Estimating Willingness to Pay for Improving Municipal Solid Waste Management Using a Choice Experiment: A Case Study of Central China

Z J Zhang*

School of Economics, Zhejiang Gongshang University, Hangzhou, China

Corresponding author and e-mail: Zhijian Zhang, zj_zhang@zjgsu.edu.cn

Abstract. To minimize the mismatch between the inadequate capacity of municipal solid waste management (MSWM) services caused by substantially increasing municipal solid waste and the rising demand for higher environmental quality in central China, this paper employed choice experiment method to estimate the willingness to pay of households to improve MSWM services. Based on household survey data from two cities, the estimation results reveal that households, in general, are willing to contribute extra money for the improvement of MSWM services and there is considerable preference heterogeneity across households and cities. Households in Nanchang tend to focus on frequency of waste transportation while households in Anqing prefer frequency of waste collection. Household income, household size, householder age, and especially environmental attitude, are important sources of preference heterogeneity. On an average, households in Nanchang and Anqing are willing to pay 25.632 CNY and 13.275 CNY per month for the improved MSWM services respectively.

1. Introduction

Municipal solid waste management (MSWM) is a major challenge in urban areas throughout the world, especially in the rapidly growing cities of developing countries [1, 2]. As the largest developing country, rapid economic development, rising urbanized population and changed life style have substantially accelerated the volume of municipal solid waste (MSW) generated in China [3, 4]. Almost two thirds of cities are besieged by garbage, most MSW is disposed in landfills and the remainder is covered or heaped in China [5, 6]. Open-air stinking wastes that have not yet been disposed of in many residential areas provide breeding grounds for houseflies, mosquitoes, vermin, and mice. Environmental pollution-related and infectious diseases arising from poor waste management still account for a non-negligible position in ill-health and death. Waste has become a severe threat to public health and environmental quality, and even a serious social problem. Unfortunately, constrained by the limited financial resource from government alone, the capacity for waste management has not kept pace with the growth rate of waste generation. As safe disposal in 1990 was highly limited, the safe disposal rate reached only 53% in 2006 [7]. Accomplishing an effective MSWM system should be a priority for the governments of all cities in China in the years to come [8].

Zhang, Z.
Estimating Willingness to Pay for Improving Municipal Solid Waste Management Using a Choice Experiment: A Case Study of Central China.
In *Proceedings of the International Workshop on Environmental Management, Science and Engineering (IWEMSE 2018)*, pages 382-392
ISBN: 978-989-758-344-5

A considerable number of studies have attempted to analyse MSWM in China [7-16]. Most of these studies either are correlated with the current situation, challenges and suggestions in regard to MSWM systems across regions, or focus on evaluating the MSWM services of different areas from a macro perspective. These important studies indicate the direction for the development of MSWM through a supply-driven approach. However, to what extent does current waste management system provide services that matched households' preferences? It's a critical issue that local authorities should design the MSWM systems considering the preferences or willingness to pay (WTP) of households for the characteristics of services and the technology restrictions of service providers. Recently, some researches have turned to analyse the MSWM services using the demand-responsive approach. For instance, Chu and Xi [17] found that households have different preferences over municipal solid waste collection (e.g., collection frequency and location of containers). Even though they have to pay extra money privately, most households are willing to improve MSW source separation facilities [18]. In a closely related paper, Wang and He [19] employed a contingent valuation method to estimate the households' WTP for an improved MSWM program. They found that a household in Eryuan (a county in southwest China) is willing to pay approximately 17.1 CNY per month for the improved MSWM program on average. This important work, however, does not disentangle what characteristics or attributes of MSWM services households are more willingness to pay and are there preference heterogeneities on improving MSWM services across households and areas.

This study extends the literature by applying a stated preference choice experiment (CE) technique to estimate households' willingness to pay for improving MSWM services in two cities of central China. Specifically, the detailed objectives of this research are listed below.

(1) Elicit households' valuation for the improved MSWM services and implicit price for each attribute.
(2) Identify the factors that influence households' WTP for improving MSWM services.
(3) Carefully examine the preference heterogeneities across households and areas and explain the potential source of heterogeneity.

The contribution of this study to the literature is twofold. Firstly, although six studies have employed CE method to estimate households' WTP for improving MSWM services [20-25], to our best knowledge, this is the first CE study taking preference heterogeneity into consideration on the economic value of MSWM services through random parameter logit model. Secondly, the CE presented in this paper is the only one study that evaluates households' WTP for improving MSWM services in mainland China. Consequently, facing severe challenge of increasing MSW and budget constraints, the non-market valuation can timely provide the authorities with demand-side information to prioritise the MSWM policy instruments which are preferred by most residents.

2. Methods

2.1. The choice experiment

The choice experiment method is consistent with utility maximisation and demand theory [26], which has been widely used in non-market valuation. The CE method assumes the observable utility function is linear in parameters and additively separable, and the probability that one individual chooses a particular alternative is a function of the attributes of that alternative and the characteristics of that individual [27]. Different assumptions of the distribution of random error term yield different choice models. When assuming the random error term is independently and identically distributed (IID) across alternatives and individuals, standard multinomial logit (MNL) model is obtained. But when IID assumption is violated, random parameter logit (RPL) model can be used.

Once parameters of the above choice model are estimated, implicit price for a change in the level of a single attribute can be obtained by dividing the coefficient of that attribute by the coefficient of

payment attribute [28]. When all attributes have increased their levels from initial state to subsequent state, overall WTP for an improved scenario can be calculated.

2.2. Experiment design

This process began with gathering opinions from waste management official, experts in environmental issues and urban residents along with reviewing the literature. After a collection of background information, a series of focus group discussions were conducted to identify potential perspectives upon the attributes of MSWM and their levels as well as other related issues. Four attributes of MSWM are included in final CE survey (see Table 1). Generally, MSWM also has an attribute of waste disposal, but in pretest survey local households universally express little concern about waste disposal and think waste disposal are too far away from them and would not affect their quality of life. The suggested attribute levels are displayed in Table 1.

Table 1. Attributes and their levels of MSWM.

Attributes	Levels
Waste classification	No waste classification needed[a]
	Waste classification and free containers from government
Frequency of waste collection	Once a day[a]
	Twice a day
Frequency of waste transportation	Once a day[a]
	Twice a day
Fee	5 CNY per month[a]
	10 CNY per month
	15 CNY per month

Note: [a] The current level of each attribute.

Once attributes and attribute levels were determined, a fractional factorial was conducted [27, 29]. Using the orthogonal design in SPSS 20.0, 12 choice sets were left after dominant and implausible alternatives were removed from the design, but orthogonality was reserved. The 12 choice sets were averagely divided into two blocks, and each respondent was exposed to one version only. Each choice set contains two alternatives and an option to keep the status quo.

A pilot test was conducted with a group of 20 respondents to check for respondents' understanding on the MSWM, choice context, adequacy of the attributes and levels considered, and other factors such as the wording, format and length of the questionnaire. Apart from choice experiment module, the final version of questionnaire included another two modules. Before choice experiment module, questionnaire contained questions on the respondents' knowledge, attitudes and awareness toward environment and MSWM in general. During choice experiment period, we reminded respondents that: please choose each choice set separately; when choose alternative A or B, you have to pay an incremental monthly fee for the improved MSWM services in addition to your existing payment; the money you spend on this additional fee would not be available for other household expense. And the last module consisted of items on socio-economic information of respondents.

2.3. Study sites and data collection

The study sites were two inland cities (Nanchang and Anqing), which are situated in central China. Nanchang is the capital of Jiangxi province, which has a higher level of economic and social development than Anqing. However, in those areas, the capacity of MSWM cannot keep pace with

the sharp increase of municipal solid waste generated. The limitation on financial budget and the increasing real operational cost of MSWM have made it tougher to dispose of solid waste in many communities. The heaped waste that has not received timely treatment poses a serious threat to environmental quality and human health, especially in summer when the speed of waste rotting is particularly fast. As a result, the demand of households for improving the MSWM services is dramatically rising.

On July 5, 2013, after a systematic training session was held for the interviewers, the survey was put into field. We employed face-to-face personal interviews as our survey mode in each city. In order to limit interviewer bias the interviewers followed a random route procedure to select respondents. The starting point was randomly determined by dicing and then every third household was visited. Since waste is collected and paid for at the household level, we chose the household as the unit of analysis and selected the head of household as respondent in each household. Overall, 240 attempts were made and 182 interviews were completed on August 20, 2013. After removing 7 protest bids (3 respondents indicated "the government should pay for this", 3 respondents indicated "I don't believe the policies would actually happen", and 1 respondent indicated "the fee rises too much"), the remaining 175 questionnaires were used in the following analysis (see Hanley et al.) [30]. More information on the number of samples in each city was reported in Table 2.

Table 2. The number of samples in each city.

City	Population[a]	Attempts[b]	Interviews[c]	Effective samples
Nanchang	5.04 million	120	86	82
Anqing	5.31 million	120	96	93

Note: a The data are from China's sixth national census (2010); b The number of planed samples; c The number of completed interviews.

3. Results and discussion

3.1. Social, economic and attitudinal characteristics of the respondents

Table 3. Descriptive statistics of respondents (N=226).

		Nanchang			Anqing		
Variable		Nanchang mean[a]	Sample mean	Sample std. dev.	Anqing mean[a]	Sample mean	Sample std. dev.
Gender	Male	52%	54%	0.50	51%	53%	0.50
	Female	48%	46%		49%	47%	
Marital status	Married	78%	77%	0.42	81%	84%	0.34
	Single	22%	23%		19%	16%	
Age		35.49	38.46	12.46	37.28	40.57	12.37
Education		9.98	10.07	3.86	8.05	8.37	3.20
Household income		8.63[b]	8.71	7.02	6.49[c]	5.89	3.29
Household size		3.39	3.93	1.16	3.27	3.97	1.24
Environmental knowledge		–	2.01	1.19	–	1.43	1.32
Environmental awareness		–	3.74	0.44	–	3.55	0.50
Neighbors' environmental awareness		–	2.80	0.82	–	2.69	0.79

Source: a China's sixth national census, 2010; b Nanchang Statistics Bureau, 2014; c Anqing Statistics Bureau, 2014.

The descriptive statistics of the respondents were presented in Table 3. Across the two sub-samples, the social and economic characteristics of each sub-sample were similar to the city averages with the exception of age and household size in both sub-samples and household income in Anqing sample. The former was mainly due to the fact that the population mean was calculated based on all the people in city while the sample only included heads of households. With respect to household size, the sample mean was higher in each city because a certain proportion of persons in respondents' households were from countryside or even did not have "hukou" (household registration). The slightly lower income level of Anqing sample may be explained by the big gap between the rich and the poor in Anqing and the sample was happening to consist of more poor people.

As regard to attitudinal characteristics, the environmental knowledge of respondents in Nanchang was considerably more than that in Anqing. The respondents' environmental awareness and their neighbors' environmental awareness in Nanchang were also higher than those in Anqing, but the differences were small.

3.2. Estimation results of choice experiment

Initial descriptive statistical analysis showed that the sample was representative of the population. Variables used in the choice models and their definition and coding were presented in Table A2. Note that the software used to undertake these estimations was Nlogit 4.0.

3.2.1. The results of multinomial logit (MNL) model. Two different MNL models were estimated for Nanchang and Anqing data sets (see Table 4). The first model was a basic specification that showed the importance of the choice set attributes in explaining respondent's taste for different options, and the second model, on the basis of the first model, additionally included socio-economic and attitudinal variables by interactions with alternative specific constant (ASC).

Table 4. Parameter estimates from MNL model for Nanchang and Anqing data sets.

	Nanchang		Anqing	
Variable	Model 1	Model 2	Model 1	Model 2
ASC	1.628**	1.494	2.437***	-2.137
Wc	0.862***	0.898***	0.112*	0.075**
Fwc	0.322**	0.315**	0.620	0.625
Fwt	0.621***	0.573***	0.578**	0.353**
Fee	-0.368***	-0.365***	-0.524***	-0.504***
ASC*Gender		-0.175		0.013
ASC*Age		-0.236		-0.421*
ASC*Mar		-0.629		0.118
ASC*Edu		0.019		0.083*
ASC*Hinco		0.059**		0.092**
ASC*Hsize		0.110		0.093
ASC*Eknow		0.167*		-0.021
ASC*Eaware		1.363***		0.599**
ASC*Naware		0.381***		0.303*
Observations	492	492	558	558
Log-likehood	-320.870	-310.638	-421.159	-377.917
Pseudo R-square	0.252	0.276	0.227	0.306

Note: * significance at 10%; ** significance at 5%; and *** significance at 1%.

In model 1 for each data set, the coefficients on ASC and all attributes have expected signs and are significant at the 10% level or less except the insignificant coefficient on 'frequency of waste

collection' from Anqing data set, which indicates that respondents across the two cities, in general, are concerned about the improvement of attribute levels and a relatively reasonable experimental design we have. The model fit of model 2 for each data set is improved by incorporating the interaction terms. Model 2 is highly consistent with model 1 in terms of signs and significance of attribute coefficients. It reveals that assuming other factors remain constant, improving the levels of 'waste classification', 'frequency of waste collection' and 'frequency of waste transportation' would increase respondents' utility while increasing the fee would decrease their utility. But respondents from different data sets have different preferences for attributes, e.g., respondents in Nanchang tend to focus on 'waste classification' and 'frequency of waste transportation' while respondents in Anqing are inclined to 'frequency of waste collection'. It should be noted that the coefficient on 'frequency of waste collection' has the largest value but is not significantly different from zero at the 10% level in Anqing data set, and its accuracy and reliability deserve the following further study.

The interaction terms have different signs and significance across the two data sets. Model 2 for Nanchang manifests respondents who have higher household income, more environmental knowledge, higher awareness of environmental protection, or more positive subjective perception of the environmental behaviors of their neighbors are willing to pay more for improving MSWM services, ceteris paribus. As to Anqing data set, education, household income, environmental awareness, and subjective perception of the environmental behaviors of neighbors have significantly improved households' willingness to contribute money. These findings are consistent with previous studies [20, 21, 31, 32]. However, older people in Anqing are more reluctant to pay, which is intuitively correct since older people have low level of environmental awareness and are more conservative in spending in China.

Despite widely used, MNL model has severe limitations with respect to the well-known assumption of independence of irrelevant alternatives and its ability to capture random taste heterogeneity across individuals [33, 34]. Hence, we will move to apply a less restrictive and more flexible model to the following analysis.

3.2.2. The results of random parameter logit (RPL) model. As RPL model tends to be unstable and identification issues arise when all coefficients vary over the population, the coefficient on fee is fixed while other coefficients are allowed to vary in our analysis (see Goett et al., Revelt and Train) [35, 36]. Considering some respondents may be satisfied with the status quo, e.g., respondents need not have to spend time and energy on waste separation nor have to pay extra money, we specify the coefficients on 'waste classification', 'frequency of waste collection' and 'frequency of waste transportation' to be normally distributed. Attributes showing insignificant standard deviation are then respecified as nonrandom parameters. At last, 'frequency of waste collection' and 'frequency of waste transportation' are specified as random parameters and other variables remain nonrandom parameters in estimation models for the two data sets. To identify the potential sources of heterogeneity, random parameters are interacted with socio-economic and attitudinal variables. Initially, all possible interactions are put into estimation model for each city and finally only interactions that are significant at the 10% level or less are retained. The estimation results are shown in Table 5.

The estimation of RPL model results in considerable improvement of model fit over the MNL model. All parameter estimates related to the attributes and ASC are statistically significant and have the expected signs including the 'frequency of waste collection' for Anqing data set, on which the coefficient is insignificant in the MNL model. The ASC and 'waste classification' are nonrandom parameters for the two cities, implying that respondents generally agree to improve the services of MSWM at the expense of extra spending and waste separation, which is out of our expectation. One possible explanation is that, along with the increasing negative impacts of waste on residents and

vigorously publicizing waste separation from government and environmental organizations, households are gradually aware of the necessity of improving MSWM services.

For Nanchang data, the RPL model reveals that, even though the respondents derive significantly positive utility from 'frequency of waste collection' and 'frequency of waste transportation' on average, the standard deviations for these two attributes are both significant, indicating that there are heterogeneous preferences for these two attributes. The interaction results show that respondents with higher household income demand MSWM program with higher level of 'frequency of waste collection'. Those respondents having higher awareness of environmental protection prefer MSWM program with higher level of 'frequency of waste collection' and 'frequency of waste transportation'. Finally, respondents having more environmental knowledge or more positively evaluate their neighbors' environmental behaviors attach higher utility to MSWM program which has higher level of 'frequency of waste transportation'. On the whole, it is environmental concern, rather than household income, that contributes to explain the heterogeneous preferences for MSWM attributes.

Table 5. Parameter estimates from RPL model for Nanchang and Anqing data sets.

	Nanchang		Anqing	
Variable	Mean	Std. dev.	Mean	Std. dev.
Random parameters in utility function				
Fwc	4.054**	0.827*	3.732*	2.721**
Fwt	4.636**	1.528***	1.689***	2.169**
Nonrandom parameters in utility function				
ASC	1.686*		5.574***	
Wc	1.056***		0.355*	
Fee	-0.446***		-0.855***	
Potential sources of heterogeneity				
Fwc: Hinco	0.046*		0.165*	
Fwc: Hsize			0.305*	
Fwc: Eaware	0.703*		0.274***	
Fwc: Age			-0.372*	
Fwt: Edu			0.203*	
Fwt: Hsize			0.546*	
Fwt: Eknow	0.552**			
Fwt: Eaware	2.561***		1.023**	
Fwt: Naware	0.753*		0.387*	
Observations	492		558	
Log-likehood	-302.824		-366.307	
Pseudo R-square	0.295		0.327	

Note: * significance at 10%; ** significance at 5%; and *** significance at 1%.

In Anqing, the RPL model shows that the mean values and standard deviations for 'frequency of waste collection' and 'frequency of waste transportation' are significant, suggesting the presence of heterogeneity in preference for these two attributes. In addition, the standard deviation parameter for 'frequency of waste transportation' exhibits considerable variability, meaning that some respondents derive negative utility from higher level of this attribute. Respondents who have higher household income, or who are younger, prefer MSWM program with higher level of 'frequency of waste collection'. Whereas those who receive higher education, or who have more positive subjective perception of the environmental behaviors of their neighbors tend to choose MSWM program that has higher level of 'frequency of waste transportation'. Finally, household size and environmental awareness significantly increase the preference of respondent for MSWM program with higher level of both 'frequency of waste collection' and 'frequency of waste transportation'. These findings are similar to other scholars' conclusion that household size and environmental awareness effectively

improve the WTP of households for MSWM program with sufficient waste separated collection [18, 37]. Nevertheless, in contrast with the findings in Nanchang, environmental knowledge has played an insignificant role in explaining attributes preference in Anqing, indicating that only high levels of environmental knowledge matter.

3.3. Welfare estimates

Once we have obtained the results of choice model, welfare measures can be estimated. The implicit prices for MSWM attributes are calculated using the results of MNL models (Model 2) and RPL models (see Table 6). And the confidence intervals for the implicit price measures have been calculated using the delta method.

Table 6. Implicit prices for attributes (in CNY) and 95% confidence intervals (95% level).

	Nanchang		Anqing	
Attribute	MNL	RPL	MNL	RPL
Wc	2.460 (-0.508, 5.429)	2.368 (-0.542, 5.278)	0.149 (-1.930, 2.227)	0.415 (-1.299, 2.129)
Fwc	0.863 (-1.604, 3.330)	9.090 (-1.091, 19.270)	—	4.365 (-0.511, 6.079)
Fwt	1.570 (-0.245, 3.385)	10.395 (-0.194, 20.983)	0.700 (-0.601, 2.002)	1.975 (-7.843, 11.794)

Note: —The parameter estimate is not significantly different from zero at the 10% level; Confidence intervals in parentheses.

As can be seen in Table 6, compared to the estimates of implicit prices derived from the MNL models, the resulting implicit prices derived from the RPL models are consistently larger except the implicit price for waste classification attribute in Nanchang data set. A similar result has also been reported by Revelt and Train [36], and Sillano and Ortúzar [38], which is related to the fact that RPL model decomposes the unobserved utility and normalizes parameters on the basis of part of the unobserved utility. Furthermore, we can find larger confidence intervals for implicit prices in the RPL models, corresponding to those in the MNL models, reflecting the substantial variations in respondents' preferences for these attributes.

Table 7. Willingness to pay for the improved MSWM services (in CNY) and confidence intervals (95% level).

	Nanchang	Anqing
WTP for MSWM	25.632 (23.834, 27.431)	13.275 (9.648, 16.902)

Considering the MNL models have restrictive assumption and their model fits are worse than the RPL models', our following analysis is based on the results of RPL models. An implied ranking of attributes in terms of respondents' preference for each data set can be derived. 'Frequency of waste transportation' is the highest ranked attribute in Nanchang while 'frequency of waste collection' is the highest ranked attribute in Anqing. As 'waste classification' requires households to spend time and energy on waste separation at the household level, it is the lowest ranked attribute in the two data sets. Furthermore, as showed in Table 7, on an average, households in Nanchang are willing to pay

25.632 CNY per month for the improved MSWM services while the WTP of each household in Anqing is 13.275 CNY per month. The big gap on WTP for the improved MSWM services between Nanchang and Anqing is caused by the imbalance development of the society and economy across regions in China. In addition to relatively affluent income, more importantly, households in Nanchang have a higher level of environmental concern, which has an appreciable impact on increasing households' WTP for improving MSWM services (see Table 3, 4 and 5). In addition, we also compared our WTP estimates with previous researches in other countries or areas (see Table 8). There is some space for increasing the level of garbage treatment fee, which is both the precondition for sustaining MSWM and the incentive mechanism for residential waste reduction.

Table 8. Comparison of WTP estimates.

Study	Country and area	WTP per household per month	Share [a]
Nanchang (present study)	Mainland China	25.632 CNY (USD 4.18)	0.35%
Anqing (present study)	Mainland China	13.275 CNY (USD 2.16)	0.27%
Ku et al. [22]	Korea	1178-1918 KRW (USD 1.24-2.02)	0.03-0.05%
Afroz and Masud [31]	Malaysia	22 MYR (USD 6.89)	1.7%
Fonta et al. [32]	Nigeria	230 Naira (USD 1.8)	1.82%
Afroz et al. [39]	Bangladesh	13 Taka (USD 0.18)	0.12%
Jin et al. [40]	Macao	67-81 MOP (USD 8.33-10.15)	0.36-0.44%

Note: a denotes the share of average annual household income; The exchange rate between the country's currency and dollar is the exchange rate at that time.

4. Conclusions and Implications

This paper was motivated by providing policy-makers with additional information to adopt appropriate MSWM measures to improve the poor environmental quality of urban households in central China. In this study, the CE technique was employed to elicit households' preferences for various improved MSWM alternatives in two cities.

The results from MNL models suggest that even though households have different preferences for MSWM attributes across the two cities, households in each city are generally willing to contribute extra money for MSWM services associated with higher levels of attributes. In order to obtain more reliable results and figure out the presence of unobserved heterogeneity in the preference for MSWM attributes, RPL model was specified for the respondents from each city. The findings support that the possible sources of heterogeneous preferences for 'frequency of waste collection' and 'frequency of waste transportation' are multiple household characteristics. Social-economic characteristics and especially environmental attitude are critical factors that stimulate households willing to pay extra money for improving attribute levels of MSWM services.

We further obtained implicit price measures for MSWM attributes and WTP measures for the improved MSWM services of the two cities. Households in Nanchang are willing to pay more for the higher level of 'frequency of waste transportation' while households in Anqing are willing to pay more for the higher level of 'frequency of waste collection'. In general, households in Nanchang and Anqing are willing to pay 25.632 CNY and 13.275 CNY per month for the improved MSWM services respectively. This information is important for the Environment Protection Agency to determine which MSWM options will provide the greatest benefits to the widest households in the two cities where financial resources are limited and conflicting development interests exist. However, it is important to note that actual decision is a more complex process, which needs more cost-benefit information and valuation criterion.

Acknowledgement

This research was supported by the General Program of the National Natural Science Foundation of China (Grant No.71773114).

References

[1] Han H, Zhang Z, Xia S and Li H 2018 *J. Environ. Plan. Manage.* 61 568-596
[2] Moh Y and Manaf L A 2017 *Resour. Conserv. Recycl.* 116 1-14
[3] Cheng H, Zhang Y, Meng A and Li Q 2007 *Environ. Sci. Technol.* 41 7509-7515
[4] Hong J, Li X and Cui Z 2010 *Waste Manage.* 30 2362-2369
[5] Chung S S and Lo C W 2008 *Waste Manage.* 28 272-281
[6] Wang L A ,Pei T Q, Huang C and Yuan H 2009 *Waste Manage.* 29 2203-2208
[7] Chen X, Geng Y and Fujita T 2010 *Waste Manage.* 30 716-724
[8] Zhang D Q, Tan S K and Gersberg R M 2010 *J. Environ. Manage.* 91 1623-1633
[9] Hong R J, Wang G F, Guo R Z, Cheng X, Liu Q, Zhang P J and Qian G R 2006 *Resour. Conserv. Recycl.* 49 129-146
[10] Jiang J, Lou Z, Ng S, Luobu C and Ji D 2009. *Waste Manage.* 29 1186-1191
[11] Li Z, Yang L, Qu X and Sui Y 2009 *Waste Manage.* 29 2596-2599
[12] Linzner R and Salhofer S 2014 *Waste Manage. Res.* 32 896-907
[13] Liu C, Wu X 2010 *Waste Manage. Res.* 29 371-378
[14] Ren X, Hu S 2014 *Waste Manage. Res.* 32 340-347
[15] Yuan H, Wang L A, Su F and Hu G 2006 *Waste Manage.* 26 1052-1062
[16] Zhu M, Fan X, Alberto R, He Q, Federico V, Liu B, Alessandro G and Liu Y 2009 *Waste Manage.* 29 1227-1233
[17] Chu Z, Xi B, Song Y and Crampton E 2013 *Habitat Int.* 40 194-200
[18] Zhang W, Y Che, Yang K, Ren X and Tai J 2012 *Waste Manage. Res.* 30 1261-1271
[19] Wang H, He J, Kim Y and Kamata T 2014 *Waste Manage. Res.* 32 695-706
[20] Jin J, Wang Z and Ran S 2006 *Waste Manage. Res.* 24 301-309
[21] Karousakis K and Birol E 2008 *J. Environ. Manage.* 88 1099-1108
[22] Ku S, Yoo S and Kwak S 2009 *Environ. Manage.* 44 278-287
[23] Othman J 2007 *Int. J. Manage. Stud.* 14 189-212
[24] Pek C and Jamal O 2011 *J. Environ. Manage.* 92 2993-3001
[25] Sakata Y 2007 *Waste Manage.* 27 639-644
[26] Bateman I J, Carson R T, Day B, Hanemann W M, Hanley N, Hett T, Jones-Lee M, Loomes G, Mourato S and Ozdemiroglu E 2003 *Guidelines for the use of stated preference techniques for the valuation of preferences for non-market goods* (Cheltenham, UK: Edward Elgar)
[27] Louviere J J, Hensher D A and Swait J D 2000 *Stated choice methods: analysis and applications* (Cambridge: Cambridge University Press)
[28] Boxall P C, Adamowicz W L, Swait J, Williams M and Louviere J 1996 *Ecol. Econ.* 18 243-253
[29] Hensher D A, Rose J M and Greene W H 2005 *Applied choice analysis: a primer* (Cambridge: Cambridge University Press)
[30] Hanley N, Colombo S, Mason P and Johns H 2007 *J. Agr. Econ.* 58 433-453
[31] Afroz R and Masud M M 2011 *Waste Manage.* 31 800-808
[32] Fonta W M, Ichoku H E, Ogujiuba K K and Chukwu J O 2008 *J. Afr. Econ.* 17 277-304
[33] Beharry-Borg N and Scarpa R 2010 *Ecol. Econ.* 69 1124-1139
[34] Train K E 1998 *Land Econ.* 74 230-239
[35] Goett A A, Hudson K and Train K E 2000 *Energy J.* 21 1-28
[36] Revelt D and Train K 1998 *Rev. Econ. Stat.* 80 647-657
[37] Basili M, Matteo M D and Ferrini S 2006 *Waste Manage.* 26 209-219
[38] Sillano M and Ortúzar J D D 2005 *Environ. Plan. A* 37 525-550

[39] Afroz R, Hanaki K and Hasegawa K 2009 *J. Environ. Manage.* 90 492-503
[40] Jin J, Wang Z and Ran S 2006 *Ecol. Econ.* 57 430-441