EEPSEA
2015-RR17

Environmental Satisfaction among Residents in Chinese Cities

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Published by WorldFish (ICLARM) – Economy and Environment Program for Southeast Asia (EEPSEA)
EEPSEA Philippines Office, WorldFish Philippines Country Office, SEARCA bldg., College, Los Baños, Laguna 4031 Philippines; Tel: +63 49 536 2290 loc. 196; Fax: +63 49 501 7493; Email: admin@eepsea.net

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ISBN: 978-971-9994-83-1

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Suggested Citation: Wang C. and Zhang C. 2015. Environmental satisfaction among residents in Chinese cities. EEPSEA Research Report No. 2015-RR17. Economy and Environment Program for Southeast Asia, Laguna, Philippines.

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October, 2015

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ACKNOWLEDGMENT

This work was carried out with the aid of a grant from the Economy and Environment Program for Southeast Asia (EEPSEA) of WorldFish.

We thank Dr. Herminia Francisco, Ms. Julienne V. Bariuan, and EEPSEA staff for their support throughout the study. We would like to express our gratitude to Dr. Daigee Shaw, Dr. Herminia Francisco, Dr. Benoit Laplante, Dr. Pham Khanh Nam, and the participants of the 2013 and 2014 EEPSEA annual conferences for their valuable guidance and helpful suggestions. Mengying Li, Guang Zhu, Yue Ma, and Shuolin Shi provided able research assistance.

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ENVIRONMENTAL SATISFACTION AMONG RESIDENTS IN CHINESE CITIES

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EXECUTIVE SUMMARY

In recent years, the deterioration of the environment has become a top concern in China; it will remain central to the public debate as urban areas continue to expand and household incomes grow steadily. This paper investigates the factors that influence and shape the satisfaction of urban residents with the local air and water quality in Chinese cities by using a unique dataset collected through an interview survey with about 25,000 participants. The study shows that a respondent's true rating could be systematically different from his stated choice in the survey; the latter may be affected by various reasons. Empirical results reveal that respondents have a well-marked tendency to underreport their level of satisfaction. Although the survey found that about 51% and 44% of the respondents are satisfied with local air and water quality, respectively, study results show that 57% and 58% of them are actually satisfied. In addition, a respondent's true level of satisfaction is more likely to be lower if the individual is male and younger. Educational attainment is also correlated to a respondent's level of satisfaction.

1.0 INTRODUCTION

1.1 Background

After more than 30 years of extraordinarily rapid economic growth, China is facing the most severe environmental degradation in its history. The combustion of fossil fuels and many industrial processes release large amounts of air, water, and solid pollutants. As do many other countries around the world, China is trying to improve its environmental quality while promoting economic growth. The governmental appropriations for environmental protection have doubled since the 1990s. Over the period 1996–2000, environmental investment expenditure in China averaged only 0.8% of GDP, and reached 1.1% in 2000. Between 2001 and 2010, it continued to grow; it reached 1.67% of GDP in 2010. It is forecasted that the investment for environmental protection will amount to about CNY 3,400 billion (about USD 515 billion) over the five-year period from 2011 to 2015. Air and water quality, industrial solid waste reduction, and biodiversity protection have improved over the years; however, this is still not in line with the environmental pressures and challenges facing China (OECD 2007).

Environmental quality and protection efforts are becoming central to the debate of an increasing number of environmentally conscious Chinese people.[1] It will continue to do so as urban areas continue to expand and household incomes grow steadily. On one hand, Chinese people are exposed to various environmental risks associated with excessive pollution; on the other, increased access to environmental information, in the form of both comprehensive environmental statistics by the government and reports from the media, enables the Chinese to reinforce their demand for environmental goods. Public perception is a crucial indicator of the effectiveness of relevant environmental protection policies; thus, the satisfaction level of residents deserves high priority and much more attention for debate and policy making.

This paper contributes to understanding how a resident's socioeconomic status affects his level of satisfaction on environmental quality using a unique survey dataset. The database was compiled through an interview survey conducted in 32 major Chinese cities in 2011. Previous studies have shown that when participants in a survey are prompted to express their ratings or willingness to pay for a specific environmental good, a sizeable proportion of responses were biased (Boyle 2003; McConnell and Walls

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[1] Some large-scale collective resistances against environmentally destructive projects in recent years are good example of people's rising environmental consciousness. This year (2012) has seen three influential cases of such collective resistance in China, with each of them involving tens of thousands of local residents participating in demonstrations: Shifang of Sichuan province, Qidong of Jiangsu province, and Ningbo of Zhejiang province.

2005). One major reason for this bias could be that the respondent does not actually have to pay for the good in question, and therefore would more freely understate his ratings. This bias could also have happened in the survey of this study, in which respondents were asked to rate their levels of satisfaction with the quality of their local air and water on a scale from 1 to 10 (from the least satisfactory to the most satisfactory). In this case, respondents could think that an underreported satisfaction level may increase the chance of its provision in the future. On the other hand, it is also possible that the bias could go to the other direction. A respondent might report a level that is higher than his actual rating. This happens if he believes giving a politically correct answer, rather than the intended choice, is important. It is also possible that if he thinks that the government already provides more environment protection than needed, his exaggerated response could encourage the reduction in environmental protection. As conventionally used regression methods cannot deal with response bias, the authors used econometric models (Hsiao and Sun 1999) to control for it in the later analysis.

The empirical results of this study revealed that respondents have a well-marked tendency to underreport their level of satisfaction. Whereas the survey found that about 51% and 44% of the respondents are satisfied with local air and water quality, respectively, the results of this study showed that 57% and 58% of them are actually satisfied. A respondent's true level of satisfaction is more likely to be lower if the individual is male and younger. Educational attainment is also correlated to a respondent's level of satisfaction.

The paper is organized as follows. Section 1.2 describes the data. Section 1.3 briefly reviews related literature. Section 2 presents the empirical models. Section 3 reports the results of the regression exercises, discusses the aggregation issue, and provides an analysis of the relationship between residents' attitudes and their socioeconomic status. Conclusions are drawn in the final section of the paper.

1.2 Data Description

Data were collected from a public service survey, namely, the 2011 Lien Service-Oriented Government Index for Chinese Cities, conducted by the Polling Center of Shanghai Jiao Tong University and funded by the Nanyang Technological University. The survey was conducted from April to June 2011, using a computer-assisted telephone survey interview system. This was the first large-scale random sampling survey undertaken to assess the residents' evaluation of public services in China. In the survey, about 25,000 respondents from 32 major Chinese cities—including 4 municipalities, 22 provincial capital cities,[2] 5 cities at semi-provincial level, and Suzhou city[3]—were asked to rate their satisfaction of the quality of their local air and water on a scale from 1 to 10 (from the least satisfactory to the most satisfactory) along with questions on other types of public services.[4]

Table 1 provides the summary statistics of the major variables of the survey that were included in this paper. Specifically, the paper designated as "satisfied" ratings of 7 or higher for the level of satisfaction with air and water quality in the survey; this means that 50.66% of respondents are satisfied with local air quality, and 44.43% are satisfied with local water quality. The modal value of the distribution of the scale is "7" for questions on both air and water quality.

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[2] Except Nanning of Guangxi, four other autonomous regions' capital cities and Xining of Qinghai province were excluded from the sample because of potential communication difficulties due to the use of minority languages.

[3] Suzhou is included in the sample because it is highly industrialized and the size of its economy is equal to or even larger than many provincial capitals.

[4] For example, the question on air quality in the city is: "How do you rate the air quality in the city you live in? Choose one number between 1 and 10 (from the least satisfactory to the most satisfactory):"

1	2	3	4	5	6	7	8	9	10

Table 1. Summary statistics of the full sample

Variable	Categories	Percentage	
Age	19–29	45.90	
	30–39	24.03	
	40–49	14.89	
	50–59	7.57	
	60+	7.60	
Gender	Male	54.88	
	Female	45.22	
Education	Preliminary or lower	3.95	
	Middle school	14.11	
	High school	26.10	
	Junior college	23.10	
	University	28.22	
	Postgraduate	4.51	
Party	CCP Member	19.71	
Satisfaction with local air/water quality	1, least satisfactory	2.54	3.12
	2	2.53	2.92
	3	5.38	5.76
	4	6.73	7.67
	5	14.38	16.17
	6	17.78	18.92
	7	18.94	19.26
	8	18.23	16.52
	9	8.61	6.01
	10, most satisfactory	4.88	3.66
Number of Respondents		**24,543**	

Note: For the percentages of the different levels of satisfaction toward water quality, the number of observations is 24,044.

For more details about the data sample, Table 2 summarizes the key information for each of the 32 cities in the sample. Based on Table 2, it appears that younger and educated people, and CCP (Communist Party of China) members were overrepresented in most of the sampled cities. This would have created bias if one had been aiming to understand the level of satisfaction for a city as a whole or for the entire country. However, the information from the survey was useful as the paper aimed to estimate the impacts of an individual's socioeconomic characteristics on one’s level of satisfaction toward local environmental quality.

Table 2 also presents sulfur dioxide (SO_2) concentration values and the GDP per capita of the cities. The values show huge variations in development stage and air quality across the sampled cities. Table 2 also suggests that the cities with the highest mean level of satisfaction toward air and water quality are Haikou and Hangzhou, respectively. Both cities are indeed places with better environmental conditions. For example, the level of ambient SO_2 concentration in Haikou was the lowest among the 32 cities surveyed. Cities in relatively poor areas, such as Lanzhou and Taiyuan, have lower levels of satisfaction toward air quality, which correlate to their very high SO_2 concentrations.

The paper also analyzed how an individual's ratings about environmental quality could be affected by his socioeconomic backgrounds. Independent variables for the empirical analyses collected in the interviews included respondents’ level of educational attainment, age, political status, gender, etc. Observations with missing values on the independent variables from the sample were not considered in the data analysis. Furthermore, as in many other surveys, the respondents in the present survey tended to disregard the question on income; even when they answered, they might not have been honest when reporting income.

Table 2. Summary statistics, by city

City	No. of Respondents	Male (%)	Aged 39 or Under (%)	High School or Lower (%)	CCP Member (%)	Ratings (Mean)		City Characteristics (2010)	
						Air	Water	SO_2 Concentration	GDP per Capita
Beijing	948	55.91	76.48	43.99	22.26	5.96	5.78	0.032	75,943
Changchun	699	47.64	56.80	43.35	19.89	6.81	6.20	0.030	43,936
Changsha	702	50.57	54.56	50.14	21.37	6.35	6.15	0.040	66,443
Chengdu	999	49.05	57.56	36.44	27.93	6.56	6.34	0.031	48,510
Chongqing	927	53.94	82.42	43.04	13.05	6.54	6.30	0.048	27,596
Dalian	699	54.08	63.66	45.35	19.17	7.35	7.11	0.037	77,704
Fuzhou	700	53.00	64.14	54.86	20.43	6.61	5.92	0.009	44,667
Guangzhou	887	58.06	84.44	42.39	14.77	5.36	5.23	0.033	103,625
Guiyang	704	50.00	56.39	56.68	19.74	7.09	6.18	0.057	26,057
Haikou	703	59.89	78.81	51.35	17.78	8.06	6.49	0.007	30,329
Hangzhou	702	50.14	75.21	32.76	24.79	6.90	6.86	0.034	69,828
Harbin	694	59.65	69.60	47.84	18.16	5.79	6.06	0.045	36,951
Hefei	698	54.15	62.75	42.69	27.65	6.66	6.32	0.020	54,796
Jinan	693	59.88	79.22	38.67	16.59	5.87	6.71	0.045	57,966
Kunming	699	54.65	67.10	41.77	25.32	7.33	5.81	0.040	33,550
Lanzhou	705	52.48	54.33	46.67	24.26	4.09	5.47	0.057	34,009
Nanchang	694	57.93	63.40	43.80	21.18	6.47	6.27	0.055	43,769
Nanjing	692	59.10	68.35	39.16	21.68	5.89	6.05	0.036	64,037
Nanning	693	57.72	78.64	48.63	19.77	7.48	6.79	0.028	25,622
Ningbo	695	46.47	72.52	50.94	19.71	6.82	6.27	0.031	69,368
Qingdao	703	52.49	65.15	49.79	19.91	7.64	6.87	0.052	65,827
Shanghai	931	58.75	72.72	33.30	13.75	5.81	5.57	0.029	76,074
Shenyang	1028	49.61	47.67	45.72	26.26	6.38	6.22	0.058	62,357
Shenzhen	911	59.39	87.27	49.84	10.76	5.66	5.23	0.011	106,880
Shijiazhuang	700	55.57	69.71	59.00	15.86	5.95	5.96	0.054	33,915
Suzhou	704	58.38	74.15	56.25	11.93	6.66	5.80	0.033	93,043
Taiyuan	695	59.14	72.09	41.15	21.15	5.04	5.33	0.068	50,225
Tianjin	692	57.23	80.92	39.88	18.79	5.61	5.64	0.054	72,994
Wuhan	930	56.02	86.34	24.52	18.49	5.29	5.59	0.041	58,961
Xiamen	680	52.94	57.06	58.53	17.79	7.73	7.36	0.021	58,337
Xi'an	942	54.56	83.12	25.69	21.23	6.30	5.96	0.043	38,341
Zhengzhou	694	58.93	64.70	47.55	19.88	5.78	5.65	0.053	49,947

Sources: SO_2 concentration: NBS and MEP (2011); GDP per capita: NBS (2011); the others are constructed from the survey data.

Note: (1) The number of observations in each city is based on the sample for air quality. (2) For water quality, the total number of observations is 24,044. (3) For city-level variables, SO_2 concentration is measured in milligrams per cubic meter (mg/m^3); (4) GDP per capita is in RMB. (5) CCP = Communist Party of China

Higher education level would not only lead to higher income level, but to higher environmental awareness as well, especially in a developing country like China. Besides income and education, other variables related to socioeconomic status (i.e., age and gender) were also used to explain environmental awareness and satisfaction. Therefore, the study used these variables as controlling variables. Membership in CCP is also an important socioeconomic status variable in China for two reasons. First, CCP members are more likely to be elite members and employed in government and government-related units. Second, CCP members are more likely to give more politically correct answers.

1.3 Related Literature

Previous research on eliciting direct or indirect preference for public goods, especially the environment, is abundant (Hanemann 1994; Veisten 2006; Mogas, Riera, and Brey 2009; Morey et al. 2008). With increasing income, people wish to enjoy better environmental welfare (Beckerman 1992; Carson, Jeon, and McCubbin 1997; McConnell 1997).

Contingent rating has been widely used in studies on health care, transportation, marketing, and environmental evaluation (Green and Srinivasan1990; Álvarez-Farizo, Hanley, and Barberan 2002; Sayadi, Gonzalez-Roa, and Calatrava-Requena 2005, 2009). The respondents were asked to indicate their preference in a numeric (usually on a 1–10 scale) (Mackenzie 1992) or semantic scale (Bergstrom, Rubinfeld, and Shapiro 1982). There are many reasons for the widespread use of the contingent-rating method in the literature; respondents are quite familiar with the format of questions due to prior experience (such as opinion surveys), thus making it easier to administer. In addition, it is especially superior in phone surveys; other approaches (e.g., ranking and choice experiment) are quite difficult to administer (Layton and Lee 2006). Mackenzie (1992) pointed out that contingent rating can elicit more information than ranks and choices can, and they can further bear some ordinal significance. However, the method has often been criticized for its cardinal properties, which lead to the inability to compare ratings across individuals and to inconsistency in welfare estimates (Hanley, Mourato, and Wright 2001). In response to these criticisms, some techniques of transforming the rating record to ranking or other ordered data have been applied in the literature (Mackenzie 1992; Roe, Boyle, and Teisl 1996; Stevens, Barrett, and Willis 1997). For example, Cuccia and Cellini (2007) transformed 1–10 ratings into dichotomous variables with the critical grade 7 when studying the importance of cultural heritage for tourists. The validity of the estimation largely relies on the quality of the data. Other than sampling error, which is presumably unavoidable, response bias is another important source of inaccuracy in estimation results. This may occur if some respondents misunderstand the wording of the questions, lack the necessary knowledge to answer the questions, give rapid and ill-considered answers so as to hasten their questioning, or feel under social pressure not to give mainstream answers.

The present paper takes advantage of a very large sample from the phone survey undertaken in 2011. Being different from previous studies, this paper makes two major contributions to the existing literature. First, the authors analyzed detailed data at the household level to understand how an individual's level of satisfaction with local environmental quality is affected by his socioeconomic status. Individual behaviors were also aggregated to obtain a national level of satisfaction. This complements several previous studies on the attitude of stakeholders toward the environment in China using regional data (Guo and Fan 2007; Zhai and Suzuki 2008). Second, the response bias in the survey data arising from the respondents' tendency to underreport their levels of satisfaction toward local air and water quality was determined. The respondents' actual levels of satisfaction could thus be estimated.

2.0 EMPIRICAL MODELS

This section starts with a discussion of a conventional random utility model (McFadden 1974). The set $\{0, 1, \ldots, M\}$ were used to denote the set of mutually exclusive and collectively exhaustive choice alternatives faced by individuals participating in the survey. During the phone interview, each person was asked to report his or her level of satisfaction with local air and water quality over the interval 1–10 (from the least satisfactory to the most satisfactory). By some measures, the research team grouped these ratings into three different preference levels: "dissatisfied," "neither satisfied nor dissatisfied," or "satisfied."

Let n index respondents and y_n^* denote a respondent's intended response, taking on values {1, 2, 3} and $y_n^* = 1$ as "dissatisfied", $y_n^* = 2$ "neither satisfied nor dissatisfied" and $y_n^* = 3$ "satisfied". [5] The ordered logit model for the intended response can be described by each response probability:

$$\text{prob}\left(y_n^*=1\right) = \frac{1}{1+e^{(x_n\alpha-\alpha_1)}} \equiv F_{1n},$$

$$\text{prob}\left(y_n^*=2\right) = \frac{1}{1+e^{(x_n\alpha-\alpha_2)}} - \frac{1}{1+e^{(x_n\alpha-\alpha_1)}} \equiv F_{2n}, \qquad \text{Equation (1)}$$

$$\text{and} \quad \text{prob}\left(y_n^*=3\right) = 1 - F_{1n} - F_{2n} \equiv F_{3n}$$

where:

x_n = vector of independent variables[6] measuring socioeconomic characteristics of respondent n and city dummies.

Given the possible bias in the respondents' answers, a distinction needs to be made between the stated and intended choice of each respondent. The intended choice was generated from the true motivations and preferences of the respondent.

Note that in this study's data sample, a respondent's intended choice can be systematically different from his stated choice; the latter may be affected by various reasons. As such, let y_n denote the respondent's actual choice as stated during the survey interview. If the respondents state their intended choice in the survey, then the conventional random utility model is used since

$$\text{prob}\left(y_n=j\right) = \text{prob}\left(y_n^*=j\right), \quad j=1, 2, 3. \qquad \text{Equation (2)}$$

One reason for the differences between stated choice and intended choice could be that respondents tend to distort their true evaluation of the environment. As stated in the introduction section, a respondent might underreport or overreport her ratings about environmental quality.

To describe how the response bias is modeled in the analysis, this paper assumed that a one-sided negative response bias existed in the data collected from the survey. The following procedures are similar to that proposed by Hsiao and Sun (1999), who modeled positive response bias in a product marketing research.

Those respondents whose intended rating was a specific satisfaction level of environmental quality tended to declare a lower satisfaction level, and thus presented a negative response bias. It might have happened because the respondent believed that his underreported satisfaction level may increase the chance of its provision in the future. To model such bias, the study introduced an indicator w_{jn} with probability $\pi_{jn} \in [0,1]$ that $w_{jn} = 1$ and probability $1 - \pi_{jn}$ that $w_{jn} = 0$. The alternatives are indexed so that a larger j denotes a higher level of environmental satisfaction. Because of the tendency to underreport his evaluation of environmental quality, a respondent would choose the level j only in the following two cases:

1. First, his intended choice is level j and he does not report a lower level in the phone interview (i.e., $y_{jn}^* = 1$ and $w_{j'n} = 0$ for all $j' \leq j$).
2. Second, his intended choice is a rating higher than j, but he reports j in the interview (i.e., $w_{jn} = 1$ and $y_{jn}^* = j$ for all $j' > j$). Formally, the probability of each response in this study can be written as

$$\text{prob}\left(y_n=3\right) = [1-\pi_{1n}-\pi_{2n}]F_{3n},$$

$$\text{prob}\left(y_n=2\right) = [1-\pi_{1n}]F_{2n} + \pi_{2n}F_{3n}, \qquad \text{Equation (3)}$$

$$\text{prob}\left(y_n=1\right) = 1 - \textstyle\sum_{j=2}^{3} \text{prob}\left(y_n=j\right).$$

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[5] It is not difficult to model more than three alternatives.

[6] There are no choice-specific independent variables in the data sample used in this study. The discrete choice models presented in this paper can be extended to consider such variables.

In this model, only the respondents whose intended choice is alternative j' could have positive chances to choose alternative j for $j' \leq j$ in the interview. There is no chance that a respondent with intended choice j will choose any higher level j'' ($j'' > j$). It follows from Equation (3) that $\text{prob}\left(y_n{=}3\right) \leq \text{prob}\left(y^*_n{=}3\right)$, which implies the downside bias in the highest rating exercise. This suggests that the probability of observing that a respondent reports "satisfied" is not higher than the probability that his intended choice is "satisfied." The model setup also indicates that $\text{prob}\left(y_n{=}1\right) \geq \text{prob}\left(y^*_n{=}1\right)$. However, the sign of the difference between prob ($y_n = 2$) and prob ($y^*_n = 2$) is indecisive.

It is possible that a positive bias might have existed in the survey. This response bias can be modeled and estimated in a similar way as in Equation (3). A slight modification of the econometric model used in this study (i.e., reversing the order of the options of satisfaction level in the estimation process) allowed the authors to easily test if there was such overreporting in the data sample.

The second reason for the possible differences between stated choice and intended choice is that a respondent may not remember or know about the questions and choices. He may have given his rating just by guessing. To model such randomized responses, the study assumed that there is a probability $\rho_{jn} \in [0,1]$ that that respondent j will choose alternative j, regardless of his intended choice. Then, the probability of each response in this study can be written as

$$\begin{aligned} \text{prob}\left(y_n{=}3\right) &= \rho_{3n} + [1 - \rho_{1n} - \rho_{2n} - \rho_{3n}]F_{3n}, \\ \text{prob}\left(y_n{=}2\right) &= \rho_{2n} + [1 - \rho_{1n} - \rho_{2n} - \rho_{3n}]F_{2n}, \\ \text{prob}\left(y_n{=}1\right) &= 1 - \textstyle\sum_{j=2}^{3} \text{prob}\,(y_n{=}j). \end{aligned} \qquad \text{Equation (4)}$$

This model is labeled as randomized response model.

Equations (2)–(4) can be estimated by maximizing the following log-likelihood function

$$\log \text{L} = \textstyle\sum_{n=1}^{N} \sum_{j=1}^{3} y_n \log\left[\text{prob}\left(y_n = j\right)\right], \qquad \text{Equation (5)}$$

where prob ($y_n = j$) is defined by Equation (2) in the random utility model, by Equation (3) in the one-sided response bias model, and by Equation (4) in the randomized response model.

The models are also referred to as Model 1, Model 2, and Model 3, respectively. Sun (1995) showed that the maximum likelihood estimate for Models 2 and 3 is consistent and asymptotically normally distributed with the asymptotic covariance matrix equal to the inverse of the negative of the information matrix. The study used estimated results and statistics to determine the presence of response bias in the data and to select the appropriate model.

To get a more flexible version of the response bias model, one can further let $\pi = G_j\,(\eta'_j x_n)$, where $G_j(.)$ is a probability function in Model 2. For more information on this setup, see Hsiao and Sun (1999). This extended setup may allow one to link the characteristics of a respondent with his chance of underreporting. The links are described by the coefficients η'_js. To estimate, a format for distribution function $G_j\,(.)$ should be assumed. Given that survey respondents are very likely to underreport their level of satisfaction with the environmental quality, the authors estimated the response bias model with the assumption that $\pi_{jn} = \pi_j$ for any n and j = 2, 3. The same was assumed to hold true for ρ_{jn} in Model 3.

3.0 EMPIRICAL RESULTS

This section reports the empirical results of applying the above-mentioned models to the survey data on the respondents' levels of satisfaction toward the quality of local air and water. All models were assumed to take ordered logit specifications. The results on response bias are reported first, followed by those on the socioeconomic factors that affect respondents' satisfaction level for air quality. Individual behaviors were also aggregated to obtain a "national" level of environmental satisfaction.

3.1 Estimation and Model Selection

In the first set of regressions, the satisfaction level was labeled as "dissatisfied" if a respondent chose numbers between 1–3 when asked his level of satisfaction with local air quality, scales from 4–6 as "neither dissatisfied nor satisfied," and the numbers from 7–10 as "satisfied." The authors used the data to estimate the three econometric models discussed in the previous section. The Akaike Information Criterion (Akaike 1973) was used to determine the appropriate model to be used for examining the air quality satisfaction level. It was found that Model 2 (i.e., one-sided response bias model) was the best fit for the survey data on air quality.

Table 3 reports the estimation results of the respondents' level of satisfaction toward air quality. Column 1 details the city-level variables such as GDP per capita and SO_2 concentration in 2010 used in this study.[7] Column 2 uses 31 dummy variables for the cities in order to control variations in environmental quality, socioeconomic characteristics, and natural conditions across cities. These factors may have affected a resident's ratings.

Table 3. Estimates of one-sided response bias model: Air quality

Variable	Description	Re-categorize Scales into Three Groups: "1–3", "4–6" , "7–10"		Re-categorize Scales into Three Groups: "1–4", "5–7" , "8–10"	
		(1)	(2)	(3)	(4)
Intercept1		−11.0290***	−2.906***	−11.419***	−2.796***
		(0.042)	(0.037)	(0.032)	(0.033)
Intercept2		−8.946***	−0.634***	−9.147***	−0.241***
		(0.058)	(0.038)	(0.071)	(0.039)
HH income	log(.)/10	−0.632***		−0.706***	
		(0.163)		(0.154)	
Age	30–39	0.177***	0.127***	0.147***	0.138***
		(0.032)	(0.032)	(0.030)	(0.031)
	40–49	0.377***	0.409***	0.341***	0.428***
		(0.038)	(0.039)	(0.036)	(0.039)
	50–59	0.780***	0.785***	0.745***	0.941***
		(0.059)	(0.059)	(0.051)	(0.058)
	60+	1.236***	1.243***	1.132***	1.373***
		(0.074)	(0.072)	(0.062)	(0.068)
Gender	Male	−0.132***	−0.123***	−0.065***	−0.056***
		(0.027)	(0.026)	(0.025)	(0.025)
Education	Middle school	0.088	0.051	0.079	−0.049
		(0.079)	(0.065)	(0.073)	(0.064)
	High school	0.064	−0.001	−0.048	−0.237***
		(0.075)	(0.060)	(0.069)	(0.059)
	Junior college	−0.042	−0.132**	−0.174**	−0.370***
		(0.076)	(0.060)	(0.070)	(0.060)
	University	−0.113	−0.137**	−0.248***	−0.373***
		(0.075)	(0.059)	(0.070)	(0.059)
	Graduate	−0.065	−0.036	−0.170*	−0.240***
		(0.095)	(0.080)	(0.088)	(0.079)
Political	CCP Member	0.160***	0.120***	0.144***	0.103***
		(0.034)	(0.034)	(0.032)	(0.034)

7 Air quality is determined by SO_2 and many other types of pollutants. However, the authors do not have data on ambient levels of other pollutants except SO_2.

Table 3 continued

Variable	Description	Re-categorize Scales into Three Groups: "1–3", "4–6", "7–10"		Re-categorize Scales into Three Groups: "1–4", "5–7", "8–10"	
		(1)	(2)	(3)	(4)
City variables	SO_2 concentration	−28.300***		−27.850***	
	(mg/m^3, log(.))	(0.974)		(0.887)	
	GDP per capita	−6.610***		−7.358***	
	(log(.)/10)	(0.130)		(0.121)	
City Dummies		No	Yes	No	Yes
probability of respondents		0.017***	0.022***	0.030***	0.048***
choosing "dissatisfied"		(0.003)	(0.002)	(0.004)	(0.003)
probability of respondents		0.103***	0.138***	0.180***	0.259***
choosing "neither		(0.018)	(0.009)	(0.029)	(0.010)
satisfied nor dissatisfied"					
N		19,811	24,543	19,811	24,543
-logL		18,131.01	21,372.91	19,404.99	22,553.66
correct prediction (%)		51.93	57.87	51.06	56.86

Notes: (1) Standard errors are reported in ( ); (2) ***, ** and * indicate significance levels at 1%, 5%, and 10%, respectively.

When the responses from the interviewees with regard to their satisfaction level for air quality were grouped into three categories, it became apparent that statistically significant response bias existed in the data sample. The authors found that respondents tended to underreport their opinions of air quality.
For example, column 2 indicates that the respondents who actually are "neither satisfied nor dissatisfied" or "satisfied" with local air quality have a 1.7% chance of saying that they are not satisfied with it during the phone interview. They would have a 10.3% chance of saying that they are "neither satisfied nor dissatisfied" when their intended choice is really "satisfied."

While the above-mentioned estimated chances of response bias (or "protest" votes) come from a specific econometric model on the data analyzed, some ideas about the plausibility of these estimated results can be obtained by looking at the body of empirical evidence reported in the literature concerning the percentage of protest votes in contingent valuation studies on environmental goods. Dziegielewska and Mendelsohn (2007) identified 27% of an air pollution data sample from Poland as protesters. In a case study involving endangered species, Kotchen and Reiling (2000) found that 19% of the data sample collected in Maine had been protest responses. Hence, the analysis conducted in this study is in line with other studies of protest votes in the valuation of environmental goods. When comparing the estimated chances of protest votes in this paper with the results from previous studies, note that a much wider range of chances has been reported in the literature.

It is also possible that respondents might have overreported their satisfaction level for air quality. The authors therefore estimated the modified models for the same data. The results suggest that the chances that a respondent who is actually "dissatisfied" would choose "satisfied" or "neither satisfied nor dissatisfied" are zero.

Respondents may have their own interpretations of the scales, which could possibly make the discrimination between the three choice alternatives inappropriate. In order to evaluate this possibility, the authors subsequently recoded the response variable. Qualitatively, the same results are found in the last two columns of Table 3 for the air quality satisfaction regression. In a third regression exercise, only two categories of the level of satisfaction were defined—"satisfied" and "dissatisfied" with grade 7 as the cut-off. The patterns of the estimated coefficients are similar to those from the models with three categories. Response bias was also found in the data.[8]

[8] Results are available from the authors upon request.

The authors also performed similar regression exercises on the data regarding the respondents' level of satisfaction with water quality. Akaike Information Criterion also indicated that Model 2 (i.e., one-sided response bias model) was the best fit for the survey data on local water quality when categorizing the three levels of satisfaction, with scales of 1–4, 5–7, and 8–10. Table 4 reports the results from the regression of water quality ratings using the one-sided response bias model. Similar patterns of the estimates as those from the air quality regressions were observed. For example, this study found a sizeable proportion of response bias in the data on satisfaction with water quality.

Table 4. Estimates of one-sided response bias model: Water quality

Variable	Description	Re-categorize Scales into Three Groups: "1–3", "4–6", "7–10"		Re-categorize Scales into Three Groups: "1–4", "5–7", "8–10"	
		(1)	(2)	(3)	(4)
Intercept1		–9.714***	–2.282***	–6.078***	–1.601***
		(0.060)	(0.034)	(0.035)	(0.025)
Intercept2		–8.164***	–0.313***	–3.820***	0.708***
		(0.077)	(0.047)	(0.126)	(0.081)
HH income	log(.)/10	–0.483**		–0.417**	
		(0.241)		(0.167)	
Age	30–39	0.207***	0.105***	0.176***	0.126***
		(0.046)	(0.030)	(0.032)	(0.026)
	40–49	0.510***	0.325***	0.362***	0.335***
		(0.062)	(0.037)	(0.040)	(0.032)
	50–59	1.145***	0.533***	0.657***	0.547***
		(0.111)	(0.052)	(0.057)	(0.043)
	60+	6.595***	0.907***	0.959***	0.815***
		(1.813)	(0.063)	(0.073)	(0.049)
Gender	Male	–0.211***	–0.093***	–0.033	–0.049**
		(0.042)	(0.025)	(0.028)	(0.021)
Education	Middle school	–0.019	0.123**	0.050	0.095*
		(0.141)	(0.059)	(0.083)	(0.050)
	High school	–0.265**	–0.085	–0.167**	–0.128***
		(0.133)	(0.054)	(0.079)	(0.046)
	Junior college	–0.335**	–0.139**	–0.361***	–0.273***
		(0.133)	(0.054)	(0.079)	(0.046)
	University	–0.438***	–0.165***	–0.420***	–0.256***
		(0.133)	(0.053)	(0.079)	(0.046)
	Graduate	–0.551***	–0.161**	–0.429***	–0.250***
		(0.154)	(0.074)	(0.097)	(0.064)
Political	CCP Member	0.409***	0.175***	0.187***	0.136***
		(0.059)	(0.033)	(0.035)	(0.028)
City variables	GDP per capita	–5.917***		–3.503***	
	(log(.)/10)	(0.198)		(0.130)	
City Dummies		No	Yes	No	Yes
probability of respondents		0.063***	0.019***	0.067***	0.016***
choosing "dissatisfied"		(0.003)	(0.003)	(0.004)	(0.004)
probability of respondents		0.347***	0.205***	0.295***	0.226***
choosing "neither		(0.009)	(0.013)	(0.044)	(0.037)
satisfied nor dissatisfied"					
N		19,499	24,044	19,499	24,044
-logL		18,766.77	22,573.45	19,317.57	23,152.11
correct prediction (%)		47.40	51.88	53.88	53.93

Notes: (1) Standard errors are reported in ( ); (2) ***, ** and * indicate significance levels at 1%, 5%, and 10%, respectively.

3.2 Socioeconomic Influences on Individual's Satisfaction Level

The previous section explained how an individual's socioeconomic characteristics influence his true opinion concerning the air/water quality in the city. Although the empirical models presented varying estimated coefficients in Tables 3 and 4, some general observations about the coefficients can be made. Column 2 in both tables is the preferred specification for the air quality regressions, as it contains many more observations and controls for 31 dummy variables for the cities.

Tables 3 and 4 suggest that male respondents are more likely to be dissatisfied with local air and water quality than female respondents. It may result from the fact that in China, men are more involved in public affairs than are women. The latter tend to focus more on their own families and are quite kept away from the public arena. Xiao and Hong (2012) analyzed the gender gap in environmental concern among the Chinese public using the 2003 China General Social Survey data and obtained a similar conclusion. However, other studies found the opposite effect (Van Liere and Dunlap 1980).

Older individuals have higher levels of satisfaction than younger ones. In both cases reported in Tables 3 and 4, larger and positive coefficients are more associated with older people. This observation supports a large number of previous studies, which also found that the young are more concerned with environmental quality (Van Liere and Dunlap 1980). One possible explanation is that the younger ones are more motivated to care about the environment, for they have longer yet to live than the elderly. Additionally, younger people are less integrated into the dominant social order, and are thus more likely to advocate reforms in traditional thought, where environmental control is often regarded as threatening (Malkis and Grasmick 1977). It is also possible that, compared with the old, the young have more access to information regarding the environment (Shen and Saijo 2008).

The estimated coefficients for some of the education variables were also found to be statistically significant in Tables 3 and 4. Respondents with higher levels of educational attainment, especially those who have attended junior college and university, are more likely to be dissatisfied with local air quality than respondents with fewer years of schooling. However, the estimated coefficient for interviewees with master's degrees was not statistically significant (see columns 1 and 2 of Table 3); this may reflect a preference for maintaining the status quo by the highly educated people and/or the correlation between income (which is correlated positively to education) and the demand for environmental quality. The two possible sources cannot be quantified well with the available data. Note that although not all of them were statistically significant, the magnitude of the coefficients for environmental concern did not manifest a simple linear relationship with the level of educational attainment; a result different from some previous studies, which implied the existence of a positive correlation between the two. Finally, a respondent with a bachelor's degree is less likely to be satisfied with air quality as compared to those with either lower or higher levels of educational attainment.

How CCP membership affects the environmental concern is rarely, if ever, discussed in existing studies. If the CCP membership could be approximated as a high social status, then the estimated coefficients in Tables 3 and 4 imply that people with high social status are less concerned with the environment. However, most studies show positive correlation between the efficacy of environmental citizenship and social status, an indicator of capability as well as education and income (Stern 2000). These seemingly counterintuitive results can be attributed to the fact that being government supporters, CCP members experience a high level of satisfaction in the socialist society than do nonmembers.

From specifications 1 and 3 of Table 3, the respondents in cities with higher ambient SO_2 concentration and higher income level are less likely to be satisfied with local air quality. Also, respondents from wealthier families are less likely to be satisfied with local air quality.

Table 5 presents two series of data. Column 1 lists the cities in descending order by the estimated coefficients for the city dummies from specification 2 of Table 3—the higher the coefficient, the larger the possibility that a resident in the city would be satisfied with the local air quality. Column 2 shows the order of the cities based on its number of days with air quality better than Class II as defined by the Chinese National Ambient Air Quality Standards in the first half of 2011.[9] This table shows that, except for a few cities, positive

[9] The information comes from http://www.zhb.gov.cn/gkml/hbb/bgg/201107/W020110730434018324100.pdf

correlation between the two orderings existed. Generally, residents in cities with better air quality are more likely to choose higher ratings in the interview.

The location of a household and the variation of air quality across locations within a city may have also had effects on respondents' attitudes. Due to data limitation, the authors controlled for city dummies only in the regressions reported in Tables 3 and 4. Future research would focus on smaller areas in cities when data at finer geographic scales, especially variables measuring local air and water quality, are available.

Table 5. Ranks of the cities: Air quality and estimates

City	Ranking 1	Ranking 2	Probability of a Representative Rating 6–10 toward Air Quality
Haikou	1	1	98.49
Xiamen	2	3	95.47
Qingdao	3	13	92.50
Nanning	4	8	87.47
Kunming	5	2	86.27
Dalian	6	11	82.63
Hangzhou	7	20	76.42
Guiyang	8	12	75.18
Ningbo	9	24	72.92
Suzhou	10	19	67.35
Changchun	11	16	65.41
Hefei	12	29	65.36
Chongqing	13	14	65.13
Fuzhou	14	6	64.90
Chengdu	15	28	61.31
Xi'an	16	30	60.08
Nanchang	17	7	59.34
Changshan	18	9	55.53
Shenyang	19	10	52.16
Shijiazhuang	20	15	48.28
Beijing	21	31	46.46
Jinan	22	26	45.34
Nanjing	23	25	44.74
Shanghai	24	18	43.94
Harbin	25	17	42.15
Shenzhen	26	5	41.64
Tianjin	27	21	40.20
Zhengzhou	28	22	39.83
Wuhan	29	27	34.14
Guangzhou	30	4	33.30
Taiyuan	31	23	26.35
Lanzhou	32	32	11.28

Note: The representative has the following characteristics: male, aged between 30–39, and high school.

3.3 True Level of Satisfaction

The discrete choice models described above mainly focus on the individual behavior of the respondents, while policy makers are more interested in aggregate behavior. Using the sample from the 32 major cities, the authors calculated a "national" true level of satisfaction by aggregating the disaggregated model. The aggregate proportion of choosing the j^{th} option can be calculated by

$$P(j) = \int \text{prob}\,(y^* = j \,/\, x) f(x) dx, \qquad \text{Equation (6)}$$

where $f(x)$ is the population density of x. The sample being randomly drawn, $P(j)$ can be approximated by

$$\widehat{P}(j) = \frac{1}{N} \sum_{n=1}^{N} \text{prob}\,(y^* = j/x_n). \qquad \text{Equation (7)}$$

Table 6 presents the estimated results of the satisfaction level for air quality at the national level. For comparison purposes, the reported level of satisfaction is also presented. Among the interviewees in the sample, 50.66% of them reported that their ratings of local air quality are 7 or higher. However, the calculation using the model results indicates that the actual percentage would be 56.72%. The significant differences between reported and actual levels were also found when scales of 8 and higher were treated as "satisfied."

Table 6. "National" level of true satisfaction: Air quality

Description		True Level (%)	Reported Level (%)
Cut-off	Dissatisfied (1–3)	8.51	10.46
Values:	Nor dissatisfied or satisfied (4–6)	34.76	38.88
3, 6	Satisfied(7–10)	56.72	50.66
Cut-off	Dissatisfied (1–4)	13.03	17.19
Values:	Nor dissatisfied or satisfied (5–7)	48.95	51.10
4, 7	Satisfied (8–10)	38.02	31.72

Noting that the data is not well representative of the population of the 32 cities, the authors had to be very cautious in interpreting the estimated levels. For example, young people are overrepresented in the sample. Male and persons with higher level of educational attainment are also overrepresented. Considering these, the estimated coefficients in Table 3 suggest that the national level of satisfaction would be higher. The authors tried to weight the data sample to calculate the national level of satisfaction, but the relevant data is not available.

Table 7 shows the true levels of satisfaction from aggregating the estimated model for the individuals and the reported levels observed directly from the survey. It also suggests that the true level of being "satisfied" with local water quality is higher than the reported level in the survey. Comparing Tables 5 and 6, the average true level of satisfaction with water quality is much lower than for air quality.

In both cases, the true level of being "neither dissatisfied nor satisfied" is lower than the reported level.

Table 7. "National" level of true satisfaction: Water quality

Description		True Level (%)	Reported Level (%)
Cut-off	Dissatisfied (1–3)	10.13	11.80
Values:	Nor dissatisfied or satisfied (4–6)	32.36	42.76
3, 6	Satisfied(7–10)	57.50	44.45
Cut-off	Dissatisfied (1–4)	18.16	19.47
Values:	Nor dissatisfied or satisfied (5–7)	49.02	54.35
4, 7	Satisfied (8–10)	32.82	26.19

4.0 CONCLUSIONS AND DISCUSSIONS

This paper provides an empirical investigation of the factors that influence and shape urban residents' satisfaction level with the local air and water quality in China. The authors controlled and estimated the potential response bias in the data sample obtained in 2011 from a survey conducted in 32 major Chinese cities. Individual decisions were also aggregated across the cities to obtain a measure of the national level of satisfaction for air and water quality; similar results were obtained for both cases.

Empirical results showed that an individual's attitude toward local air and water quality is affected by the individual's age, gender, political attitudes, and the level of educational attainment. The older and female respondents are more likely to be satisfied with local air and water quality. It was also found that respondents tended to underreport their ratings of local air and water quality. The respondents exhibited a positive tendency to report dissatisfaction in the survey, although they were actually satisfied with the current condition. This study established that the true level of satisfaction with air and water quality in urban areas is actually higher than the raw survey results from the phone interviews suggested.

In September 2013, the research team conducted face-to-face interviews with 200 participants each in Beijing and Hangzhou, and asked similar core interview questions on environmental quality as in the phone interviews. From this supplementary survey, it was found that participants reported a much lower level of satisfaction toward local air quality in the two cities. The decrease may have been due to the timing of the survey because Beijing and many other cities in China have suffered particularly severe smog episodes since early 2013. The survey results suggest that it is important for the government to anticipate the increasing demand for environmental goods before worse scenarios occur.

The findings from this research point to potential policy implications. In the past decade, China's environmental regulation efforts mainly focused on limiting emissions of SO_2 in the air and reducing chemical oxygen demand in receiving water bodies. Now, it is transitioning into more comprehensive plans with more policy instruments and to the control of many other pollutants such as particular matter and nitrogen oxides. As socioeconomic characteristics of the population changes over time, environmental regulations should be more stringent to better meet the demands of the residents.

LITERATURE CITED

Akaike H.1973. Information theory and extension of the maximum likelihood principle. B.N. Petrov and F. Csaski (eds.) *In* Proceedings of the 2nd International Symposium on Information Theory. Akadémiai Kiadó, Budapest.

Álvarez-Farizo, B.; N. Hanley; and R. Barberán. 2002. The value of leisure time: A contingent rating approach. Journal of Environmental Planning and Management. 44(5): 681–699.

Beckerman, W. 1992. Economic growth and the environment: Whose growth? Whose environment? World Development. 20(4): 481–496.

Bergstrom T.C.; D.L. Rubinfeld; and P. Shapiro. 1982. Micro-based estimates of demand functions for local school expenditures. Econometrica. 50(5): 1183–1205.

Boyle, K.J. 2003. Contingent valuation in practice. P.A. Champ, K. J. Boyle, and T.C. Brown (eds.) *In* A primer on nonmarket valuation. Kluwer Academic Publishers, Dordrecht.

Carson R. T.; Y. Jeon; and D.R. McCubbin. 1997. The relationship between air pollution emissions and income: US data. Environment and Development Economics. 2(4): 433–450.

Cuccia T. and R. Cellini. 2007. Is cultural heritage really important for tourists? A contingent rating study. Applied Economics. 39(2): 261–271.

Dziegielewska, D.A. and R. Mendelsohn. 2007. Does "no" mean "no"? A protest methodology. Environmental and Resource Economics. 38(1): 71–87.

Green P.E. and V. Srinivasan. 1990. Conjoint analysis in marketing: New developments with implications for research and practice. Journal of Marketing. 54(4): 3–19.

Guo Q. and Fan L.M. 2007. A conjoint analysis in city household preferences for choosing energy conservation measures. China Resources, Pollution, and Environment. 17: 149–153.

Hanemann W.M. 1994. Valuing the environment through contingent valuation. The Journal of Economic Perspectives. 8(4): 19–43.

Hanley N.; S. Mourato; and R.E. Wright. 2001 Choice modelling approaches: A superior alternative for environmental valuation? Journal of Economic Surveys. 15(3): 435–462.

Hsiao, C. and B. Sun. 1999. Modeling response bias: With an analysis of the demand for an advanced electronic device. Journal of Econometrics. 89(1): 15–39.

Kotchen, M.J. and S.D. Reiling. 2000. Environmental attitudes, motivations, and contingent valuation of non-use values: A case study involving endangered species. Ecological Economics. 32(1): 93–107.

Layton D. and S.T. Lee. 2006. From ratings to rankings: The econometric analysis of stated preference ratings data. R. Halvorsen and D.F. Layton (eds.) *In* Explorations in environmental and resource economics: Essays in honor of Gardner M. Brown, Jr. Edward Elgar, Cheltenham, UK. 224–244.

Mackenzie, J. 1992. Evaluating recreation trip attributes and travel time via conjoint analysis. Journal of Leisure Research. 24(2): 171–184.

Malkis, A. and H.G. Grasmick. 1977. Support for the ideology of the environmental movement: Tests of alternative hypotheses. Western Sociological Review. 8(1): 25–47.

McConnell, K.E. 1997. Income and the demand for environmental quality. Environment and Development Economics. 2(4): 383–399.

McConnell, V. and M. Walls. 2005. The value of open space: Evidence from studies of nonmarket benefits. RFF Working Paper. Resources for the Future, Washington, D.C., VA.

McFadden, D. 1974. Conditional logit analysis of qualitative choice behavior. P. Zarembka (ed.) *In* Frontiers in economics. Academic Press, New York. 105–142.

Mogas J.; P. Riera; and R. Brey. 2009. Combining contingent valuation and choice experiments: A forestry application in Spain. Environmental and Resource Economics. 43(4): 535–551.

Morey M.; M. Thieneb; M.D. Salvoc; and G. Signorelloc. 2008. Using attitudinal data to identify latent classes that vary in their preference for landscape preservation. Ecological Economics. 68(1): 536–546.

NBS (National Bureau of Statistics). 2011. China city statistical yearbook 2011. China Statistical Publishing House, Beijing, China.

NBS (National Bureau of Statistics) and MEP (Ministry of Environmental Protection). 2011. China statistical yearbook on environment 2011. China Statistical Publishing House, Beijing, China.

OECD (Organisation for Economic Co-operation and Development). 2007. OECD environmental performance reviews: China. OECD, Paris, France.

Roe B.; K.J. Boyle; and M.F. Teisl. 1996. Using conjoint analysis to derive estimates of compensating variation. Journal of Environmental Economics and Management. 31(2): 145–159.

Sayadi S.; M.C. Gonzalez-Roa; and J. Calatrava-Requena. 2005. Ranking versus scale rating in conjoint analysis: Evaluating landscapes in mountainous regions in southeastern Spain. Ecological Economics. 55(4): 539–550.

———. 2009. Public preferences for landscape features: The case of agricultural landscape in mountainous Mediterranean areas. Land Use Policy. 26(2): 334–344.

Shen J. and T. Saijo. 2008. Reexamining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. Journal of Environmental Psychology. 28(1): 42–50.

Stern P.C. 2000. New environmental theories: Toward a coherent theory of environmentally significant behavior. Journal of Social Issues. 56(3): 407–424.

Stevens T.H.; C. Barrett; and C.E. Willis. 1997. Conjoint analysis of groundwater protection programs. Agricultural and Resource Economics Review. 26(2): 229–236.

Sun, B.H. 1995. Econometric analysis of survey response bias with an application to the demand for an advanced electronic device. University of Southern California, Los Angeles. PhD dissertation.

Van Liere K.D. and R.E. Dunlap. 1980. The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. The Public Opinion Quarterly. 44(2): 181–197.

Veisten, K. 2006. Willingness to pay for eco-labelled wood furniture: Choice-based conjoint analysis versus open-ended contingent valuation. Journal of Forest Economics. 13(1): 29–48.

Xiao, C. and D. Hong. 2012. Gender and concern for environmental issues in urban China. Society and Natural Resources. 25(2): 468–482.

Zhai, G. and T. Suzuki. 2008. Public willingness to pay for environmental management, risk reduction and economic development: Evidence from Tianjin, China. China Economic Review. 19(4): 551–566.

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