

Consumer Perceptions upon Food Safety and Demographic Determinants in China : Empirical Analysis based on a Survey of 512 Respondents

Li, Dongpo

Institute of Rural Economics, Hebei Academy of Social Sciences

Nansekai, Teruaki

Faculty of Agriculture, Kyushu University

Takeuchi, Shigeyoshi

Faculty of Agriculture, Kyushu University

Song, Min

Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences

他

<https://doi.org/10.5109/25214>

出版情報 : 九州大学大学院農学研究院紀要. 57 (2), pp.517-525, 2012-09-20. Faculty of Agriculture, Kyushu University

バージョン :

権利関係 :



Consumer Perceptions upon Food Safety and Demographic Determinants in China: Empirical Analysis based on a Survey of 512 Respondents

Dongpo LI¹, Teruaki NANSEKI^{2*}, Shigeyoshi TAKEUCHI², Min SONG³,
Tinggui CHEN⁴ and Hui ZHOU⁵

Laboratory of Agricultural and Farm Management, Division of Agricultural and Resource Economics,
Department of Agricultural and Resource Economics, Faculty of Agriculture,
Kyushu University, Fukuoka 812-8581, Japan

(Received April 27, 2012 and accepted May 10, 2012)

Based on a survey of 512 respondents from Beijing and Shanghai, this paper studies consumer perceptions upon food safety and the major affecting factors. In addition to the basic individual information of gender, age, educational background and employment, the demographic variables include professional experience of the respondent, family composition and annual income as well. The perceptions consist of overall awareness about food safety, major source of information and subjective reliability; understanding on the impact of environmental protection, main menaces to food safety, top source of agro-pollution, most risky procedure or stage; viewpoints on the major responsibility bearer of agro-pollution, best way to control agro-pollution. After the descriptive analysis on demographic characteristics and perception variables, One-way T-test reveals that all the 9 demographic variables are significant in identifying the discrepancies among most of perceptions. Moreover, further analysis is conducted on the impact of demographic variables significant in the level of 0.01. Finally, a variety of policy recommendations are put forward, from strengthening the supervisory responsibility of government, giving full play to the functions of mass media, consolidating the supervision of key sectors, to accelerating the extension of environment-friendly technology.

Keywords: China, consumer, determinant, food safety, perception

INTRODUCTION

With the fast development of science and technology in production and processing, food is being supplied with diversified taste, craft, nutrition, etc. Nevertheless, food safety is growing to be a global concern among consumers simultaneously, due to their asymmetric information on the processes, additives in the long industrial chain, and also influence of the flourishing public media. Consumers are demanding for the reinforced assurance of food safety, and even one isolated event may cause major market disruptions (Tonsor *et al.*, 2009). In addition to the endeavors by governmental agencies and enterprises, food safety, especially from the perspective of promoting consumers' confidence, has received considerable attention of scholars, including Knight *et al.* (2009), Jonge *et al.* (2010), Tonsor (2011), Lee *et al.* (2012), Yeung and Yee (2012), etc.

Being the largest developing country, China has surpassed the US to become the world's largest food and grocery retail market by the end of 2011, according to the new research revealed by the international food and grocery expert IGD (Askew, 2012). At the same time, fre-

quent outbreak of food safety scandals has undermined consumers' confidence and resulted in huge losses to food industry. Thus scholars are imposed with the indispensable obligation to study consumer perceptions and determinants upon food safety. In latest years, especially after the melamine milk powder incident occurred in September of 2008 (for more details, refer to Qiao *et al.*, 2012), many scholars have conducted empirical studies on food safety, on the basis of consumer survey. In general, the study topics include: (1) consumers' overall perceptions on food safety. Wang *et al.* (2009) and Xu and Wu (2010) examine consumers' willingness to pay (WTP) for the safe fishery products, certified & traceable food, respectively. Qiao *et al.* (2010) study the changes of consumers' confidence on domestic dairy industry after melamine milk powder incident, while Zhang, X. *et al.* (2010) divide the sampled consumers into four groups, in respect to their perceptions and attitudes to GM food. (2) Consumers' behaviors on choosing safe food. Zhang, C. *et al.* (2010) examine consumers' identification of safe dairy products; Ortega *et al.* (2011) measure the heterogeneity in consumers' preferences for selecting safe pork; Kim (2009) conducts factor analysis on consumers' purchase of GM food. (3) Integrated study of perceptions and behaviors towards food safety. Han *et al.* (2012) compare the consistency of consumers' stated and revealed preferences to certified pork.

Although the existing studies have covered many essential aspects and provided instructive recommendations, there are still a variety of topics need to be researched with further depth. For instance, (1) consumers' overall awareness towards the situation of food

¹ Institute of Rural Economics, Hebei Academy of Social Sciences, P. R. China

² Faculty of Agriculture, Kyushu University

³ Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, P. R. China

⁴ College of Economics and Management, Shanghai Ocean University, P. R. China

⁵ Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University

* Corresponding author (E-mail: nanseki@agr.kyushu-u.ac.jp)

safety, which constitutes the basis for analysis of individual behaviors; (2) inclusion of questions covering the whole industrial chain of food supply, from agricultural production as the origin process; (3) empirical analysis of the relationship between consumers' demographic characteristics and perceptions, etc. Therefore, based on the survey of 512 respondents from Beijing and Shanghai, the top two metropolises in China, this study analyzes consumer perceptions towards food safety, including general concern and valuation; major information sources and the subjective reliabilities; awareness on the causes and countermeasures of food safety risks. To explore significant determinants behind the perceptions, a variety of demographic variables are included, from the gender, age, employment, education background of the respondents, to the member composition and annual income of each household. The remainder of the paper is organized as follows: Section 2 briefly describes the questionnaire, sampling and demographic characteristics; Sections 3 exhibits major perceptions of the surveyed consumers; Sections 4 analyzes the major determinants behind; Section 5 presents the conclusions and policy recommendations, followed by further discussion.

ABOUT THE FIELD SURVEY

Questionnaire and sampling

To understand the present situation and farmers' perceptions on food safety, we conduct the survey with questionnaire-based personal interviews, to collect first-hand data. The questionnaire consists of 30 multi-option questions, which are divided into the following 4 sections, according to different topics of information we intend to collect.

As shown in Table 2, (1) we inquire consumers' overall awareness towards food safety with 4 questions in the first section. The main topics include their concern about food safety, ranking from *very much* to *not at all*; subjective valuation on the safety of current food supply, with the main candidate answers ranging from *very safe* to *very risky*; major source of concerning information, where the candidate answers incorporate not only the traditional mass media of radio & television, newspaper & magazine, newly developing media of internet, but also the other routes as relatives, experts, commercial advertisement, package information, etc; most reliable information source, varying from government, experts, internet, relatives, producers & vendors, commercial advertisement. Besides, with a question for reference, we ask consumers' awareness on the 3 kinds of certified food of Harm-free, Green and Organic. (2) Section 2 is composed of 7 questions, within which the first 5 questions include consumers' awareness on the relationship between environmental pollution and food safety, with 5-level ordinal options from *very intimate* to *not exist*; most risky substance to food safety, with the multiple options of industrial, agricultural, and civil pollution; top source of agro-pollution, to be chosen from industrial pollutant, urban or rural civil pollutant, and agricultural

chemicals; most risky procedure or stage within food supply, covering from agro-production to consumption. In addition, we have another 2 questions, inquiring consumers' perceptions upon major responsibility bearer of agro-pollution, with the options of the government, farmer, producer of agro-inputting materials (chemicals in main), consumers, etc; best ways to control agro-pollution, including the optional answers of legislative perfection, extending environmental technology, etc. (3) Although not adopted in this study, we ask consumers' perceptions on the safety of dairy products with 10 questions in section 3. The topics vary from overall awareness; subjective valuation on the risky substances and processes; acquaintance upon the food certificating systems of GAP (Good Agricultural Practices) and HACCP (Hazard Analysis Critical Control Point); purchasing and consuming behaviors. (4) In the final section, our questionnaire contains 8 questions on demographic characteristics of the respondents. In addition to gender, age, employment, education level, we inquire their family scale, member composition and annual income of the household simultaneously (Table 1).

In January to March, 2012, we surveyed consumers in the two metropolises of Beijing and Shanghai. The survey was completed thanks to the kind corporation of China Agricultural University and Shanghai Ocean University, from where altogether 30 students were selected and trained as surveyors. All of them are undergraduates or postgraduates majoring in food economics or similar fields. The respondents are determined from two ways: on one hand, they are relatives of the surveyors or residents nearby; on the other hand, random surveys were conducted through interviewing consumers, encountered mainly near the major supermarkets. In principle, one surveyor can interview no more than 20 consumers. Because some of the authors participated in this survey as well, the initial sample size amounted to 617. Nevertheless, screened mainly from rationality and completion of data, 512 samples are accepted as valid and used in the final analysis, thus the ratio of valid samples is 82.89 percent.

Demographic characteristics

(1) Basic individual information. In this survey, 304 respondents are female, with the proportion of almost 60 percent, while the males account for 40.6 percent. Viewing from age distribution, 20–29 year-old respondents have the largest proportion of 30 percent, following by the ages of 30–39 (26 percent), 40–49 (22 percent), etc.

(2) Additional individual information. As to the occupation, respondents employed in enterprises and public institutions account for the largest proportion of 28.7 percent and 23.2 percent, respectively. Meanwhile, although categorized as the other types, 21.6 percent of the sampled consumers are student, retired, etc; 13.7 percent are free employee. In addition, much fewer respondents answered as serving in government or being unemployment. With regard to whether possessing professional background in agriculture, food and medicine,

only 14.8 percent of respondents provided positive answers. Judging from the data collected, 45.9 percent of the respondents have the experience of receiving college education, and 14.8 percent are even postgraduates; 28.1 percent having the experience of attend high school, while respondents have middle school and less educational background account for only 11.2 percent.

(3) Household information. As to the dichotomous questions on whether family consists of preschool child, primary or middle school student, and elderly over 60 years, the positive answers are 10.2 percent, 40.8 percent and 31.1 percent, respectively. Finally, with respect to the annual household income, one third of the respondents answered as 70–150 thousand *yuan*, following by 35–70 thousand *yuan* (28.6 percent), less than 35 thousand *yuan* (17.2 percent) and 150–300 thousand *yuan* (16.4 percent), while only 4.5 responded as over 300 thousand *yuan* (Table 1).

PERCEPTIONS ON FOOD SAFETY

Overall awareness on current situation

(1) Concerning about food safety. Among 505 valid respondents, altogether 87.5 percent answer as *very much* or *much* concern; 11.5 percent of consumers respond as *a little* concern; while only 1.0 percent of consumers answer as *do not* concern. Similar with the remarks of Xu and Wu (2010), Ortega *et al.* (2011), etc, it reveals the heightened public concern over food safety in China, especially after the outbreak of a series of scan-

dals.

(2) Valuation of food safety. Altogether 42.7 percent of consumers choose the answer of *risky*, accounting for 42.7 percent within the valid samples; consumers respond as *safe* amount to 36.8 percent, following by the 12.9 percent consumers answering as *very risky*, while only 3.6 percent of consumers evaluate the current supply of food as *very safe*. This pessimistic result about food safety is in line with Qiao *et al.* (2010), where most of the respondents feel unsafe upon dairy products.

(3) Mostly used information source. More than half (50.9 percent) of the interviewed consumers get information concerning food safety from radio and television, following by internet (26.6 percent), newspaper and magazine (8.7 percent); each of the other sources chosen as most important information accounts for no more than 5 percent among the respondents. The ranking is in accordance with the relative importance major media, in terms of providing living information to the public in China today. Particularly, with the fast popularization of internet, it has transcended paper-based newspaper and magazine to be the most important source of getting information on food safety, for more than one fourth of the sampled consumers.

(4) Mostly reliable information source. Although looks similar with questions in (3), which focus on the reality that where consumers be informed directly, questions here tend to capture consumers' subjective judgment of the most reliable information source. According to the answer of 500 valid respondents, government and

Table 1. Demographic characteristics of the surveyed consumers

Characteristic	Valid N	%	Characteristic	Valid N	%
1. Basic individual information					
1.1 Gender of the respondent (<i>d1</i>)	512	100.0	2.3 Education level of the respondent (<i>d5</i>)	499	100.0
Male	208	40.6	Primary school and less	10	2.0
Female	304	59.4	Junior middle school	46	9.2
1.2 Age of the respondent (<i>d2</i>)	504	100.0	High school	140	28.1
<20	30	6.0	College	229	45.9
20–29	151	30.0	Postgraduate	74	14.8
30–39	131	26.0	3. Household information		
40–49	111	22.0	3.1 Preschool Child (<i>d6</i>)	512	100.0
50–59	55	10.9	Yes	52	10.2
60≤	26	5.1	No	460	89.8
2. Additional individual information			3.2 Primary and middle school student (<i>d7</i>)	512	100.0
2.1 Employment of the respondent (<i>d3</i>)	505	100.0	Yes	209	40.8
Government	31	6.1	No	303	59.2
Public institution ^a	117	23.2	3.3 Elderly over 60 years (<i>d8</i>)	512	100.0
Enterprise	145	28.7	Yes	159	31.1
Free employee	69	13.7	No	353	68.9
Jobless	34	6.7	3.4 Annual household income (<i>d9</i>)	493	100.0
Other (student, retired, etc)	109	21.6	<35000 <i>yuan</i> ^b	85	17.2
2.2 Background in agriculture, food and medicine (<i>d4</i>)	512	100.0	35000–70000 <i>yuan</i>	141	28.6
Yes	76	14.8	70000–150000 <i>yuan</i>	164	33.3
No	436	85.2	150000–300000 <i>yuan</i>	81	16.4
			300000–500000 <i>yuan</i>	18	3.7
			500000 <i>yuan</i> ≤	4	0.8

Note: ^a Public institution refers to the institution of public interests, i.e., hospital, educational institutions, academy, etc; ^b *yuan* is the major currency unit in China, and 1 US\$ equals to 6.30 *yuan* by the end of 2011.

Source: field survey by the authors

Table 2. Summary of consumer perceptions on food safety

Characteristic	Valid N	%	Characteristic	Valid N	%
1. Overall awareness on current situation					
1.1 Concerning about food safety	505	100.0	2.2 Top menace to food safety	504	100.0
Very much	218	43.1	Industrial pollution	290	57.5
Much	224	44.4	Agricultural pollution	148	29.4
A little	58	11.5	Civil pollution	46	9.1
Not at all	5	1.0	No idea	20	4.0
1.2 Valuation of food safety	505	100.0	2.3 Top source of agro-pollution	501	100.0
Very safe	18	3.6	Industrial pollutant	199	39.7
Safe	186	36.8	Urban civil pollutant	37	7.4
Risky	216	42.7	Rural civil pollutant	34	6.8
Very risky	65	12.9	Agricultural chemicals	229	45.7
No idea	20	4.0	Other	2	0.4
1.3 Mostly used information source	493	100.0	2.4 Most risky procedure or stage of food supply	505	100.0
Radio & television	251	50.9	Agricultural production	215	42.6
Newspaper & magazine	43	8.7	Harvest of agro-products	12	2.4
Internet	131	26.6	Processing	234	46.3
Relatives	24	4.9	Transportation	24	4.8
Experts (doctor, researcher, etc.)	12	2.4	Marketing	7	1.4
Commercial advertisement	7	1.4	Consumption	1	0.2
Package information	21	4.3	Other	11	2.2
Other	4	0.8	No idea	1	0.2
1.4 Mostly reliable information source	500	100.0	3. On the risk management		
Government	174	34.8	3.1 Major responsibility bearer of agro-pollution	506	100.0
Experts (doctor, researcher, etc.)	168	33.6	Government	273	54.0
Internet	31	6.2	Farmer	29	5.7
Relatives	53	10.6	Producer of agro-chemicals, etc	170	33.6
Producers & vendors	11	2.2	Consumer	7	1.4
Commercial advertisement	29	5.8	No idea	15	3.0
None	29	5.8	Other	12	2.3
Other	5	1.0	3.2 Best way to control agro-pollution	506	100.0
2. On the major affecting factors			Perfecting the legislation	168	33.2
2.1 Relationship of environment and food safety	503	100.0	Extending environmental technology	136	26.9
Very intimate	356	70.8	Subsiding environmental behaviors	37	7.3
Intimate	102	20.3	Strengthening the penalties	96	19.0
No idea	40	8.0	Enlarging farm managerial scales	54	10.6
Almost no	3	0.6	Other	15	3.0
Not exist	2	0.4			

Source: field survey by the authors

experts are selected by consumers with the largest proportions of 34.8 percent and 33.6 percent, respectively; following by relatives with a percentage of 10.6. It is of interests that internet possesses the favorite respondents of only 6.2 percent; despite that 26.6 percent of interviewed consumers choose it as the mostly used information source. Similarly, in the analysis of Zhang, X. *et al.* (2010), respondents are found to attach high importance to government and scientists, from perspective of ensuring the safety of genetically modified food (Table 2).

On the major affecting factors

(1) Relationship of environment and food safety. According to the data collected in this survey, 70.8 percent of the interviewed consumers believe that there are *very intimate* relationship between environment and food safety; 20.3 percent admit the existence of *intimate* relationship; while very few respondents deny the influence of environment to food safety. It indicates that

the concept of environmental protection has gained wide acceptance, even from the perspective of food safety.

(2) Top menace to food safety. Among the optional answers, industrial pollution is selected by 57.5 percent of consumers, which is the largest proportion among respondents; following by agricultural pollution with the proportion of 29.4 percent; while only 9.1 percent of the consumers selected civil pollution as the top menace to food safety. In addition to industrial pollution, this result reveals that impacts of agricultural pollution are drawing public attention simultaneously, for the guarantee of food safety.

(3) Top source of agro-pollution. Agricultural chemicals and industrial pollutant are the most important source of agro-pollution, to 45.7 and 39.7 percent of the interviewed consumers, respectively. Many of food safety problems in China can be traced back to the farm level, as some farmers still rely heavily on the use of highly toxic pesticides, to maintain the output of agro-

products (Zhou and Jin, 2008; Li *et al.*, 2012). Meanwhile, both urban and rural civil pollutants are selected by no more than 8 percent of the respondents.

(4) Most risky procedure or stage of food supply. Among consumers' answer, processing and agricultural production are most risky to food safety, with the proportion of 46.3 and 42.6 percent, respectively. For food processing, the high ratio may due to asymmetric information on the operations, additives, and the frequent disclosure of concerning scandals by the public media (Ortega *et al.*, 2011; Qiao *et al.*, 2012). Simultaneously, much fewer respondents selected the other procedures or stages, i.e., harvest of agro-products (2.4 percent), transportation (4.8 percent), marketing (1.4 percent), consumption (0.2 percent), etc (Table 2).

On the risk management

(1) Major responsibility bearer of agro-pollution. Most of the surveyed consumers ascribe the responsibility to government, following by producer of agro-chemicals, etc, with the proportions of 54.0 and 33.6 percent, respectively. In prior literature, Dellios *et al.* (2009) introduce the Corporate Social Responsibility (CSR) into food industry, and explore the important role of government in tackling with food safety problems. Similarly, Qiao *et al.* (2010) analyze responsibilities of government and corporate agencies, in taking efficient countermeasures to ensure food safety and maintain consumers' confidence. In addition, much fewer respondents believe that this responsibility should be taken by farmers (5.7 percent) and consumers (1.4 percent), etc.

(2) Best ways to control agro-pollution, answers of which can be divided into three groups. The first group includes perfecting the legislation, extending environmental technology, supported by 33.2 and 26.9 percent of respondents, respectively. As surveyed by Qiao *et al.* (2012), quite few (12.4 percent) consumers have knowledge about the Act of Food Safety that has gone into

effect on June 1, 2009. According to our prior survey, toxic pesticides are still being widely used, while bio-controls of pest are not yet well extended to agricultural production (Li *et al.*, 2012). The second group comprises strengthening the penalties, enlarging farm managerial scales, with the favorite proportion of 19.0 percent and 10.6 percent. Significance of the larger farming scales lies in the easier adoption of advanced and environmental technology, with much initiatives and capital power. The third group consists of subsidizing environmental behaviors and others, from the eyes of 7.3 and 3.0 percent of surveyed consumers (Table 2).

IMPACT OF DEMOGRAPHIC CHARACTERISTICS

Significance of demographic effects

To measure relative importance of the candidate perceptions, we calculate their ratios within each demographic variable. Furthermore, similar with Steiner *et al.* (2005), Gacula and S. Rutenbeck (2006), Coefficient of Variation (CV) of these ratios is computed to showcase discrepancy of consumers' perceptions towards a certain optional answer upon food safety, crossing different features within each demographic characteristic (Table 3). Taking the first value of 0.17 as an instance, it is the CV of percentages of male and female respondents concerning food safety very much. In general, a smaller value of CV indicates less variation of responding ratios, hence less influence from difference of this demographic characteristic. For another instance, as to the ratios of concerning about food safety *very much*, CVs from different gender and age are 0.17 and 0.14, respectively, thus affects of the gender is larger than that of the age. In succession, to identify significance of the CVs, One-Way T-test is conducted with the application of SPSS 13.0 (Steiner *et al.*, 2005)¹. The null hypothesis is that each of the population mean of CVs is not significantly differ

Table 3. Coefficient of Variation of responding ratios within each demographic characteristic

Perception and options ^a		d1	d2	d3	d4	d5	d6	d7	d8	d9
Concerning about food safety	Very much	0.17	0.14	0.17	0.08	0.26	0.02	0.03	0.07	0.32
	Much	0.09	0.12	0.07	0.10	0.18	0.03	0.04	0.03	0.21
	A little	0.20	0.39	0.52	0.07	0.59	0.00	0.15	0.13	0.54
	Not at all	0.99	1.22	1.08	0.82	0.96	1.41	1.41	0.41	1.11
...
Best way to control agro-pollution	Perfecting the legislation	0.12	0.13	0.23	0.19	0.39	0.16	0.13	0.03	0.49
	Extending environmental technology	0.02	0.39	0.23	0.23	0.09	0.00	0.16	0.05	0.27
	Subsidizing environmental behaviors	0.06	0.61	0.55	0.06	0.56	0.04	0.02	0.26	0.71
	Strengthening the penalties	0.17	0.42	0.56	0.09	0.32	0.22	0.21	0.15	0.55
	Enlarging farm managerial scales	0.07	0.46	0.28	0.12	0.36	0.08	0.34	0.13	0.63
	Other	0.24	1.31	1.31	0.70	1.13	0.42	0.24	0.51	2.06

Note: ^a responses of *no idea* are excluded in this table; ^b the same coefficient is computed within other perceptions.
Software: SPSS 13.0

¹ In many studies (e.g., X. Zhang *et al.*, 2010), crosstabs analysis with the Chi-square test is applied to identify the determinants of consumer behaviors and conceptions. However, Chi-square test assumes that the expected value for each cell is 5 or higher (Bruin, 2006). After the computation of CVs here, this assumption of Chi-square test cannot be met, and thus T-test is adopted.

Table 4. T-values of the discrepancy of responds with different demographic characteristics

	d1	d2	d3	d4	d5	d6	d7	d8	d9
Concerning about food safety	1.72	1.81	2.02	1.45	2.80*	1.05*	1.22	1.86	2.72*
Valuation of food safety	2.67*	2.18	1.92	2.55*	3.44**	2.06	1.30	1.54	4.17**
Mostly used information source	4.14***	4.75***	3.33**	2.76**	5.66***	2.84**	3.35**	2.28*	5.45***
Mostly reliable information source	3.85***	4.94***	4.14***	2.89**	5.47***	1.76	3.29**	2.78**	6.71***
Relationship of environment and food safety	3.84**	2.51*	2.36*	2.17*	3.30**	2.14*	2.29*	1.94	2.18*
Top menace to food safety	2.50	3.37*	2.18	3.39*	5.63**	1.39	1.49	8.49**	4.39**
Top source of agro-pollution	1.74	2.38**	1.52	2.63*	2.85**	1.87	1.34	1.29	2.51*
Most risky procedure or stage of food supply	2.51**	2.62**	3.26**	2.78**	3.68**	2.98**	1.87	2.72**	3.42**
Major responsibility bearer of agro-pollution	2.62*	2.93**	2.86**	1.63	3.22**	1.48	2.70*	1.96	5.40***
Best way to control agro-pollution	3.43**	3.37**	3.12**	2.38*	3.28**	2.45*	4.15***	2.60**	2.99**

Note: * Numerals are the T-values of One-Sample T-test on whether mean of CVs within each perception significantly differ from 0;

^b ***, ** and * denote statistical significance in the level of 0.01, 0.05 and 0.1 respectively.

Software: SPSS 13.0

from 0, when respondents' choice is unaffected by this demographic characteristic. If the null hypothesis is rejected with a small p -value than the thresholds of 0.01, 0.05 or 0.1, there is evidence that significant discrepancy exists among different features within a demographic characteristic, and *vice versa* (Bruin, 2006).

As shown in Table 4, education level of the respondent (d5) and annual household income (d9) are significant, despite the differences in significance level, in capturing respondents' discrepancy upon options towards all the 10 types of perceptions. Meanwhile, all the other 7 demographic variables are measured as significant in identifying discrepancies among most of the perceptions. Thus in our questionnaire, the adoption and classifica-

tion of the demographic variables are rational, in showcasing the diversified perceptions among surveyed consumers.

Effect on the overall awareness

Based on the results of T-test in Table 4, it makes sense to conduct further analysis on consumers' perception, with significant effect from their demographic characteristics. Nevertheless, to capture the major determinants of consumers' perceptions, only relationships significant in the level of 0.01 are included below.

(1) Mostly used information source is significantly determined by the following variables. i) Gender of the respondents (*Gender*), where the males are getting

Table 5. Percentages of responses to the major sources of information

	Gender (d1)		Age of the respondent (d2)					
	Female	Male	<20	20–29	30–39	40–49	50–59	60≤
Radio & television	50.0	52.2	26.7	45.8	45.7	56.8	66.0	80.8
Newspaper & magazine	8.3	9.4	3.3	8.5	10.9	12.6	3.8	0.0
Internet	27.9	24.6	60.0	33.1	29.5	15.3	15.1	7.7
Relatives	5.2	4.4	0.0	3.5	6.2	3.6	9.4	7.7
Experts	2.1	3.0	6.7	2.1	2.3	2.7	1.9	0.0
Commercial advertisement	1.4	1.5	0.0	0.7	1.6	3.6	0.0	0.0
Package information	4.5	3.9	3.3	4.9	3.1	5.4	3.8	3.8
Other	0.7	1.0	0.0	1.4	0.8	0.0	0.0	0.0
#Valid N	290	203	30	142	129	111	53	26

	Education level of the respondent (d5)					Annual household income (1000 <i>yuan</i>) (d9)					
	Primary and less	Junior middle	High school	College	Post-graduate	<35	35–70	70–150	150–300	300–500	500≤
Radio & television	60.0	67.4	58.3	47.5	38.4	63.9	52.5	47.8	44.3	50.0	25.0
Newspaper & magazine	0.0	4.3	8.6	10.5	8.2	6.0	10.1	11.5	6.3	5.6	0.0
Internet	10.0	2.2	18.0	33.3	37.0	19.3	23.7	26.1	34.2	33.3	75.0
Relatives	20.0	8.7	5.0	2.7	6.8	3.6	4.3	5.7	6.3	5.6	0.0
Experts	0.0	2.2	1.4	2.3	5.5	0.0	2.2	3.2	2.5	5.6	0.0
Commercial advertisement	0.0	2.2	3.6	0.5	0.0	1.2	2.2	1.9	0.0	0.0	0.0
Package information	10.0	10.9	5.0	2.3	4.1	4.8	4.3	3.8	6.3	0.0	0.0
Other	0.0	2.2	0.0	0.9	0.0	1.2	0.7	0.0	0.0	0.0	0.0
#Valid N	10	46	139	219	73	83	139	157	79	18	4

Source: field survey by the authors

Table 6. Percentages of responses to the mostly reliable sources of information

	Gender (<i>d1</i>)		Age of the respondent (<i>d2</i>)						Employment of the respondent (<i>d3</i>)					
	F.	M.	<20	20–29	30–39	40–49	50–59	60≤	Gov.	Public ins.	Enter-prise	Free Job	Job-less	Other
Government	30.8	40.4	37.9	25.5	37.2	40.5	40.7	38.5	35.5	34.2	33.6	42.6	35.3	32.1
Experts	37.7	27.9	34.5	33.6	34.1	37.8	24.1	30.8	38.7	41.0	33.6	27.9	26.5	29.2
Internet	6.8	5.3	3.4	10.1	5.4	0.9	9.3	7.7	0.0	3.4	4.9	10.3	2.9	11.3
Relatives	10.3	11.1	10.3	10.1	9.3	9.0	18.5	11.5	16.1	7.7	9.1	10.3	17.6	12.3
Producers & vendors	2.4	1.9	3.4	4.0	1.6	0.9	0.0	3.8	0.0	0.9	1.4	4.4	2.9	3.8
Commercial advertisement	5.1	6.7	0.0	6.0	5.4	8.1	3.7	7.7	6.5	6.8	6.3	2.9	11.8	3.8
None	5.8	5.8	10.3	9.4	6.2	1.8	1.9	0.0	3.2	5.1	9.1	1.5	2.9	6.6
Other	1.0	1.0	0.0	1.3	0.8	0.9	1.9	0.0	0.0	0.9	2.1	0.0	0.0	0.9
#Valid N	292	208	29	149	129	111	54	26	31	117	143	68	34	106

	Education level of the respondent (<i>d5</i>)					Annual household income (1000 <i>yuan</i>) (<i>d9</i>)					
	Primary and less	Junior middle	High school	College	Post-graduate	<35	35–70	70–150	150–300	300–500	500≤
Government	30.0	55.6	42.0	30.5	25.7	41.7	37.1	33.8	32.1	22.2	0.0
Experts	20.0	20.0	29.0	38.1	36.5	21.4	40.0	34.4	35.8	22.2	50.0
Internet	20.0	4.4	2.9	6.6	9.5	6.0	7.1	5.6	3.7	22.2	0.0
Relatives	20.0	11.1	14.5	7.5	10.8	13.1	6.4	10.6	9.9	27.8	0.0
Producers & vendors	10.0	4.4	1.4	1.8	2.7	6.0	1.4	0.6	3.7	0.0	0.0
Commercial advertisement	0.0	4.4	5.1	5.8	9.5	4.8	4.3	6.9	7.4	5.6	25.0
None	0.0	0.0	3.6	8.4	5.4	7.1	2.1	6.3	7.4	0.0	25.0
Other	0.0	0.0	1.4	1.3	0.0	0.0	1.4	1.9	0.0	0.0	0.0
#Valid N	10	45	138	226	74	84	140	160	81	18	4

Source: field survey by the authors

more information from the traditional media of radio, television, newspaper and magazine, while the females are relying more on the information from internet and relatives. ii) Age of the respondent (*d2*) is found as being positive with the use of radio and television, and negative with internet, respectively. iii) Education level of the respondent (*d5*), where negative relationships are found with the use of radio and television, while positive with that of internet. iv) Annual household income (*d9*) is measured as negative with radio and television, while positive with internet, similarly (Table 5). These findings are in line with the reality that internet is usually used for getting information, by young people with more leisure time, demands of fashion life–style and better educated. Meanwhile, the traditional media are still important in affecting consumers' perception and behavior.

(2) Mostly reliable information source. i) On the significant variable of *Gender*, 40.4 percent of the male respondents answer as being convinced on information released by the government in the first place, while 37.3 percent of the females believe expert as the mostly reliable source of information concerning food safety. ii) In terms of the *Age*, consumers aged 50–59 are sampled as having largest faith on government and relatives, while those aged 40–49 choose the experts. In addition, although proportioned only 10.1 percent, the 20–29 aged young consumers responded as having the largest proportion of relying on the internet. iii) Analyzing from the employment, free–employed consumers and those serving for the government are identified as possessing

the top proportions of believing in the information issued by the government and experts, respectively. iv) With regard to the impacts of education, consumers with middle–level educational background possess highest reliance on government, while that on the experts belong to consumers received advanced education. v) As to the effects of income, negative relationship is measured with the percentage of reliance on government. Meanwhile, total annual household income over 500 thousand *yuan* have the largest proportion of trust on experts of concerning fields (Table 6).

Effect on the perceptions of risk management

(1) Major responsibility bearer of agro–pollution. According to the result of T–test, largest discrepancies are identified across the annual household *income* of the consumers. In detail, those with the annual income over 300 thousand *yuan* have the largest proportion of at least 70.6 percent, attributing the major bearer to government (Table 7). It may because that people with much more income than average have the high–level demands of life, with food safety included as the basic requirement. As Chinese government has substantial power on almost all the sectors of national economy, it is indispensable to relay on the function of government for ensuring food safety.

(2) Best ways to control agro–pollution. Among the demographic characteristics, only whether there is primary or middle school student in a household (*d7*) is measured as significant in the level of 0.01. The major reasons behind may include that in the two metropo-

Table 7. Percentages of responses to the major responsibility bearer of agro-pollution

	Annual household income (1000 <i>yuan</i>) (<i>d9</i>)					
	<35	35–70	70–150	150–300	300–500	500≤
Government	59.3	51.1	55.6	53.2	70.6	100.0
Farmer	3.7	6.6	8.0	5.2	0.0	0.0
Producer of agro-chemicals, etc	30.9	38.0	34.0	39.0	23.5	0.0
Consumer	2.5	1.5	0.6	1.3	0.0	0.0
Other	3.7	2.9	1.9	1.3	5.9	0.0
# Valid N	81	137	162	77	17	4

Source: field survey by the authors

lises, almost all the family have only one child, who is treated preciously by the whole family. Moreover, children enrolled at primary or middle school are in critical time for both physical and mental growth. Different from preschool children who intake food supplied mainly by the family or kindergarten, primary and middle school student often buy food outside and intake by themselves. Thus their food safety is drawing significant attentions from both family and society. For the respondents with student in their family, the largest proportion of 37.6 percent supported the perfecting of concerning legislation, which is larger than that of negative respondents. Meanwhile, more consumers answered as without student are in favor of extending the environment-friendly technologies (29.8 percent) and strengthening the penalty on behaviors undermining the environment of agriculture (21.6 percent), being 5.9 and 4.5 percent than that of the consumers answered as yes, respectively (Table 8).

Table 8. Percentages of responses to the best ways to control agro-pollution

	Primary and middle school student (<i>d7</i>)	
	Yes	No
Perfecting the legislation	31.2	37.6
Extending environmental technology	29.8	23.9
Subsiding environmental behaviors	7.5	7.3
Strengthening the penalties	21.6	16.1
Enlarging farm managerial scales	8.6	14.1
Other	1.4	1.0
#Valid N	292	205

Source: field survey by the authors

CONCLUSIONS AND RECOMMENDATIONS

Major conclusions

Based on the survey to 512 respondents from Beijing and Shanghai, this paper studies consumer perceptions on food safety. (1) Analyses on the overall awareness indicate that most of the interviewed consumers are concerning about food safety; more than half of the respondents think the current situation of food supply is risky or very risky; television and internet are the most impor-

tant source of information on food safety, while concerning information getting from the government and expert are esteemed as most reliable. (2) In terms of perceptions on the major affecting factors, the significance of environment protection in ensuring food safety has been accepted by more than 90 percent of the surveyed consumers. Industrial and agricultural pollution are thought to be the top menace to food safety by almost 90 percent of respondents, while agro-chemicals and industrial pollutant are the top source of agro-pollution, to more than 80 percent of the sampled consumers. Processing and agricultural production are the most risky procedure or stage, with the proportion of 46.3 and 42.6 percent, respectively. (3) As to the risk management of food safety, most of the respondents think that the government and producers of the materials inputted to agriculture, especially those of the agro-chemicals, should take the responsibilities of agro-pollution at first. Perfecting the legislation and extending environmental technology are believed as the best ways to control agro-pollution by 60 percent of the consumers.

In succession, T-test reveals that all the 9 demographic variables are significant in identifying discrepancies among most of the perceptions. (1) With respect to the most important information source, internet is more used for getting information, by young people with more leisure time, demands of fashion life-style and better educated. Meanwhile, the traditional media of television, newspapers and magazine are still important in affecting consumers' perception and behavior. (2) From the perspective of most reliable information source, government is supported more by male, high-aged and free-employed consumers, while experts are trusted more by female, middle-aged, public servant and rich consumers. (3) Government is attributed to take the responsibility of agro-pollution significantly by those with the annual income over 300 thousand *yuan*. (4) Whether there is primary or middle school student in a household is measured as high-significantly affecting respondents' aptitude upon the best ways to control agro-pollution.

Policy recommendations

(1) Since the government is chosen as the mostly reliable source of information and major responsibility bearer of agro-pollution by most respondents, its supervisory obligations on food safety should be strengthened. Under the unified coordinating and leadership of the

National Food Safety Committee², responsibility of each department needs to be clarified, hence improve the supervisory efficiency through more initiative and regular investigations. (2) Considering the fact that most of the consumers responded as concern and worry about food safety, results of the supervisions should be disclosed to the public promptly. (3) Based on the findings of most risky procedure or stage, key sectors of food safety supervision include: appropriate sterilization, additives and labeling in the processing operations of food manufacturers; proper manufacture and application of agro-chemicals. (4) As to the internet which is found being widely used while relatively less trusted, further inspections are needed to improve its reliability in releasing food safety information. On the other hand, the government should take full use of mass media in collecting clues and communicating with the public. (5) Being one of the best ways to control agro-pollution, concerning legislations are necessary, including further provisions in the existing acts and formulation of Act of Agricultural Pollution Prevention, etc. (6) Due to the intimately relating environment and agro-pollution, and the functions in controlling agro-pollution, extension of environment-friendly techniques needs to be accelerated.

Further discussion

Food safety will continue to be a public concern in China. In addition to the increased demand of healthy and safe foods with the rapidly growing economy, it can be attributed to the frequent occurrence of scandals. Just when we write manuscript of this paper in April of 2012, large volume of jellies and medicine capsules are exposed as containing excessive amounts of chromium. In this wide-concerning incident, even some famous companies are involved, and the major mattering substance is suspected as the illegally added industrial gelatin. For the government and domestic food industry, they still have to strive for food safety. Meanwhile, a variety of topics are open to academic research, in terms of exploring technologies and countermeasures to ensure food safety. For instance, comparative study on behaviors and perceptions between producer and consumers, upon different food or culture, are beneficial for the administration of food safety.

REFERENCES

- Askew, K. 2012 Global: China becomes world's largest food market. *Just food*: http://www.just-food.com/news/china-becomes-worlds-largest-food-market_id118784.aspx
- Bruin, J. 2006 Newtest: Command To Compute New Test. UCLA: Academic Technology Services. *Statistical Consulting Group*: http://www.ats.ucla.edu/stat/spss/output/Spss_ttest.htm
- Dellios, R., X. Yang and N. K. Yilmaz 2009 Food safety and the role of the government: implications for CSR policies in China. *i Business*, **1**: 75–84
- Gacula, M. Jr. and S. Rutenbeck 2006 Sample size in consumer test and descriptive analysis. *J. Sens. Stud.*, **21**(2): 129–145
- Han, Q., H. Zhou, T. Nanseki and J. Wang 2012 The consistency of consumer's stated preference and revealed preference: evidence from agricultural product market in China, *J. Fac. Agr., Kyushu Univ.*, **57**(1): 227–234
- Jonge, J. de, H. V. Trijp, R. J. Renes and L. J. Frewer 2010 Consumer confidence in the safety of food and newspaper coverage of food safety issues: a longitudinal perspective. *Risk Anal.*, **30**(1): 125–142,
- Kim, R. B. 2009 Factors influencing Chinese consumer behavior when buying innovative food products. *Agr. Econ. – Czech*, **55**: 436–445
- Knight, A. J., M. R. Worosz and E. C. D. Todd 2009 Dining for safety: consumer perceptions of food safety and eating out. *J. Hosp. & Tourism Res.*, **33**: 471–486
- Lee, L. E., O. Niode, A. H. Simonne and C. M. Bruhn 2012 Consumer perceptions on food safety in Asian and Mexican restaurants. *Food Control*, **26**(2): 531–538
- Li, D., T. Nanseki, S. Takeuchi, M. Song, T. Chen and H. Zhou 2012 Farmers' behaviors, perceptions and determinants of pesticides application in China: evidence from six eastern provincial-level regions. *J. Fac. Agr., Kyushu Univ.*, **57**(1): 255–263
- Ortega, D. L., H. H. Wang, L. Wu and N. J. Olynk 2011 Modeling heterogeneity in consumer preferences for select food safety attributes in China. *Food Policy*, **36**: 318–324
- Qiao, G., T. Guo and K. K. Klein 2010 Melamine in Chinese milk products and consumer confidence. *Appetite*, **55**: 190–195
- Qiao, G., T. Guo and K. K. Klein 2012 Melamine and other food safety and health scares in China: Comparing households with and without young children. *Food Control*, **26**: 378–386
- Steiner, C. F., T. L. Darcy–Hall, N. J. Dorn, E. A. Garcia, G. G. Mittelbach and J. M. Wojdak 2005 The influence of consumer diversity and indirect facilitation on trophic level biomass and stability. *OIKOS*, **110**: 556–566
- Tonsor, G. T. 2011 Consumer inferences of food safety and quality. *Eu. Re. Agr. Econ.*, **38**(2): 213–235
- Tonsor, G. T., T. C. Schroeder, J. M. E. Pennings and J. Mintert 2009 Consumer valuations of beef steak food safety enhancement in Canada, Japan, Mexico and the United States. *Can. J. Agri. Econ.*, **57**: 395–416
- Wang, F., J. Zhang, W. Mu, Z. Fu and X. Zhang 2009 Consumers' perception toward quality and safety of fishery products, Beijing, China. *Food Control*, **20**: 918–922
- Xu, L. and L. Wu 2010 Food safety and consumer willingness to pay for certified traceable food in China. *J. Sci. Food & Agri.*, **90**: 1368–1373
- Yeung R. and W. M. S. Yee 2012 Food safety concern: Incorporating marketing strategies into consumer risk coping framework. *Brit. Food J.*, **114**(1): 40–53
- Zhang, C., J. Bai, B. T. Lohmar and J. Huang 2010 How do consumers determine the safety of milk in Beijing, China? *China Econ. Rev.*, **21**: S45–S54
- Zhang, X., J. Huang, H. Qiu and Z. Huang 2010 A consumer segmentation study with regards to genetically modified food in urban China. *Food Policy*, **35**: 456–462
- Zhou, J. and S. Jin 2008 Safety of vegetables and the use of pesticides by farmers in China: Evidence from Zhejiang province. *Food Control*, **20**: 1043–1048

² According to provision on the Act of Food Safety (2009), National Food Safety Committee was established in the State Council on February 9 of 2010. As the top administrative agency of food safety, this committee is headed by the outstanding vice-premier and other two vice-premiers, and composed by 15 concerning ministries.