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Household Willingness to Pay for Improved Solid Waste Management Service: The Case of Ambo Town, Ethiopia

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Abstract

Solid waste management is continued to be a major challenge and environmental problem of Ambo town. Households are the main sources of solid waste as well as they are the main victims due to unmanaged solid waste. Thus, involving the households' as a stakeholder with a service charge could be reasonable to propose mechanisms for cost recovery and to provide the service sustainably. The objectives of this study are to identify factors affecting households' willingness to pay (WTP), amount they are willing to pay and estimate the aggregate demand for improved solid waste management service. A multistage sampling technique was employed to select 396 respondents for the study. The binery probit model was used to obtain the mean WTP and identify factor affecting households' WTP decision. The result depicts that mean monthly WTP by the households is Birr 29.55. The probit model result also revealed that quantity of solid waste generated, monthly income, perception of household's about solid waste management, sex household head, marital status and educational level were statistically significant in determining household's decision to pay. Tobit model was employed to examine determinants of the amount of money the households are WTP. Based on the model result, quantity of solid waste generated, perception of household's, family size, educational level and total income were significant variables in explaining maximum amount are WTP. The result of the study suggests that any policy directed towards the provision of effective solid waste management in the town should incorporate demand side information related to household's WTP, amount WTP and significant factors determine their WTP.

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In addition, giving more emphasis to introduce service charge for improved solid waste management is the appropriate strategy in order to solve financial constraint and for implementation of integrated improved solid waste management which involves the household as stakeholders.

Keywords: Demand; Solid waste management; Probit model; Tobit model; Willingness to pay.

1. Introduction

The rapid urbanization that has been taking place during the 20th century virtually transformed the world in to communities of cities and towns facing similar challenges on environmental issues in which most of them have to be addressed at international level [1]. Cities are the threat to the environment from time to time due to increasing quantity and complexity of waste related to their expansion. The estimated quantity of Municipal Solid Waste (MSW) generated worldwide is 1.3 billion metric tons in 2012 and 2.2 billion tons are expected by a year 2025. Urbanization, industrialization, increasing population and economic development are all contributing to the rise in waste production and also to its increasing complexity and hazardousness [2].

Solid waste generation has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries. The fast expansion of urban and industrial activities stimulated by rapid population growth has produced vast amounts of solid and liquid wastes that pollute the environment and destroy resources. Consequently, solid waste is not only increasing in quantity but also changing in composition from less organic to more paper, packing wastes, plastics, glass, metal wastes among other types which leading to low decomposition and collection rates [3].

According to [4], **"**Solid waste management (SWM) involves the collection, storage, transportation, processing, treatment, recycling and final disposal of waste. To achieve the above stated means of management, household considered as one of the stakeholders and have their own responsibility. The primary objective of solid waste management activity is to make the environment sound and safe in human health via disposed waste in a well-organized manner. Controlled waste disposal can help improve and protect the health of population and preserve valuable environmental resources. But at present in low and middle income countries collection coverage can be as low as around 40%, compared to 98% for high-income countries. The rest is either burned or left to decompose in open space or dumped in unregulated landfills, which is damaging the environment [2].

Waste is a serious dilemma for environment and health related problem of Ambo town society. Most of solid wastes that are generated in the town remain uncollected and simply dumped in open areas, road sides, river, drainages, and gullies and sometimes burned. All these practices severely harm Ambo town environment and health of the society in many ways. The disposal method that the town used is also open dumping type which widely practiced in many developing countries and has hazardous effect on health of the public and the environment.

Solid waste management in Ambo town has been always evaluated based on the role and performance of the town municipality which runs the solid waste management activities, the supply side, while the demand side is ignored. However, with the increasing volume of solid waste, the town administration could not be able to

satisfactorily collect and dispose the waste. The problem is usually inadequate budget, infrastructural and lack of community participation for its management compared to solid waste generation in the town. All the same, households are the main sources of solid waste as well as the main victims of the negative effects of unmanaged solid waste, so it is reasonable to participant the household's as stakeholders.

Therefore, this study is designed to generate demand side information, which is vital for the planning process of improved solid waste management system. So detail study on the demand of households for improved solid waste management (ISWM) service should be the first step required for design appropriate solid waste management strategies.

The general objective of the study is to explore households demand for improved solid waste management service and its determinants. Specifically the study attempt:

- To examine the existing condition of solid waste management practices in the town;
- To elicit households' aggregate willingness to pay for improved solid waste management service;
- To determine factors affecting households willingness to pay decision and
- To identify factors which determine the amount households are willing to pay for improved solid waste management service.

2. Literature Review

Waste management is a cross-cutting issue impacting on many aspects of society and the economy. It has strong linkages to a range of other global challenges such as health, climate change, sustainable production and consumption [5]. The sources of solid wastes are dependent on the socioeconomic and technological levels of a society. According to [6] in all cases the following sources are universal: Domestic solid wastes, Commercial wastes, Institutional wastes, Industrial wastes, Street sweepings, and Construction and demolition wastes.

Although developing countries generate less solid waste as compared to developed countries, the collection, storage, transportation, processing, and disposal of solid waste is highly ineffective, and consequently damaging the environment [2]. The major sources of these problems are the lack of society participation in terms of manpower and particularly finances. These are the great challenge to developing countries to practice proper solid waste management. Through considering these problems different studies were undertaken to incorporate the participation of the society as manpower and cost recovery and to identify the major factor affecting willingness to pay for improved solid waste management.

According to [7] on an average, 63% of the households are willing to pay for improved waste management. This finding corroborates the environmental economic theory which assumes that the demand for an improved environmental quality increases with income. The results of the study indicate that those individual more awareness about ISWM, households have larger families, income, educated people are more willing to pay for improvement in the service.

Using contingent valuation method in his study, [8] elicited the household willingness to pay for improved solid

waste management Mekelle city, Ethiopia. The result revealed that the current city fee for sanitation is far below the WTP of the residents. The mean WTP estimated used as a guide for municipal officials in setting a more appropriate fee that can finance improvement in city SWM.

In addition to this, some other researchers [9], [10] tried to estimate household WTP for improved waste management. In general, all empirical studies reviewed have shown that households' willingness to pay for improved technologies could be affected by socio-economic, demographic and solid waste related variables pertinent to a particular area. However, one variable may affect willingness to pay in one area positively and significantly while that same variable might be insignificant or having the reverse effect in another area and situation. In addition, the mean willingness to pay is different from area to area and duration of time.

3. Research Methodology

3.1. Sampling Techniques and Sampling design

A multi-stage sampling techniquewas employed to select the sampling unit. Ambo town was selected purposively because it is the place where solid waste a serious problem from time to time. In the first stage, cluster sampling technique was used and classified the town in to six strata based on its "*kebeles*[a]"administration. In the second stage, *kebeles* in the town classified in to strata based on sub-section or "*gots*[b]" formed by *kebeles* administration. In third stage, simple random sampling technique was used to select *gots* from each *kebeles*.The numbers of households drawn from each *'gots'* were determined based on the size of the *'gots'*. Finally, sample households were randomly selected using the probability proportional to size (PPS) sampling techniques by taking the population of the six *kebeles* as population for the study. This study applies a simplified formula provided by [11] to determine the required sample size at 95% confidence level, and level of precision = 0.05.With proportionate random sampling, 400 households were selected and 396 considered for the study.

3.2. Sources and Methods of Data Collection

The data for the study were generating from both primary and secondary sources. Primary data were collected through individual interviews and elicit bidding with the help of structured questionnaire that were administered to households' head. The first section deals with households' socio economic and demographic characteristics such as age, family size, educational level, monthly income and the like following [12].The second parts deal with the existing condition of solid waste management practices in the town. The third section consists of scenario about benefit and cost of improved solid waste management and questionnaire to assess households' willingness to pay using contingent valuation methods (CVM).This study employed a single-bounded dichotomous choice format, followed by open-ended questions in the WTP section. In addition to the structured questionnaire, direct personal observations were made to gather additional primary information.

Secondary data were gathered from different sources including published and unpublished materials from administrative office and municipality solid waste management office of Ambo town.

Description of alternative services scenarios explored

For this study devised two alternatives waste collection services scenarios for which households can state their specific preference and in order to elicit WTP during data collection

Scenario I: Low cost-Communal containers: more communal containers which have the waste holding capacity of will be placed in households' neighborhood at a central location and each household stored the waste generated in the container. A vehicle would pick up the container and take it away to be emptied before it is completely full.

Scenario II: Low cost-Tractor-trailers: more tractor trailers would go to the neighborhood on a scheduled basis and park for a few minutes at each block or road junction to collect solid waste. When the vehicle reaches residents have responsibility to give wastes to collectors, and then collectors use tractor to dispose the waste. All waste generated by each households stored in temporary storage inside their compound until the schedule.

3.3. Methods of Data Analysis

Based on the objectives of this study, both descriptive statistics and econometric models were employed to analyze the qualitative and quantitative data.

3.3.1. Econometric Model Specification

In this study, the households were asked at first whether he/she is willing to pay or not for improved service. This is going to be analyzed with binary probit model.

The next inquiries are, if the household is willing to pay then, what is the maximum amount that he/she will be willing to pay question is continue.

Probit model: The binary probit model is used to identify factors that influence household's willingness to pay for improved solid waste management.

The dependent variable in this model will have a value 1 if the household is willing to pay; 0 otherwise. The probit model is built on a latent variable with the following formulation:

$$WTP_i^* = \beta_i X_i + \varepsilon_i \varepsilon_i \sim N(0,1)$$

$$WTP_i = 1 \; if WTP_i^* > 0$$

$$WTP_i = 0 \; if WTP_i^* \leq 0$$

Where: WTP^*=responses of household WTP which is either 1 for Yes or 0 for No,

β_0 =constant term, β_i = is a vector of parameters reflecting the relationship between willingness to pay and variables in X_i, and X_i=represent independent variables affecting willingness to pay, $\varepsilon_i = is$ random error term. According to [13], one of the main objectives of estimating an empirical WTP model based on the contingent valuation (CV) survey responses is to derive a central value (mean) of the WTP distribution. Thus, the truncated mean WTP value is calculated employing the following equation as specified by [7]:

$$Mean(WTP) = \frac{(Ln(1 + e^{\beta_0})}{\beta 1}$$

That is, first the intercept and slope of bid was estimated by regressing dependent variable (.yes. or no response) on initial bid value, other explanatory variables held constant, and then these estimated coefficients was replaced in the above formula to calculate the mean WTP value.

Tobit Model: It is important to note that the dependent variable, or the WTP, is not fully observed and the dependent variable is censored at zero values for a substantial part of the sample OLS (ordinary least squares) estimator cannot be applied, we use a Tobit model for the observed maximum willingness to pay (MWTP):

$$MWTP^* = \beta_0 + \beta X_i + \varepsilon_i$$

$$MWTP_i = MWTP^* if MWTP^* > 0$$

$$= 0 \; if MWTP^* = 0$$

Then the Tobit model used for this study specified as follows:

$MWTP = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots\ldots + \beta_{12} X_{12} + \varepsilon i$

β0: Constant, βi: Coefficients of the independent variables, X_i= represent independent variables affecting household willingness to pay and amount are willing to pay and ε_i= is error term.

3.4. Definition of Variables and Working Hypotheses

In the study area, different variables are expected to affect households' willingness to pay (WTP) and magnitude they are willing to pay for improved solid waste management services.

Accordingly, the major variables expected to have influence on both households' willingness to pay and amount they are willing to pay are determined on the basis of economic theories, empirical studies and prior knowledge of the study area.

The following table summarizes the variables description and expected sign of explanatory variables.

Table 1: Description of variables and Working Hypotheses

Description of Variables	Measurement unit	Types of Variable	Expected sign
WTP and Maximum WTP **(dependent variables)**	1 =yes, 0 otherwise- use as base, and birr respectively	Dummy and continuous	
Independent variables			
Age of the respondents	Number of years	Continuous	-
Family size	Number of family in adult equivalent	Continuous	+/-
Educational level of respondents	Years of schooling	Continuous	+
Sex of the respondents	1=female,0=male-base	Dummy	+/-
Marital status of respondent	1= married,0=otherwise-base	Dummy	+
Monthly income of the households	ETH Birr	Continuous	+
Time spent in the area	Years of living	Continuous	+
Quantity of weekly generated solid waste by households	Volume of waste generated in 50kg sacks	Continuous	+
Responsibility of solid waste management	1 = if they think the households is responsible, 0 = otherwise-base	Dummy	+
Case of Diseases in the Household	1= if any member of the HH affected by waste related diseases for the past 1 year, 0 otherwise-base	Dummy	+
House ownership	1= if own house,0= otherwise-base	Dummy	+
Environmental awareness of the respondent	0=if not awareness-base 1= if aware	Dummy	+
Bid price offered to the respondents	ETH Birr	Continuous	-
Perception of the household about improved solid waste management	0=poor-base ,1=good, 2=V. good	Categorical dummy	+

Source: Own completion, 2016

4. Results and Discussion

4.1. Households' Solid Waste Disposal Practices in the Town

In order to assess the routine method of solid waste disposal practices of households and to know the destination of uncollected solid waste in the study area, the researcher asked the respondents about their common disposal system.

The result revealed that 61% of the respondents claimed to dispose their waste through thrown it on open space, nearby river, drainage or street.

Six point eight percent of the respondents used waste collector by paying money to dispose the waste generated. Only 2.5% of the respondents use backyard landfill to dispose their waste. About 16.5% of the households dispose the solid waste by digging a hole around the house and bury or burn in the compound/village while around 13.2% of the household's responded no fixed methods of solid waste disposal (Table 2).

Table 2: Methods of solid waste disposal by the households

Disposal Methods	Frequency	Percentage
Digging a hole around the house and bury or burn in the compound/village	66	16.5
Backyard landfill	10	2.5
Thrown it on open space, nearby river, drainage or street	244	61
Give to house to house collector	27	6.8
No fixed methods (may use thrown in open space, drainage, burning in compound/village or digging a hole and bury)	53	13.2

Source: Based on survey result, 2016

As it is observed in Table 2, door to door solid waste collection of the town is very insignificant both in spatial coverage and efficiency. As a result large numbers of household's preferred improper and unauthorized solid waste disposal such as thrown it on open space, nearby river, drainage or street and burning. This confirmed that the destinations of the majority of uncollected solid waste are in roads, drainage, river banks, bridges, and open areas. This improper disposal of solid waste exposed communities to different respiratory and water borne diseases.

As the researchers observed uncollected domestic waste is also the most common cause of blockage of drainage channels. It also covers pavements and other walk ways as well as filling the open spaces. Therefore, the participation of the whole community in the improved solid waste management (ISWM) program of the town is very essential and highly expected to bring changes on the existing low status of the town SWM system.

4.2. Households' Suggestions to Practice Improve Solid Waste Management in the Town

The households were asked to air their opinions that may lead to improve the existing solid waste disposal in the town. Accordingly, 312 (78.9%) of respondents believe that arrange infrastructure and place used for solid waste disposal by government and other responsible body is one of the issues that deserve attention to improve the existing solid waste management. About 52 (41.9%) of the respondents suggested that provide awareness & training to the households about ISWM play a vital role in ISWM. Develop participatory type of solid waste management program and cooperative which participating in solid waste management are other essential issues considered to improve the solid waste management in the town (Table 3).

Table 3: Suggestions of households to improve solid waste management in the town

Household's suggestions	Frequency	percentage
Government should prepare infrastructure and place used for disposal of solid waste.	312	78.9
Provide awareness & training to the households about ISWM	275	69.3
Develop participatory type of solid waste management program	222	56
Develop cooperative which participating in solid waste	136	34.3
Monitoring and punishing those individuals/institution chosen improper and unauthorized solid waste disposal	24	6
No suggestions	66	16.7

Source: Based on survey data, 2016

4.3. Willingness to Pay Analysis for Improved Solid Waste Management

From the total of 396 sample households who are willing to participate in improved solid waste management about 241 (60.9%) willing to pay the initial bid value while 155 (39.1%) households are not willing to pay (Table 4).

Table 4: Willingness-to-pay responses for initial bid value

Responses	Initial bid value (in ETB)				Total
	10	20	30	40	
Number of no responses	25(6.5)	28(7.1)	51(12.9)	51(12.9)	155(39.1)
Number of yes responses	72(18.2)	71(17.9)	49(12.4)	49(12.4)	241(60.9)

Source: Based on survey data, 2016; number in the parentheses are indicate percentage

The households were asked to point out their reasons for unwilling to pay the initial bid value. About 43.2% of households reported that they could not afford the price they set because of not enough income and about 37.4% of them reported the government should fill the gap as a subsidy. The rest 19.4% stated the amount they decided to pay is adequately sufficient for the stated improved solid disposal methods (Table 5).

Table 5: Reasons for households' unwillingness to pay initial bid value

Reason	Number of households	Percentage
Do not have enough income to pay the stated amount	67	43.2
The government should subsidize	58	37.4
The amount they decided to pay is adequately sufficient	30	19.4
Total	155	100

Source: Based on survey data, 2016

The mean willingness to pay (WTP) for single bound dichotomous choice for the survey response of the Probit model can be calculated by dividing the regression constant (intercept) by the negative of the bid coefficient as discussed in the methodology section. Thus, the mean WTP is found to be birr 36.08 (Table 6).

The mean WTP using the open-ended format is found Birr 23.01 per household per month, which is less than but closer to the WTP, obtained using the close-ended format. The mean WTP computed from the probit model and open ended format provide Birr 29.55.

By multiplying this mean (Birr 29.55) by the total number of households in the town, the monthly total WTP is estimated at Birr 572,413.05.

Table 6: Probit Model Results for initial bid value to compute mean WTP

Variables	Coefficient	Standard error	Z- value
Starting bid value	-0.0262836	0.0058782	-4.47***
Constant	0.9482944	0.1651114	5.74***

*** represents significance at 1% significance level

As seen in Table 7 below, the total monthly WTP of the town, using the mid WTP in each interval is estimated at Birr 496, 984.4 per month. The total willingness to pay Birr 496, 984.4 is obtained by multiply the class mark in column (2) by the total households willing to pay that amount in column (4).This is the amount all households in Ambo town are expected to pay if the suggested improved solid waste management service is to be realized in the town. The total revenue collected from the households of the town is obtained by multiplying the class mark by the corresponding total number of households WTP at least the given interval (column 8). The result revealed that, the total revenue various based on monthly payment and number of households WTP the given interval.

Table 7: Total willingness to pay and total revenue for improved SWM services

Class interval for amount HHs WTP (1)	Class mark for amount HHs WTP(2)	Sample distribution of HHs for class interval (3)		Total number of HHs WTP for class interval (4)	Total WTP (5)	Sample HHs WTP any amount in the interval (6)		Total HHs WTP any amount in the interval(7)	Total revenue (8)
I	II	III		IV	V	VI		VII	VIII
		No	%			No	%		
0-9	4.5	91	22.98	4451.5	20031.8	396	100	19371	87169.5
10-19	14.5	94	23.74	4598.6	66679.7	305	77.02	14919.5	216332.75
20-29	24.5	90	22.73	4403.0	107873.5	211	53.28	10320.9	252862.05
30-39	34.5	35	8.84	1712.4	59077.8	121	30.56	5917.9	204167.55
40-49	44.5	34	8.59	1664.0	74048.0	86	21.72	4205.5	74048.0
50-59	54.5	33	8.33	1613.6	87941.2	52	13.13	2541.5	138511.75
60-69	64.5	3	0.76	147.2	9494.4	19	4.79	927.9	59849.55
70-79	74.5	2	0.50	96.9	7219.1	16	4.04	780.7	58162.15
80-89	84.5	0	0	0	0	14	3.54	683.8	57781.1
90-100	94.5	14	3.53	683.8	64619.1	14	3.54	683.8	64619.1
Total		396	100	19,371	496,984.4				

Source: Based on survey data, 2016

4.4. Aggregate Demand Curve for Improved SWM Service

In this study, the aggregate demand has been derived from the above households' willingness to pay scenario in Table 7. The aggregate demand curve is derived using the mid willingness to pay amount along the vertical axis and the number of households' willingness to pay at least that mid value per month per household along the

horizontal axis (Figure 1).The figure shows the demand curve for improved SWM services in the study area. Any point on the curve shows all the households that demand the services for a given price. The demand schedule that has been obtained from the survey is believed to provide basic information for policy makers, planners, donors and administrators who are involved in the promotion of improved solid waste management services to make sound investment and related decision. As shown in Figure 1, the demand curve is negatively sloped indicating the decline in the demand for ISWM services as cost of getting the services increases, like most other economic goods, under the ceteris paribus assumption.

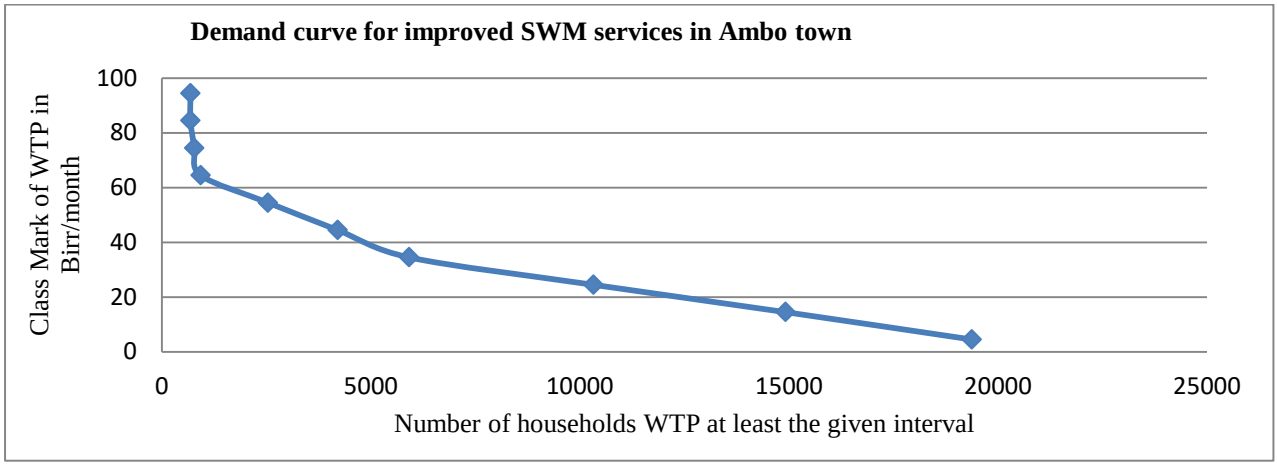

Figure 1: Estimated demand curve for improved SWM services in Ambo town

Source: Based on survey data, 2016

4.5. Determinants of Households' Willingness to Pay and Maximum Amount are Willing to Pay

This section presents the econometric model results on the determinants of households' willingness to pay (WTP) and maximum amount are willing to pay for improved solid waste management (ISWM) service. Before fitting important variables in to the model test for violation of linear regression assumption like multicolinearity and heteroscedasticity test were done. The result shows that multicollinearity and heteroscedasticity was not a serious problem.

The estimated results of the econometric models are presented in Table 8 below. The Probit model result showed that the amount of solid waste generated is positively and significantly influence households' decision WTP at less than 1% significance level. The marginal effect of this variable shows each additional unit solid waste generated per week; the probability of households becoming WTP would increase by 9.8%. Similarly, Tobit model result revealed that for each additional amount of solid waste generated the amount of money households willing to pay for ISWM will increase by Birr 4.8, under *ceteris paribus* assumption. Quantity of solid waste generated by the households, therefore, positively influences both households' decision to pay and amount they are willing to pay. The result corroborates the findings of earlier studies by [8]. Therefore, any attempt need to introduce integrate improved solid waste management require to consider the amount of waste generated by each households and set the collection price based on the amount of waste generated.

Consistent with a priori expectation, perception of the household about ISWM is found to influence positively and significantly the probability of household's willingness to pay and amount WTP for ISWM at less than 5% and 1% significance level respectively. As households perception about ISWM increases from poor to good the willingness to pay increases by 15.2%. Also, as households' perceptions about ISWM increases from poor to good will increase the amount they are willing to pay by Birr 4.18. The reason is straight forward, as households who perceived the multiple attributes of ISWM to be positive more likely to pay more than those who did not perceive the attributes as such. This shows that changing the perception of the households about ISWM through giving awareness and training play a vital role for adoption of ISWM services effectively.

Being female households the probability of WTP increased by 23.4%. The result revealed that female respondents more WTP for ISWM when compared to male respondents. By the same manner, marital status was positively and significantly related to the households' willingness to pay and found to be statistically significant at less than 5% significance level. The result suggesting that, married people are willing to pay more than those not married by 6.8%. The result is in agreement with the finding of earlier researchers [9, 10]

Table 8: Results of Probit and Tobit Econometric Model

Variables	Determinants of willingness to pay decision (WTP) – Probit model results			Determinants of maximum amount willing to pay (MAWTP) – Tobit model results	
	Coefficient	Z-Value	Marginal effect	Coefficient	t- Value
Amount of solid waste	0.2852127	2.78***	0.097694	4.976386	5.21***
Perception of HH head	0.4437947	2.23**	0.152013	4.17695	2.92***
Diseases related to SW	0.0479941	0.20	0.01661	2.742405	1.14
Sex of HH head	0.6398638	2.20**	0.2346767	3.290997	1.51
Age of HH head	-0.0209257	-1.20	-0.0071677	-0.1467791	-1.10
Marital status	0.2854229	2.16**	0.097766	0.8518822	0.77
Education level	0.0678498	2.27**	0.0232406	1.124301	3.66***
Family size	0.2033378	1.58	0.0696493	2.9919	2.77**
Year in the town	-0.0007709	-0.07	-0.000264	0.0068724	0.07
House arrangement	-0.0401279	-0.37	-0.013745	0.2886125	0.26
Total monthly income	0.0003691	5.62***	0.0001264	0.0037993	9.38***
Starting bid value	-0.4664446	-1.56	-0.0227593	-0.2523354	-1.30
constant	-2.2375	-2.01		-43.52707	-4.45
Prob> chi2 = 0.0000, Wald chi2(12) = 91.57, Pseudo R^2 = 0.3570, Log likelihood = -170.44287				Prob> F = 0.0000, Log pseudo likelihood = -1485.3388, Pseudo R2 = 0.0980	
Number of observations= 396; *** and ** represents significance at 1% and 5% level of significance respectively.					

HH = household; SW= solid waste

Source: Model output result based on survey data, 2016

From the table above observed that education level of the respondent was another variable found to be significant at less than 5% and 1% significant level in influencing both household decisions in WTP and amount they are willing to pay respectively. This is related to the fact that heads of households with better educational level are more in a position to recognize the advantages of ISWM and to demonstrate willingness to take part in it, consequently. As the year of schooling increases by a unitary value the probability of households WTP increase by 2.3% while the amount of money the households willing to pay may increase by Birr 1.12, other factors held constant.

Number of family size has a positive impact on the amount willing to pay and it is significant at 5%. The more children one has, the more could be amount of money willing to pay for ISWM services. This may be due to as the number of family size increases the amount of waste generated also increases this result in increase the amount willing to pay.

The result of the survey shows that monthly income has a positive impact on the households WTP and maximum amount are willing to pay as expected and it is found to be significant at less than 1% significance level. Both the Probit and Tobit model presented in Table 7 shows that when income of the households increases by a unitary value probability of being willing to pay and the amount of money the households could pay for ISWM increases by 0.02% and 0.059 monetary units respectively, other factors held constant. Hence, income is a strong determinant in explaining household WTP and amount they are willing to pay. The result is similar with the finding earlier study by [7].

5. Conclusion and Recommendations

Solid waste management is continued to be a major challenge and environmental problem of Ambo town. One of the major causes of this problem is insufficient finance for the service. Hence, this study was conducted with the general objective of analyzing demand for improved solid waste management (ISWM) services to see the possibility of cost recovery through service charges and its determinants in Ambo tow. The specific objectives of the study were to determine households' willingness to pay (WTP) for improved solid waste management and to identify factors which determine households' willingness to pay and amount are willing to pay.

The data used for the study were collected from 396 randomly selected sample households in the town. Primary data were collected using a structured questionnaire. Employed a single-bounded dichotomous choice format followed by open-ended questions to elicit households' WTP. In addition, secondary data were extracted from relevant sources to supplement the primary data. Both descriptive statistics and econometric model were employed in data analysis.

The main findings from the WTP analysis revealed that the mean WTP computed from the probit model and open ended format provide Birr 29.55 per month. By multiplying this mean (Birr 29.55) by the total number of

households, the monthly total amount WTP is estimated at Birr 572,413.05. The total amount all households in Ambo town are expected to pay using the mid WTP is estimated at Birr 496, 984.4 per month. Both the probit model and the mid WTP result shows that the expected total amount WTP by all households in Ambo town falls between Birr 496,984.4 to Birr 572,413.05 per month.

Probit and Tobit econometric model were employed to identify determinants of households' willingness to pay and amount they are willing to pay. The probit model result revealed that amount of solid waste generated by the households, perception of the households about improved solid waste management, sex of the households, marital status, educational level and total monthly income are found to be positively and significantly related to households' WTP. The Tobit model results shows that amount of solid waste generated by the households, perception of the households about improved solid waste management, family size, educational level and total monthly income are positive and significant determinants of amount households are willing to pay.

The result of the study suggested that any policy, to bring improved solid waste management service needs to include the demand side information related to determinants of households' willingness to pay and amount willing to pay. There is also a very wide room for cost recovery through introduce service charge for improved solid waste management in order to solve financial constraint and implementation of integrated ISWM strategies which involve the households as stakeholders.

6. Limitations of the Study

The scope of this study is obtaining demand side information and its determinants for improved solid waste management. The supply side information is not in detail assessed in this study. The future study using this as bench mark may undertake other comprehensive study which considers the supply side. The study is restricted in Ambo district, West Showa zone of Oromia National Regional State. Hence, the results are practical validity mainly to this area. But other areas having comparable or similar contexts (social, economic, and institutional set up) may use recommendations with great cautions. As the study uses contingent valuation methodology (CVM), the study is subject to all limitations associated with the method like starting bias problem, though; efforts have been made to minimize its limitations, thereof.

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