Using a Contingent Valuation Approach for Improved Household Solid Waste Management in Algeria

Brahim, DJEMACI

University of Boumerdes (Algeria)

15 December 2015

Using a Contingent Valuation Approach for Improved Household Solid Waste Management in Algeria

Abstract: This study examines the values of willingness to Pay (WTP) for improved household solid waste management in Algeria, Isser City. A payment card contingent valuation technique was used to elicit households' willingness to pay for an improvement in management of their solid waste. The data were analyzed using interval regression technique. The results show that the mean willingness to pay of households for improved solid waste management is 1,485 DZD. The amount of tax on garbage is fixed between 500 and 1000 DZD for households and the cost of the new management is estimated to 2844 dinars per ton. The total value of CAP from households covers only 37% of the costs of new program. The results further reveal that the significant factors determining households' willingness to pay for improved solid waste management (collection and disposal) are age, type of housing, distance, educational level, income and service quality.

1.   Introduction

In the framework of the program of the integrated management of municipal waste (PROGDEM) of 2001, the Algerian government has adopted a new policy on municipal waste management to respond to major problems caused by waste to municipalities. This program is based on the landfill as a mode of waste disposal through the construction of 80 sanitary landfill sites (SLS) and the total eradication of illegal dumping. The other axis of this program is to determine the means and equipment necessary to implement this new policy through the plans of urban waste management in each municipality. In 2007, over 650 plans were realized on the whole territory. The investment cost of the SLS and the modernization of means of waste service are supported by the State through the various programs of economic revival.

This program focuses on a new strategy. This is based on the precautionary-prevention principle, polluter-payer principle, producer-collector principle, and the role of information- sensitization of the citizen. The principal actions concerned by PROGDEM are the following ones:

- Elaboration and implement of the municipal plans of management of waste;

- Arrangement of sites controlled discharge ;

- Promotion of recycling activities and waste recovery;

- Introduction of new forms of management;

- Gradual Adaptation of the tax household waste collect and the improve its recovery rate;

- Sensitization, forming and education.

The objective of PROGDEM is to improve the quality of the environment, protect public health by implementing measures to prevent, eradicate illegal discharge and replacing them with by landfills centers. The cost of implementation of this program is financed by the State however the cost of management will be assured by all households through the Tax of waste collection TEOM[1] (MATET, 2003). Among the lines of this program is the elaboration of plans managing directors of the urban waste at the level of all the municipalities which will present the new organizational plans of households waste and assimilated (HWA). The latter provides a quantitative and qualitative estimation of the evolution of HWA relative to population growth and economic development taking into account prevention policies such as the possibility of reduction to the source. This new plan should be based on the following points:

- A sectorization of territory,

---

[1] Tax collection of household waste.

- A frequence of the collection;

- An inventory of the human and material resources necessary;

- An introduction of the selective collection.

The evaluation of investment needed for the new waste program at the local level must be examined and presented (OJ, 2007)[2].

The implementation of such program will result in additional costs to municipalities which do not any more manage to provide the actual cost of waste collection. In addition to a recovery rate of the TEOM very low about 15% nationally[3] (MATET[4], 2005). If a recovery rate of 100%, the recipe of this tax remains below the cost of the new management where from the importance to revalue this tax and to improve its rate of covering. We note that the Finance law of 2002 introduced the TEOM for three categories, households, businesses and firms with ranges that vary from one category to another.

It is between 500 and 1000 DZD[5] for the households and higher amounts for others categories. The fixation of the amount of this tax is the competence of collectivities locals. Indeed, this tax is poorly perceived by the inhabitants following the actual situation of waste collection service. Thus, the fixation of these ranges did not consider the socioeconomic characteristics of the inhabitants. The principals' questions which we research to respond are following ones: what are the factors that can influence the behavior of individual in local public policies to preserve the environment quality related to waste management? Has the localization of a discharge an impact on the willingness to pay (WTP)? What is the value of (WTP) to improve the quality of this service?.

The use of contingent valuation method (CVM) is shown here to determine the value and factors that influence household WTP to improve waste service and the fixed the amount of tax (TEOM). At present, no study was realized in Algeria for this type of problem. The CVM is a method based of the survey, is frequently used to express monetary values on environmental goods and services not markets. Her important use is explicated by the flexibility and the capacity to estimate the total value including the value of passive use (Carson et al., 2001). Thus, it can be used to estimate values for specific programs, valuation environmental damage and to fix the amounts of tax. This object is to get directly with individuals their expressing of WTP to benefit from an environment good (Beaumais and Chiroleu-Assouline, 2002).

---

[2]Executive Order n° 07-205 of 30 june 2007 Fixing the modalities and procedures for the elaboration, publication and revision of the scheme of municipal household waste management and assimilated.
[3] At December 31, 2004 (latest data available).
[4] Ministry of Planning, Environment and Tourism
[5] 1 USD is equivalent to 100

These last years, this method is used by the different disciplines. The database Evri[6] has been an increase in the number of studies using the CVM, they went from 524 published studies from 1999 to 1971 in 2008. Several studies have interested the willingness to pay (WTP) or accept (WTA) of populations in developing countries. The CVM applied to developing countries could be an important component of evaluating a project if it is not marketed (Hans et al, 1999). So, for example, waste services. Afroz et al. (2008) have estimated the WTP of the residents of Dhaka city in Bangladesh to improve the quality of waste collection service using. The survey face to face and a theoretical model based on random utility theory have been well used. This method was also used in Ghana to analyze the WTP for the purchase of compost from municipal waste in urban and suburban areas by a Probit model (Danso et al., 2006). A study was conducted in Malaysia to estimate the WTP of the sector contractors and building construction to adopt a new management of their construction waste. The question to participate or not in the program was first raised, followed by a question opened in the favorable case (Begum et al ., 2007). Fanta et al., (2007) have used the CVM to determinate a price for a new solid waste management in the State of Enuga, Nigeria. A probit model is used to identify the characteristics of households which are probably going to provide a positive WTP. Furthermore, another study was conducted in Oyo State, Nigeria (Yusuf et al., 2007) to determine the WTP of inhabitants in the case of improved waste service by a Logit model. However, the total economic value of a good or service is composed by two values, use value and non-use value (Carson et Hanemann, 2005). In the case of collection service and waste disposal, use value may be direct, indirect and induced (Heintz, 2002). Direct use refers to households and activities that use the service to disposal waste or recover waste materials.

The objective of such a service is primarily to disposal waste products by consumers, thus improving soil quality through the components of compost (impact on the ecosystem). Finally, it represents a source of income for some households (informal sector). On the other hand, the value of non-use may be the limitation of various nuisances. The option value is the future value of an active. The service waste allows through sorting of preserving an environmental goods for future generations. The objective of this paper is to determine the factors that influence the household decision to participate in the management cost of a new waste program. This study estimate willingness to pay inhabitants to improve the service of the management of waste in Algeria. This WTP can be used as a reference to the political decision-makers to revalue the amount of the TEOM and to the local responsible to fix the rates. Thus, to compares the amounts of WTP with the cost associated with to the realization of this program. Nevertheless, this paper provides policy makers with background information on

---

[6] http://www.evri.ca/francais/default.htm

individuals' behavior in favor of protecting and conserving the environment. Nevertheless, this paper offers to the public decision-makers of the elements of appreciation of the behavior of the individuals in favor of protecting and some conserving the environment. Besides the individual socioeconomic variables used to estimate this WTP, a variable localization or distance between home and the discharge was included in our model to estimate the impact of that on the WTP. The use of surveys constitutes a relevant instrument to help the public decision since it is a question of appreciating certain explanatory factors at the origin of economic decisions which concern public goods (Luchini, 2002).

We will show in the first point our study area, the design and conduct of the survey by presenting the characteristics of our sample. Econometric analysis is then presented. It includes an interval model to estimate the amount of WTP. Then, different results will be presented in the third item. We will end with a comparison between the WTP and the estimated cost of the new management.

2. Survey design, data collection and analytical model

2.1. Survey site,

The choice of study area has covered the city of Issers in Algeria located 60 km from the capital Algiers. It has a surface area of 67.03 km2 with 33,366 inhabitants in 2008 (27,920 inhabitants in 1998 against 22,387 inhabitants in 1987), or an average annual rate of increase (AARI) of about 1.95%. The final destination of the waste collected at the discharge wild south-east of the city next to a river. It covers an area of about one hectare and located in a hydraulic earth surrounded by agricultural activities (market gardening and arboriculture). The dumping of waste types is done in a random manner, and the waste is burned in the open.This situation can damage to the environment, so causing a pollution of superficial waters by direct contamination of groundwater via the infiltration of lixiviats. Thus, it can be a source of nuisances and externalities (smoke, the proliferation of stray's potential disease carriers ...). The localization of districts is very heterogeneous with regard to the emplacement of the discharge of 0.29 km for the closest to over 6 km in the mountainous villages, and 1.5 km from the city center. The city of Issers is decomposed in the new scheme of waste management in four sectors, each sector contains districts (see Table 1). These areas are depended to various criteria: topographical, repartition of public establishment, demographic and waste production.

Table 1 : The production of waste to the new sectros

	Sector1	Sector 2	Sector 3	Sector 4
inhabitant number	7173	8938	10559	6696
amount produce (T/days)	4.44	5.54	6.57	4.15

Source : plan for waste management in the municipality of Issers, 2007.

2.2. Administration the survey

The survey, conducted through face-to-face interviews with 244 individuals residing in different districts of the municipality of Issers. The choice of the sample is based on the method of quota sampling in terms of the proportion of households comprising the four sectors mentioned above. We have targeted the heads of households, knowing that in 2007; 5235 households resident in our study area. The survey was conducted between December 2008 and early January 2009. The realization and the admiration for the questionnaire have been the subject of our attention; the respect of the technical recommendations made by the panel of NOAA (1993) including design of the survey for the CVM is able to provide the reliable information on the passive use values of a good or a service. Carson (1999) has paid particular attention to developing the questionnaire to validate the quality of a study of CVM. We used pictures of illegal dumping in the city, a future landfill site, modes of collection and transportation equipment and pre-collection as suggested by the NOAA. We were more careful for several questions on the use and the administration of the method of evaluation contingent in developing countries as underlines it Whittington (1998). The final questionnaire was contained 26 questions and was divided into three sections to obtain:

- Information about the social and economic characteristics of respondents.

- Information on household attitudes towards environmental perception and their opinions on the service of waste;

- Information of WTP under the two scenarios presented above.

Geographic questions were asked including: distance between the home and the localization of the discharge.

The questionnaire has been pre-tested with 16 individuals to bring up the incomprehension's of questions and analyze all variables, and the opportunity to supplement omissions. This pre-test allowed us to correct the income variable that we have increased the number of classes proposed in classes from in passing by 6 classes in 10 classes. The photographs used have well-lit mode current collection and disposal of waste. They helped the individuals to compare between a wild discharge and a landfill site. Concerning the vehicle of payment, we asked respondents to choose between a fund intended for the management of waste or a tax integrated into the municipal budget.

2.3. Format of elicitation

Two scenarios were proposed to all respondents:

1. The first scenario is that where the government decides to leave the mode of waste management at the level of the municipality in her current state without any improvement. We asked households: "*What would be the amount you are willing to pay for the removal of household waste?*". A payment card has been proposed in order to compare the WTP with that of the scenario 2. The actual management correspond the collection of waste and municipal discharge uncontrolled.

2. The second scenario, the governments decide the application of the PRODEM at the level of the municipality. The investment cost is assured by the government; however residents must contribute financially to the costs of management. The following question was posed to respondents "*Would you accept the idea that the inhabitants of the town contribute financially to improve the collection, treatment and disposal of household waste?*". The response is yes or no. in the favorable case, another question of revelation of the WTP is exposed: "What *would be the maximum annual amount you are willing to pay to achieve this program to improve the state of the environment in your community? 0, 500, 1000, 1500, 2000, 2500, 3000, 3500, 4000, more*". The choice of the payment card format is adapted to our study because the individuals are uncertain about their WTP (Broberg and Brännlund, 2008). The individual declares his WTP through several propositions of zero to plus 4000 DZA. The minimal value (zero) represents here more a behavior of protest. However, the maximum value correspond at the cost to 4000 DZA estimate by the Metap[7] report. And as the range of the payment card is truncated (Rowe et al., 1996), by uncertain responses (Alberini et al., 2003), a third question was posed to control the uncertainty of the individual and obtain its point value via an open question: «*What amount is you willing to pay more than (X) dinars you have already announced in question number 20? »*.

2.4. General characteristics of the sample

Table 2 summaries the general characteristics of the respondents. The sample is composed of 92.21% of men and 3.28 % of women. This can be explained by the fact that in societies of North Africa, conservative man is often the chief family, and thus responsible spending. This variable is excluded from our model in the absence of criterion of variation. The distribution of the age is censored to the left because only the persons of more than 25 years were interrogated. Their ages vary from 25 to 70 years with an average of 47 years. The studies of the determiners of environmental attitudes identify the age as an important factor. The educational level of respondents is very heterogeneous with 62 individuals who have no schooling and primary level, and the same

---

[7] Mediterranean Environmental Technical Assistance Programme.

number for all other levels, and the same number for all other levels. If we addition the three education levels lower, we come than 52% of the sample. This is because the average age of our sample which over half were born before 1962 the year of independence of Algeria. The education variable included in the model consists of two categories, having a standard high school (or secondary) or more and less than a high school (not regrouped level, primary and secondary). Officials representing 28.69% of individuals, this is explained by the fact that the public remains the dominant sector in employment in Algeria. The high rate of pensioners is due to the voluntary departure of employees before the legal retirement age set at 60 years due to economic reforms initiated since 1990. The workers represent 18.85%, the agricultures 8.20%, the liberal's professions 3.69%. The persons who reported being unemployed are nearly 10%, much is made of young people under 35 years. A large part of them is self-declared (informal) which allows having an unstable income and that 22% of respondents have an income below the SNMG[8]. Nearly half the sample reporting income between 20 000 and 40 000 DZD, and nearly 13% have incomes above 40 000 DZD. The variable income was included in the model as a binary variable, distinguishing between those two categories, above and below 15 000 dinars per month. The type of housing varies between buildings 31.97%, individual house 42.21% and traditional houses 25.82% (precarious, prefabricated home ground). The number of people in a household in our sample is an average of 5.27 persons. This ratio is close to the average of the department of Boumerdes (6.5 people) and the national average (6.9 people) (ONS, 2008).

Table 2: Characteristics of the respondents

	Number of invidious	**%**	**Mean**
Sex			
Men	225	92.21 %	
Women	8	3.28	
Age			47
[25, 35]	36	14.75 %	
[36, 45]	69	28.28	
[46, 55]	75	30.74	
[56, 65]	56	22.95	
[66, 75]	5	2.05	
Number of persons in the household			Municipality = 5.27
	36	14.76 %	Department = 5.6
4	50	20.95	National = 5.9
5	56	22.95	
6	51	20.90	
7	27	11.07	
+8	24	9.84	
Profession			
Farmer	20	8.20 %	
Trader	30	12.30	
worker	46	18.85	
liberal Profession	09	3.69	
Public service	70	28.69	

[8] National guaranteed minimum wage is 15 000DA since 1 January 2009.

retired	39	15.98	
unemployed	23	9.43	
Level education			
Sans	21	8.61 %	
Primary	41	16.80	
college	63	25.82	
school	60	24.59	
university	45	18.44	
Bac +5 et more	14	5.74	
Income			
< 5 000 DA	13	5.33 %	
5 000 - 10 000	17	6.97	
10 000 - 15 000	24	9.84	
15 000 - 20 000	58	23.77	
20 000 - 30 000	60	24.59	
30 000 - 40 000	41	16.80	
40 000 - 50 000	19	7.79	
50 000 - 60 000	7	2.87	
60 000 - 70 000	3	1.23	
70 000 - 80 000	2	0.82	
Habitation			
Building	78	31.97	
Individual house	103	42.21	
Traditional house	63	25.82	
Distance			1.69

The survey results show that the majority of respondents know the landfill and this is mainly due to its location. It is located along a road relating the city center and several villages, in addition, the incineration of waste in open air. The diseases caused by the discharges are well known by 88 % of the individuals including diseases like allergic, carcinogenic type (provoking cancers). However, the impact of the discharges on the property value (price of housing and land), and on the environment (landscape degradation, pollution of groundwater…etc) are less know, plus 56.15% of respondents are knows of these impacts. On the question of the quality of the actual services of collection and the disposal of waste, much of the households are not satisfied. The residents of two districts declare to be satisfied by the mode of pre-collection and not by the method of disposal. These two districts have benefited in 2007 to the new equipments' of pre-collection, and a change of mode and frequency of collection. The non-satisfaction of the services of waste is the result of a total absence of his service of in the secondary conglomeration and scattered zones. Nevertheless, the majority (85%) of respondents declare they are willing to separate their waste at source. Concerning the application of the new program, all the interviewees are quite in agreement with the program, they believe that the application of this program eliminates the negative externalities associated with the actual service of waste notably, nuisance odors; pollution of the biophysical environment (soil, air, water), and degradation of the environment.

3. Econometric Analysis

The econometric analysis it's realized by estimating an interval data model for to calculate the WTP in the two scenarios described above.

3.1. Model

The calculation of WTP from a payment card is performed by applying the regression method interval (Interval Data Model)[9] (Terra, 2005). With a payment card, the individual chooses a value from a range of proposed values. It can be deduct that the true WTP is in the interval between the chosen value and the following value (Cameron et Huppert, 1988). The technique used in models of intervals is the maximum likelihood (ML) which is more reliable than the OLS that uses the center of interval as the dependent variable (Cameron et Huppert, 1989). This method was used by several researchers, Zhongmin et al., (2003), to estimate the total economic value of ecosystem restoration in the region Ejina in China (see, for example, Kathiravan et al., 2007 ; Welsh et Poe, 1998 ; Alberini et al., 2003 ; Oueslati et al., 2008).

We assume the vector CAP = $\{CAP_1, CAP_2, \dots \dots CAP_j\}$ represent of the values of the payment cart. In our study, CAP_{Bi} is the limit chosen by the individual (i), and CAP_{Hi} is the following upper limit not chosen by the individual. The CAP_i is include between the interval $[CAP_{Bi}, CAP_{Hi}]$. How, the $\log(CAP)_i$ is between $\log(CAP_{Hi})$ and $\log(CAP_{Bi})$. The function of can be written as a log-normal function:

$$\log(CAP_i) = X_i^{'}\beta + \varepsilon_i$$

Where ε_i is normally distributed with mean 0 et variance σ. The probability can be writing as:

$$\text{Pr}\ (CAP_i, \subseteq (CAP_{Bi}, CAP_{Hi}))$$

$$= \text{Pr}\left(\frac{(\log CAP_{Bi} - X_i^{'}\beta)}{\sigma} < CAP_i < \frac{(\log CAP_{Hi} - X_i^{'}\beta)}{\sigma}\right)$$

The probability in (1) can be rewritten as the difference between two standard normal cumulative densities:

$$Pr(CAP_i) = \Phi\left[\frac{(\log CAP_{Hi} - X_i^{'}\beta)}{\sigma}\right] - \Phi\left[\frac{(\log CAP_{Bi} - X_i^{'}\beta)}{\sigma}\right]$$

For each individual (*i*), the vector X_i is defined by:

$$X_i = \begin{pmatrix} cons \\ age \\ education \\ income \\ moderne\ house \\ distance \\ distance * distance \end{pmatrix} = (cons, \hat{a}ge, Revenu, Education, \dots \dots)'$$

---

[9] Maximum of the likelihood of the model was realized under the command intreg in Stata 10.0

β are the regression coefficient, CAP_i the standard normal random variable, Φ is the cumulative standard normal density function. The log-likelihood function to maximise is:

$$\log L = \sum_{i=1}^{n} \log \left[\Phi \left(\frac{(\log CAP_{Hi} - X_i' \beta)}{\sigma} \right) - \Phi \left(\frac{(\log CAP_{Bi} - X_i' \beta)}{\sigma} \right) \right]$$

Since the estimate of the WTP in our case must be non-negative and since previous empirical studies (Cameron and Huppert, 1988 and 1989) have indicated that the distribution of valuations is frequently biased and proposes the use of a *log-nomal* conditional distribution. In this case, the mean of every individual is written as follows:

$$E\left[CAP_i | X_i, \hat{\beta}, \hat{\sigma}\right] = \exp \left(X_i' \hat{\beta} + \frac{\hat{\sigma}^2}{2} \right)$$

Later tests of the hypothesis (H0) of a linear relation against the quadratic hypothesis (H1) between the decision and the distance, (H0: $\beta_2 = 0$ and H1: $\beta_2 \neq 0$) we retained the quadratic hypothesis for the variable distance.

We calculated t-statics of the variable (distance*distance) $t = (\hat{\beta}_2 - 0)/SE(\hat{\beta}_2)$, t = 0.0869568/0.0501203 = -1.73. In absolute value, this exceeds the critical value of 10 % in this test (1.64), thus we throw reject the null hypothesis. For the, thus we accept the quadratic shape in 10 %. (Stock Watson,2003).

We assume three methods for to calculate the intervals:

Model (1), standard payment card: the interval used in his model is the interval developed by Cameron et Huppert (1989), where the lower border that is chosen by the individual and the upper border is the following value not chosen by the individual on the payment card. With other terms, if the individual (i) *will choose* the value 1000 DZA, thus we have 1000 for value minimum and on 1500 as maximum value and which will constitute the interval [1000, 1500]. 41 persons indicating a WTP equal to zero were excluded. Globally, the model (1) account eight intervals with more than 27 % of the interrogated persons have a WTP included between 1000 and 1500 DZD.

Model (2), payment card corrected by opened question: the integration of the additional opened question in the revelation of WTP after the payment card introduced new intervals. In this case, the persons declare an additional WTP equal to zero after having given a positive WTP onto the payment card. We consider that this response a confirmation the choice of the payment card and thus the lower value equals in the upper value. For example, if the individual confirm an WTP equal to 1500 DZA in the payment card, and zero in the opened question, the interval used in estimation is [1500, 1500]. On the contrary, if an individual answers positively in two questions, the choice of the payment card represents the lower border, for the upper border, it is the addition of this amount with the additional amount of the opened question. This model accounts 31 intervals with 11.48 % for the interval [500, 1000].

Model (3), payment card combined with opened question: the difference between this model and the precedent concerns the responses equals zero of the opened question by the persons having expressed a positive WTP on the payment card. In this case, we apply the standard method of the payment card to fix the upper interval (the upper border here is the following value not chosen by the individual). This combination of two techniques has allows to reduce the number of intervals from 31 to 25 and to increase the frequency of the other intervals with a rate of 17.62 for the interval [500, 1000] against 11.48 % in the model (2).

3.2. Résultat des modèles

Scenario 1

Table 3: The WTP estimate in scenario 1 ML interval

	Coef	P>|z|
Constant	-0.778248	0.322
Age	0.023503	0.100
Level education + lyceum	0.789361	0.008
Habitation modern	1.850822	0.000
Income > au 15 000 DZD	2.913463	0.000
Distance domicile / discharge	0.329079	0.062
Distance^2	-0.057788	0.059
σ	1.955828	
Log pseudo likelihood	-429.0591	
Wald chi2(6)	121.9	
Prob > chi2	0.0000	

The analysis of results of the econometric models presented in table 3 shows that among the significant variables at the 5 % a 10 %, we note the age with a positive sign, it wants to say, that more we are old plus the probability to accept to integrate the program increases. Other variables, the distance between the residence and discharge has a positive sign and the variable (distance^2) has a negative sign. Every time we go away from the discharge, the probability to participate in the program is more raised. The inhabitants living in districts situated in a perimeter of more than a one kilometer tend to participate in this program to stay in distance of the nuisances of the discharge. On the contrary, the inhabitants living most close to discharge tends not to participate in the program because they think that they already undergo several sorts of nuisances. They would seem that the conditions of life of these persons (bidonvilles, wild houses without license to build or precarious) are the cause of little of interest carried to the project. Also, the inhabitants remote from the discharge think that they are protected from the negative externalities of the discharge. As well as they disposed another alternative to disposal their waste (in party are rural villages they reuse their household refuse for agricultural purposes) what explains the negative sign of the variable quadratic of the distance. The education level of the persons having

followed the studies from the secondary school (secondary school, university).This variable influences positively the probability to participate in the program, what is supported by the literature. Indeed, the persons having reached an educational level are more conscious of negative externalities due to waste and thus are more ready to participate in the program. The two variables which are significant at the 1% with a positive effect the income variable and the variable typifies of house. Concerning the income this positive report is generally supported by the literature on WTP. The agents who have an income exceeding the SNMG are more sensitive to participation to the program. To have a modern housing (building, or single-family dwelling) influences positively the decision to participate in the financing of the program. The individuals having declared to have knowledge on the impact of the discharges on the values of the real-estate, the air and the ground tend to participate in the program to limit the effect of these impacts in their everyday lives.

We present here that marginal effect of the distance variable: the marginal effect of the distance is calculated by:

$\Delta \hat{Y} \approx (\hat{\beta}_1 + 2\hat{\beta}_2 dis)\Delta dis$, donc $\Delta \hat{Y}/\Delta dis \approx \hat{\beta}_1 + 2\hat{\beta}_2 dis$ (Wooldridge, 2002). $\Delta log(\hat{Y}) \approx \{[0,5300 + 2(-0,069)]dis\}\Delta dis$. The effect of 1 km give$[0,5300 + 2(-0,069)](1) = 0,39$; for 2 km the increasing will be to$[0,5300 + 2(-0,069)](2) = 0,25$. This effect will be negative from 3.84 km, where; Dis $*= |\hat{\beta}_1/2\hat{\beta}_2| = |0,53/2(-0,069)|$=3.84 Km. Which other terms, each time, the distance increase, the probability to participate of the program is positive. In a certain distance, the individuals do not accept to participate in the program and their probability would decrease. At a certain distance, the individuals do not agree to participate in the program and their probability would decrease.

Scenario 2

Table 4 : ML interval

	Model (1)		Model (2)		Model (3)	
	Coef	P>|z|	Coef	P>|z|	Coef	P>|z|
Constant	0.3928	0.648	0.3410	0.689	0.3996	0.641
Age	0.0288	0.061	0.0285	0.062	0.0283	0.066
modern habitation	1.2898	0.001	1.3008	0.001	1.2920	0.001
Distance domicile / discharge	0.5684	0.075	0.5697	0.072	0.5497	0.085
Distance^2	-0.078	0.051	-0.078	0.052	-0.075	0.060
Education level + lyceum	0.9121	0.002	0.9205	0.001	0.9204	0.001
Income > 15 000	3.1820	0.000	3.1660	0.000	3.1938	0.000
environmental Polity (quality)	0.5332	0.077	0.5748	0.062	0.5559	0.072
knowledge on the impact	-0.521	0.065	-0.505	0.072	-0.504	0.074
σ	2.0585		2.0398		2.0528	
Wald chi2(8)	157.49		164.92		161.98	
Prob > chi2	0.0000		0.0000		0.0000	
Log likelihood	-724.3		708.02		-742.7	

In plus the significant variables in the scenario (1), we introduced the environmental political variable to get the effect of this one on the WTP. She takes the value 1 in case changes were realized, notably in the means of pre-collection and mode of collection. It's equal to zero in the inverse case. The environmental political variable has a positive and significant sign in a 10 % threshold in three models. The parameters are similarly in three models

3.3. Willingness to pay values

The descriptive results of the WTP in the case to statute quo underline that 57.79% of the individuals have a WTP equal to zero. Just the persons have indicated do not accept the idea to participate financially of to waste service is considering as true zero. The rest is considering as the false zero, so their WTP is included in interval [0, 500]. The table 5 summarizes the WTP values in the case where the municipality makes no effort to improve the quality of actual service of waste.

Table 5: The frequencly distribution of WTP in *statut quo*

CAP	0	500	1000	1500	2000	2500	3000
Effectif	141	45	44	7	4	2	1
%	57.79	18.44	18.03	2.87	1.64	0.82	0.41

Concerning the second scenario, among 244 questionnaires corrects, there were 208 interrogated persons (83.20 %) who would wish to pay a sum of money for the new program of management of the solid waste, and only 41 interrogated persons (16.80 %) have chosen the WTP equal to zero. This null values represent to protestation attitudes (refusal to substitute of the state) (Beaumais, and Chiroleu-Assouline, 2002). Among the 208 persons have declared the WTP positif, 38 have announced the additional value equal to zero. In additional, meadow 70% of the sample has a WTP additional including between 100 and 2000DZD.

Table 6: The distribution of the WTP in scenario 2 (payment card and opnded question)

Payment Card	0	500	1000	1500	2000	2500	3000	3500	4000	Plus
effectif	41	57	62	38	19	11	14	1	1	0
%	16.80	23.36	25.41	15.57	7.79	4.51	5.74	0.41	0.41	0
Open Question	0	100	200	250	300	400	500	1000	1500	2000
effectif	79	8	32	2	1	1	91	28	0	2
%	32.38	3.28	13.11	0.82	0.41	0.41	37.30	11.48	0	0.82

After estimate the coefficients and the σ in the interval model, the mean of the WTP is to 600 DZD for status quo a little more than the value minimum of 500 DZD which a municipalities can fix within the framework of the tax provide for by the financial law of 2002.

Table 7: Mean and medean WTP estimates

	Statu quo	Model 1	Model 2	Model 3
Mean	600	1522	1485	1529
Median	650	1233	1233	1234

The estimation of WTP in three models is superior to the maximum amount of the TEOM fixed to 1000 DZD for the households. We observe that the mean in the model (1) with payment card standard is closer to the mean of the combined model (3). The mean of WTP of the model (2) is lower than the WTP of the other models (-37 and -44) respectively. The mean of WTP predicted by the model (2) is about 1486 DZD and a median of 1233 DZD. We observe that the fact of considering the null value of additional WTP as a confirmation of their WTP in M2 gives a WTP lower than the WTP of M3. It lets us understand that the use of the method of the payment card standard or combined with the other methods to constitute the intervals overestimates the WTP and will slant the results. The inclusion of the question opened after the payment card can increase or decrease the interval according to the first choice of the WTP on the payment card. In other words, if the individual chose a very high WTP on the payment card, it would have a strong tendency to add a value lower than the one who constituted the difference between the borders of the simple interval. However, if the individual gave a weak WTP onto the payment card, he would pronounce a value equal or superior to the value of the interval.

4. Discussion, cost, tax and WTP

The application of the new program for managing urban waste in the Algerian cities will generate additional costs to municipalities. Based on the plan of the city of Issers directed by the research department (TAD) on behalf of the direction of the environment of the Department of Boumerdes and determines the human and material needs of the municipality, we calculated the cost of the new management. The estimated cost of collecting and transporting waste to a landfill site takes into account two types of financial charges: expenses means necessary pre-collection for all residents of the town; transaction costs of collection and transport to the landfill site (this cost does not take into account neither the cost of managing SLS nor the cost of sorting). Needs wheeled bins have been encrypted to 832 tanks by 2012 and the acquisition of new collection trucks and the increased number of personnel. The total cost of realizing this program was estimated at 21,475 328 DZA.

The MSW production varies from one sector to another, it is of 4.44 t/year in sector 1, of 5.54 t / year in sector 2, of 6.57 t/year and of 4.15 t/year in sector 3 and 4 respectively. The total quantity of waste generated in the town of Isser is estimated at 21 tons per day, or a ratio of about 0.62 kg/capita /day. The annual production of household waste across the territory of our study evaluated 7550.95 tones for 5235 households, 10 businesses and 554 merchants in 2007 (TAD, 2007). Based on the total cost and annual production of waste, the cost is estimated at 2844.37 DZD per ton.

Funding for the management of this service should normally be provided by the TEOM combined with the general budget in case of insufficient recipes from this tax. The fact is that even with the assumption of 100% coverage and a maximum value of the TEOM, it remains below the cost of waste management. The table 8 shows the collection of taxes based on three assumptions on the territory of our case study.

The total recovery based on three assumptions would be 3 271,500.00 DZD for H1 (422.07 DZD / t), 7196,250.00 DZD for H2 (953.02 DZD / t) and 11 775,000.00 DZD for H3 (1559.40 DZD / t). Cost management estimated at 2844.37 DZD / t, with values of hypotheses H3, that the municipality will cover about 55% of expenses related to the collection, transportation and landfill.

Table 8 : Montant de recouvrement de la TEOM selon 3 hypothèses

Désignation	Nombre	Hypothèse	Taux	Montant (DZD)
Unités économiques	10	H1	10 000	100 000.00
		H2	50 000	500 000.00
		H3	100 000	1 000 000.00
Commerces, artisanats,…	554	H1	1000	554 000.00
		H2	5000	2 770 000.00
		H3	10 000	5 540 000.00
Habitations	5235	H1	500	2 617 500.00
		H2	750	3 926 250.00
		H3	1000	5 235 000.00

Indeed, if the municipality retains the maximum amount of 1000 DZD by the Finance law, the total recipe from households covers only 24.37% of the costs and 55% with the participation of firms and traders. However, the estimated WTP from the use of contingent valuation method (CVM) can cover up to 37.27% of costs[10]. Thus, this tax may be combined with a special fee for non-households, as is the case in France. It includes companies, merchants and craftsmen. In the absence of an estimate of WTP of these units, we assume that the deliberative community adopts the maximum amount prescribed by regulation. The recipe for this fee reaches an amount that will cover more than 30.45% of the cost. The deficit in this case will be (- 33%) of total costs. Similarly, when the case is in *statue quo*, the mean WTP is 600 dinars per household. Multiply that amount by the number of households, it represents only 14% of spending and the deficit will be (- 55%) cons (- 45%) in the baseline with a recipe for tax outcome of households in 24 % of estimated cost.

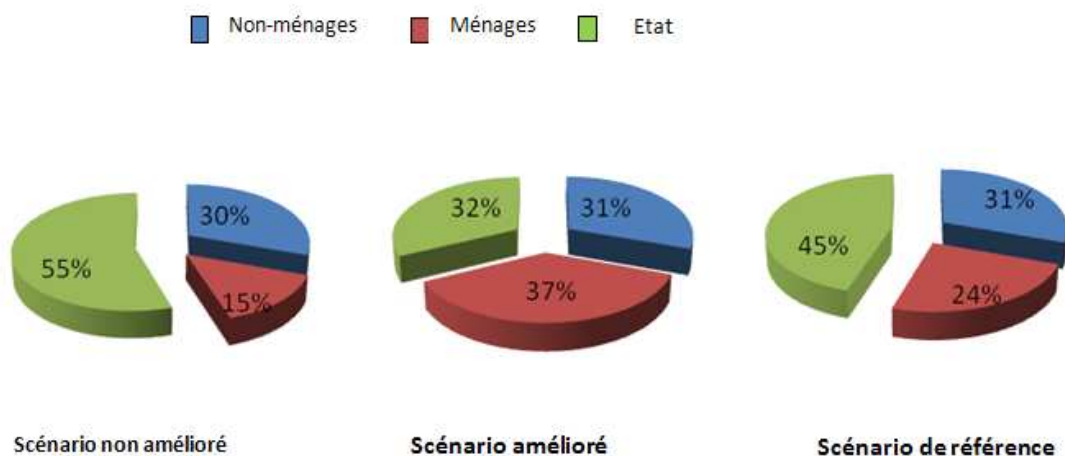[10] We chose the WTP model (2) estimated to 1485 DZD / year.

Fig 1 : The rate of covering of the costs according to the scenarios

5. Conclusions and policy implication

In this paper, we determined the factors that influence the probability of participation in financing a program of waste management at local level in Algeria, and the value of willingness to pay to improve this service. This program is inspired to PROGDEM adopted by the Ministry of the Environment in 2001. For determine this factors, we used the contingent valuation method. This survey shows that persons are strongly attached to waste management within their municipality and the quality of this service. Among the survey results, in addition to traditional variables (income, education ...), influencing the decision to contribute financially to a program of general interest, we record the type of housing and the distance from landfill. Therefore, when policy makers or community leaders must make financial decisions on public service waste, it is important to distinguish between inhabitants by type of dwelling (precarious, individual, group ...). This is consistent with the concept of taxes based on the value of property built. For example, the case of the TEOM in France calculated based on the value of the dwelling or premises (for professionals). This factor can be considered a wealth index to determine the amount or range of tax.

The other point is that relating to the distance of homes compared to a disposal site for waste (discharge in our case) is likely to generate negatives amenity. Indeed, in most cases, residents of the neighborhoods closest to have family members suffering from a disease caused by these negative externalities and suffer daily the different nuisances. These individuals must be compensated by communities by adopting a lower fee than that applied to the most remote inhabitants. At this stage, the choice of the site of a new waste disposal installation (SLS in our case) must take into consideration the distance between the facilities closest to neighborhoods.

Moreover, the amount of WTP from the same survey using a payment card followed by an opened question, as estimated by an interval model is 1485 dinars per year. The WTP level predicted by the study is significantly higher than the level of tax under the current regulations. On the other hand, the difference between WTP when establishing a new program and the WTP for the actual management can be doubled or even tripled. It goes from 600 DZD/year to 1485 DZD/year. This difference between the two WTP shows that individuals attach and give great importance to the quality of their environments. Assessments indicate that total CAP does not exceed 38% of costs. Nevertheless, our estimate will increase this rate to over 13% from the baseline, but still in deficit.

To face this deficit, the municipalities will be obliged to use two instruments: economic based on the general budget or subsidy state. And by the various existing environmental taxes, which municipalities will benefit from a rate that varies from 10% to 30% depending on the type of tax; and policy environmental instruments including prevention policies by reducing waste at source (sorting, recycling, composting ...). Indeed, these policies can impact indirectly on the costs of removal and disposal of waste. They decrease the amount of waste that will reduce costs associated with collecting and transporting up through the lower number of rotations of removal trucks.

However, the reflection about a special fee (RS) for non-household (firms or administration, and traders) that generate waste similar to household waste is inevitable to face with these costs that the municipality must bear. The actual system based on a range between 10000 and 100000 AD / year does not take into account neither the size of firms and nor the amount waste products. The choice is made by communities in most cases arbitrarily. This charge can take two models: a charge proportional to the volume of waste collected, so it's a royalty incentive or a flat fee if the quantity produced does not exceed a certain threshold before by the community and the proportional quantities that exceed this threshold.

Other conclusions of this study, concern on the question of revelation used by the contingent valuation method in developing countries. The first conclusion is reflected by the fact that uncertainty exists for individuals to express a monetary value on environmental subject. This finding is due in part to the absence of a culture within government to probe the populations before setting a fee, and secondly, that these little people are not yet accustomed to this type of investigation. This highlights the effectiveness of the payment card as a mode of revelation of willingness to pay that takes into account the problem of uncertainty. The second conclusion in this paper shows that WTP estimated by the payment card can be influenced by the choice of interval estimation of the question. Combining this technique with an open question determines the two terminals of the interval, one by the choice made on the card, and the other by answering the question open. This combination will

increase the number of intervals and this will influence the amount of CAP either up or down depending on the

ranges available on the payment card. We find that WTP is very low cost, which joins the idea that the tax on

dumping of waste is often regarded as a tax instrument, not as a lever for environmental action. And in general,

the rates of those taxes are too low as the Pigouvian rate.

References

Afroz, R., Hanaki, K., Hasegawa-Kurisu, K., 2008. Willingness to pay for waste management improvement in Dhaka city, Bangladesh. Journal of Environmental Management, 1-12.

Alberini, A., Boyle, K., Welsh, M., 2003. Analysis of contingent valuation data with multiple bids and response options allowing respondents to express uncertainty. Journal of Environmental Economics and Management 45, 40-62.

Arrow, K., Solow, R., Portney, P.R., Leamer,E.E., Radner,R., Schuman, H., 1993. Report of the NOAA Panel on Contingent Valuation.

Beaumais, O., Chiroleu-Assouline, M., 2002. *Economie de l'environnement*. Bréal, Collection Amphi.

Begum, R. A., Siwar, C., Pereira, J.J., Jaafar, A.H., 2007. Factors and values of willingness to pay for improved construction waste management - A perspective of Malaysian contractors. Waste Management 27, 1902-1909.

Broberg, T., Brännlund, R., 2008. An alternative interpretation of multiple bounded WTP data -Certainty dependent payment card intervals. Resource and Energy Economics 30, 555-567.

Cameron, T.A., Huppert, D.D., 1988. "Referendum" Contingent valuation estimates: sensitivity to the assignment of offered values. Working Paper 519, Department of Economics University of California. http://www.econ.ucla.edu/workingpapers/wp519.pdf

Cameron, T.A., Huppert, D.D., 1989. OLS versus ML Estimation of Non-market Resource Values with Payment Card interval Data. Journal of environmental economics and management 17, 230-246.

Carson, R. T. 1999. Contingent valuation : A User's Guide. Department of Economics, University of California, San Diego, discussion paper 99-26.

Carson, R.T., Flores, N.E., Meade, N.F., 2001. Contingent Valuation: Controversies and Evidence. Environmental and Resource Economics 19, 173-210.

Carson, R.T., Hanemann,W. M., 2005. Contingent Valuation. in Maler, K.G., and Vincent, J.R., (eds) Handbook of Environmental Economics, Volume 2, North Holland, 821-963.

Danso, G., Drechsel, P., Fialor, S., Giordano, M., 2006. Estimating the demand for municipal waste compost via farmers- willingness-to-pay in Ghana. Waste Management 26, 1400-1409.

Fonta, W.M., Ichoku, H.E., Ogujiuba, K.K. Chukwu, J.O., 2007. Using a Contingent Valuation Approach for Improved Solid Waste Management Facility: Evidence from Enugu State, Nigeria. Journal of African Economies, volume 17, number 2, 277-304.

Hans, J., Opschoor,B., Button, K., Nijkamp, P., 1999. Environmental economics and development. An Elgar reference collection.

Heintz, V. 2002. Comment évaluer l'amélioration du bien-être individuel issue d'une modification de la qualité du service d'élimination des déchets ménagers ?. Working Paper, Office of Theoretical and applied Economy, Louis Pasteur university. http://cournot2.u-strasbg.fr/users/beta/publications/2002/2002-11.pdf.

Kathiravan, G., Thirunavukkarasu, M., Michealraj, P., 2007. Willingness to Pay for Annual Health Care Services in Smail Ruminants: The Case of South India. Journal of Applied Sciences 7 (16), 2361-2365.

Luchini, S., 2002. De la singularité de la méthode d'évaluation contingente. *Économies et Statistique N°* 357-358.

MATE and PROGDEM, 2003. Environment State Department, National Program for MSW Management in Algeria, PROGDEM.

MATET, 2005. Analysis and recommendations in covering of the costs of the management of the municipal waste in Algeria, report realized by Ernst and Young agency

Metap, 2004. Regional project of Management of the Solid Waste in the Countries of Mashreq and the Maghreb: report of the country Algeria. January, 2004.

OJ, 2007.Executive Order n° 07-205 of 30 june 2007 Fixing the modalities and procedures for the elaboration, publication and revision of the scheme of municipal household waste management and assimilated.

ONS, 2008, Recensement général de la population et de l'habitat, en ligne http://rgph2008.ons.dz/

Oueslati, W., Madariaga, N., Salanié, J., 2008. Évaluation contingente d'aménités paysagères liées à un espace vert urbain. Une application au cas du parc Balzac de la ville d'Angers. Revue d'Études en Agriculture et Environnement, 87, 77-99.

Rowe, R.D., Schulze, W.D., Breffle, W. S., 1996. A test for payment card biases, Journal of environmental economics and management, 31,178-185.

Stock,J.H., et M.W. Watson (2003) , *Introduction to econometrics*, Second Edition.

TAD, 2007. Synthesis Rapport, MSW Management in Isser, Environment Department of Boumerdes, TAD Agency, Algeria.

Terra, S. 2005. Guide de bonnes pratiques pour la mise en œuvre de la méthode d'évaluation contingente, MEDD, D4E, document de travail 05-M04. http://earthmind.net/rivers/docs/france-methode-hedoniques.pdf

Welsh, M.P., Poe, G.L., 1998. Elicitation effects in contingent valuation: Comparisons to a multiple bounded discrete choice approach, Journal of Environmental Economics and Management 36, 170-185.

Whittington, D. 1998. Administering Contingent Valuation Surveys in Developing Countries. World Development, Vol. 26, Nº1, 21-30.

Wooldridge, J.M, 2002. *Introductory econometric: A modern approach*, 2E

Yusuf, S.A., Salimonuand, K.K., Ojo, O.T., 2007. Determinants of Willingness to Pay for Improved Household Solid Waste Management in Oyo State, Nigeria. Medwell Journals, Research Journal of Applied Sciences 2 (3), 233.239.

Zhongmin, X., Guodong, C., Zhiqiang, Z., Zhiyong, S., Loomis, J., 2003. Applying contingent valuation in China to measure the total economic value of restoring ecosystem services in Ejina region, Ecokklogical Economics 44, 345-358.