and price. For low-income people, low prices may be somewhat attractive. The higher the income level, the higher the requirements for the quality and safety of agricultural products.

Sociological variable: The occupation, education level, position and reputation determine the economic interests, social status, values and attitude system of consumers. The differences in these sociological factors make consumers different in the utilization of information, the choice of the purchase place and the purchase direction, thus affecting the purchase behavior of consumers.

Demographic factors: Gender, age, and health status are the common criteria for dividing consumer groups. Generally speaking, consumer groups with young age are the promoters of new products, while the old consumer group showing loyalty to agri-food. Female consumer group tends to pay attention to the appearance.

Psychological factors: In real life, many consumers have similar conditions in terms of age, gender, occupation, income, but show different purchase behavior. This difference is often caused by differences in psychological factors. These factors include consumer lifestyle, personal experience, cognition of agricultural products and so on. If consumers' lifestyle tend to better understand safety agri-food then he is more likely to choose safety certified agri-food. If a consumer has ever encountered the quality and safety problems of agricultural products, then he may choose the safety certification agricultural products.

### **3.3 Empirical modelling and expectation results**

According to the theoretical analysis above, this study will figure out what kind of influencing factors consumers are affected when purchasing safety certification agri-food. The model is based on the hypothesis below:

① Individual consumer's characteristics that is, sociodemographic factors. Thus, we start research on consumers' agri-food choose by their personal basic information.

② Considered the basic personal resources, consumers will be influenced by external environment. But consumers have right of choose not no constraints of agricultural supplies.

③ Consumers' determination and behavior intention will affect agri-food consumption in quite a period near the future.

Based on the hypothesis we build models as below to study factors affecting consumers' purchase behavior of safe certification food (*Table 1*). The independent variables are economic, sociological, demographic and psychological. Purchase and selection model of safety-certified agricultural products are as follows:

Table 1: Whether to buy safety-labeled agri-food (no pollute, green food, organic)= $f(X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14)$

Variable name	Annotation	Purchase	Not purchase
X1	gender	+/-	+/-
X2	marriage	+/-	+/-
X3	age	+/-	+/-
X4	education	+	
X5	occupation	+/-	+/-
X6	family income	+	
X7	main buyer	+/-	+/-
X8	dining place	+/-	+/-
X9	family size		+
X10	family health		+
X11	safety food concern	+	
X12	place to buy	+/-	+/-
X13	concerning factors	+/-	+/-
X14	Encounter safety incidents	+	

#### 4. Descriptive analysis of consumer behavioral surveys

The aim of this survey is to obtain information of local safety food consumers, including basic personal information (natural and social attributes) through a questionnaire on key areas in East, Central and West China as well as consumers' satisfaction degree of current quality and safety of agri-food and the overall satisfaction degree of local regulatory authorities.

##### 4.1 Selection of the survey places

We select different representative regions for study since comparative differences is an important part of the research. The first criterion to be considered is economic factor so we choose three provinces in East, West and Central China and then make provincial capital and a prefecture for reference considering the administrative, population, economic level and cultural differences of each region. Besides the economic factors of each city, we also considered the number of city population, which would determine the number of questionnaires we issued. To better reflect the internal differences in the same region, that is the difference between provincial capitals and prefecture-level cities, we selected the main urban districts of each city as the survey sites.

##### 4.2 Sample and data acquisition methods

This survey is to obtain data for a comparative study on the situation of agri-food consumers in different regions of China. Because the quality and safety problem of agri-food are differs in urban and villages, the survey targets urban food consumers. The heterogeneity of subjects in this survey was high due to cultural and economic differences across regions, therefore we adopted a stratified random sampling method combining hierarchical sampling to ensure the rationality of the sample. The hierarchy of the sample is reflected as follows: region (east, middle, west)—province—city—district, which ensures the uniformity of sample distribution and further reflects the representative of samples to facilitate the comparison between regions. The survey planned to issue 1070 questionnaires, 1080 were actually recovered. The questionnaires exceeding the plan are the standby questionnaires collected.

##### 4.3 The organization of survey work

Considering the large sample size required by the study and the effectiveness of economical processing problems, we decided to use a self-filled questionnaire to conduct a field survey of consumer behavior in representative regions of East, Central and West China. We firstly used a small-scale pre-survey with 40 questionnaires in Chengdu and Chongqing city so as to make the questionnaire improved. The composition of the survey team was also experimental. Due to the scattered location and cultural differences of the survey sites, the limitation of resources, and the time factors, we tried to organize a survey team in the local site so as to ensure the efficiency of the survey. We have trained all the

investigators prior to the formal investigation. Investigators were assigned to each city and city districts according to the research plan. In the summer vacation of 2016 to 2018, the survey of Sichuan, Shandong and Hubei provinces were completed respectively.

#### **4.4 Descriptive analysis**

The content of this survey covers consumers' detailed information. Besides the basic factor such as gender, age, education, occupation and income, this survey includes consumer family composition, dining form, family member health status, in order to find out the potential factors that affect consumers' agri-food purchase behavior. From the overall situation of the survey, the sex ratio of consumers was relatively average, with women accounting for 53.5% of the total sample, men 46.3%. The distribution of sex ratio in different regions was not quite different.

As the overall marital status of the surveyed consumers, the ratio of married and unmarried was roughly 2:1 (64.7%: 33.2%). From the perspective of overall age distribution of the survey subjects, nearly 80% of the consumers are concentrated at 45 years old and below. Consumers at this age stage occupy a dominant position in the society. The respondents were mainly married, showing a balanced gender ratio. In terms of age, women under the age of 45 accounted for a third of the total interviewees. The overall educational status of the surveyed consumers is mainly concentrated below graduate students, ranging from high school to university.

The education concentration of consumers is different in different sample cities. The proportion of the education level of the two cities in western China is quite different, which is mainly reflected in university and junior middle school. East area Jinan and Tai'an and Central cities Wuhan and Xiaogan show relatively consistency in the proportion of education. The sample size of graduate students and above was slightly inadequate in three districts. Overall, the distribution of consumer education levels in our survey is relatively balanced, which is more powerful in reflecting the cognition and attitude of consumers on the quality and safety of agri-food.

The classification methods are inconsistent due to the wide variety of occupations. Therefore, our questionnaire was mainly divided by the standard occupational classification. The options of this survey would not exhaust all the occupations, but we try to ensure that the occupations of the interviewees can be evenly distributed, so as to explore the impact of occupations on consumers' purchase of agri-food. The questionnaire sets two questions about dining format and whether the surveyed consumers are regular shoppers. These two questions determine whether consumers are directly involved in the whole consumption behavior of agri-food, and how much their cognition and behavior affect the whole process. According to the statistics, main home shoppers accounted for 2/3 of the population, especially female shoppers, which accounted for 42.88%. Consumers who regularly eat at home accounted for three-quarters of the total sample size. From the previous research, the purchase power of consumers will affect their agri-food purchase behavior. We therefore investigated the monthly household income of the consumers.

53% of consumers would choose farmers' markets as a place to buy, while the remaining 38% of consumers would choose supermarkets as purchase locations, only 9% chose roadside vendors. As the distribution of purchase locations in each sample city, the proportion of consumers selecting farmers' markets in western cities is higher than that in eastern and central cities, showing a relationship with consumers' consumption concept and city's development level.

### **5. Empirical analysis**

In order to better simulate and understand the impact of various factors on consumers' final purchase behavior, this section will use statistic models to analyze the purchase behavior of agri-food consumers, so as to explore the differences of consumers in different regions in buying safety-labeled agri-food. A log-linear model is usually used when analyzing categorical variables. According to the purpose of this study, we set whether to buy safety certification agri-food as the dependent variable, including two values: buy and not buy. That is, we select logistic regression model to make statistic analysis on consumer purchase behavior.

#### **1) Model establishment**

Linear regression model and log regression model are the most popular methods of statistical analysis. A log-linear model is usually used when analyzing categorical variables. According to the purpose of this

study, we set whether to buy safety certification agri-food as the dependent variable, including two values: buy and not buy. That is, we select logistic regression model to make statistic analysis on consumer purchase behavior.

Assuming that there is a theoretically existing continuous response variable  $y_i^*$  representing the possibility of an event, its domain of value is from negative infinity to positive infinity. When the value domain of the variable spans a critical point  $c$  (e. g.,  $c=0$ ), the event occurs. So there is

When  $y_i^* \geq 0$ ,  $y_i=1$

In other circumstances,  $y_i=0$

Here  $y_i$  is the actual observed response variable, where  $y_i=1$  means an event occurred, and  $y_i=0$  means an event did not occur. If assuming a linear relationship between the response variable  $y_i^*$  and the independent variable  $x_i$ ,

$$y_i^* = \alpha + \beta x_i + \theta_i \quad (1)$$

The logistic function with S-type distribution can be obtained from formula (1)

$$P(y_i=1|x_i) = P[\theta_i \leq (\alpha + \beta x_i)] = 1 / (1 + e^{-\theta_i}) \quad (2)$$

Mark the conditional probability of an event occurrence as  $P(y_i=1|x_i)=p_i$ , we can get the regression model according to the logistic function

$$p_i = 1 / (1 + e^{-(\alpha + \beta x_i)}) = e^{\alpha + \beta x_i} / (1 + e^{\alpha + \beta x_i}) \quad (3)$$

$p_i$  is the probability of the  $i$ th case, It is a non-linear function composed of the explanatory variable  $x_i$ . Transform this linear function to:

$$\ln [p_i / (1 - p_i)] = \alpha + \beta x_i \quad (4)$$

The model constructed in this paper has multiple independent variables ( $x_{1j}$ ,  $x_{2j}$ ,  $x_{3j}$ ,.....), and the corresponding logistic regression model is:

$$\ln [p_i / (1 - p_i)] = \alpha + \sum \beta_k X_{ki} \quad (5)$$

Compared with consumers in Shandong province, consumers in Sichuan and Hubei provinces are more vulnerable to psychological factors when buying safety-labeled agri-food. Consumers in Shandong who decide whether to buy safety-labeled agri-food are more vulnerable to demographic and economic factors, including consumers' age and monthly household income. In general, the age of consumers, the attention to the quality and safety of agri-food, the factors considered when buying agricultural products, the monthly family income, shopping location and the frequency of consumers shopping are the main factors for consumers to buy safety-labeled agri-food.

## 6. Conclusion

The study showed that 67.5 percent of consumers were neutral on the overall quality and safety of agricultural products, while other consumers were slightly more dissatisfied. Consumers in western and central cities are more dissatisfied than consumers in eastern cities. According to the overall evaluation of consumers on the quality supervision of agricultural products, 53.8% of consumers held a neutral attitude, and a third of consumers showed dissatisfaction. Consumers have a certain understanding of safety certification agricultural products, but it is not deep and accurate enough, especially the understanding of organic food is very insufficient. Consumers are relatively familiar with green food and pollution-free agricultural products. 85.9% of consumers have heard of green food, fewer consumers have heard of organic food, and still 6.2% of consumers have not heard of it. Consumers' identification for the safety-labeled agri-food is far lower than the familiarity, with 42.6% of them cannot identify any of the three labels.

The most important factors for consumers when buying agricultural produce are safety, price, taste and quality. Consumers in eastern cities focus mainly on the food price, while central consumers focus on safety and quality more than price. Western cities focus on taste and quality while different on safety and price. Consumers believe that the agricultural produces that are more prone to quality and safety problems are vegetables, meat, fresh aquatic products and milk. From a geographical point of view, consumers in western cities think the quality and safety of meat and milk is more serious, consumers in central cities think the quality and safety of meat and vegetables is more serious, while consumers in

eastern cities think the quality and safety of meat and fresh aquatic products is more serious. The source of information trusted by consumers is mainly the information published by the government and the media. Consumers get information on the quality and safety of agri-foods mainly from TV broadcasts, newspapers and magazines, family and friends and their own experience. 88.07 percent of consumers suspend purchases when they hear of quality and safety problems with certain agricultural products.

Consumers are different from choosing pollute-free, green food and organic food, and the influencing factors of their purchase behavior are different. The influencing factors of green food purchase behavior are more complex than those of pollute-free agricultural products and organic food. Consumers in Sichuan and Hubei are more vulnerable to psychological factors when buying safety-labeled agricultural products. Consumers in Shandong are more vulnerable to demographic and economic factors, including age and monthly household income.

Consumers are the driving force of business development. But at present, there are still some illegal manufacturers counterfeiting pollution-free agricultural products, green food and organic food certification logo to confuse consumers, reduce the credibility of safety certification agricultural products, so that the rights and interests of consumers are damaged. Therefore, the relevant government departments should strengthen the quality and safety supervision of agricultural products, and actively establish and improve the management system of pollution-free agricultural products, green food and organic food. We should establish and improve a sound routine inspection system in accordance with the requirements of laws and regulations. Relevant regulatory departments should strengthen the sense of service, improve the construction of agricultural product quality and safety information system, improve the traceability ability, and further improve the efficiency of solving problems for consumers.

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