DISCUSSION PAPER

Willingness To Pay For Clean Water Supply Service

A Case Study of Sialkot

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Abstract

Water borne diseases due to contaminated water remain a serious problem in most of the developing world, although it consumes a larger portion of municipal budgets. The situation is serious in Sialkot the district of Punjab where ground water is contaminated due to improper disposal of effluents. The current study is designed to find the determinants of willingness to pay (WTP) by households for clean water supply in the affected area. A contingent valuation survey approach and a stratified random sampling technique has been applied.Sample size consists of two hundred and sixty nine respondents. A double bounded dichotomous choice questions followed by an open ended question format has been used to elicit WTP and maximum willingness of the respondents for clean water supply. Logit and Multiple Linear Regression Model is used as econometric tool to analyze the data. The results reveal that as the income of the respondent increases, theWTP for clean water supply also increases. While multiple regression reveals a monthly mean WTP of Rs. 234.54 which is greatly affected by age, household income, education and environmental awareness i.e. respondents with higher household income and higher level of education are willing to pay more for a clean water supply.

Keywords:*Willingness to Pay, Clean water Supply, Contingent Valuation Method, BinomialLogit Regression, Leather Tanneries, Sialkot, Pakistan*

1. INTRODUCTION

1.1 Background of the Study

Throughout history, the fate of human societies has often been determined by infectious diseases, many of which are mediated by the environmental situation in which people live (Barrett et al., 1998). As the world gets more crowded and natural resources become increasingly stressed, problems of infectious diseases have, and will, become increasingly salient. In recent years the relationships between environmental change and the spread of infectious diseases have become more apparent as large-scale environmental changes become more widespread (Daszak et al., 2000).

The drinking water of Sialkot was considered the best from the rest in Pakistan before 1990 (Kang et al., 2010). Its fresh water streams originating from Kashmir are presently serving as carriers of industrial effluent and municipal sewage. There was a time when these surface water channels were known by high produce of fish and rich aqua culture. The region was famous due to higher produce of rice, wheat, cash crops and the rural agriculture based economy. With the passage of time the communities moved more towards industry and trade due to high value of Sialkot's handmade products in the world. Consequently industrialization associated with international trade has emerged as major source of regional and national prosperity. All the evils of industrialization and urbanization also attacked the region and the industry has proved to be the origin of water, air and land pollution in the area.

Safe drinking water is the basic need of a human being. Safe drinking water became contaminated especially in the industrialized area[1]. Dumping of waste water in an inappropriate way ultimately polluted the groundwater. The leather tanning industry is one of the oldest industry in Sialkot, almost 48% of the Pakistan's tanneries are situated in Sialkot. Tanning industry use large number of chemicals during tanning process and discharge toxic waste water into the streams or dump into the ground water which ultimately pollutes the ground water (Rafique et al., 2010).

As per an assessment 110 million meter cowhide is made in tanneries of Sialkot consistently by handling around 75,000 tons of conceals and skins expending 50,000 tons of poisonous concoction (Urban Unit, GOP, 2011). Around 25 to 30 percent of these chemicals are devoured by collagen in wet procedures, amid its transformation into hull and/or completed calfskin. All the adjusted piece of the chemicals i.e. remaining 75 to 80 percent is depleted out of these tanneries in the wake of being the piece of mechanical emanating. Along these lines around 30,000 tons of tanning chemicals notwithstanding other waste materials turn out to be a piece of profluent consistently.

Only 3% tanneries in Pakistan meeting the international standards of tanning. Over the years, the groundwater in the areas where these tanneries are located are highly polluted (Qadir et al., 2009). The tanning industry is highly water intensive and each ton hide required over 40,000 liter water. Even with a small capacity a tannery can process 4 to 5 ton hides in a day and use over 150,000 liter of water which is equal to the consumption of over 4000 people in a day. It is found from previous studies that a tannery can pollute the groundwater of radius 8-10 km (Ramesh &Thiru, 2014). ,

[1] SIALKOT

Like many other urban areas of the Pakistan, Sialkot is also lacking in proper waste collection, treatment and disposal system. The municipal sewage and industrial effluent is generally disposed into the unlined natural water streams networking in the whole city.This network acts as a vicious cycle of disorder and exert sever impacts on the communities and the overall environment of the region. Now persistent complains of people being infected with water related diseases, decline in agriculture produce, loss of land and properties are heard. These complaints are due to flourishing industries and land pollution resulted by contamination of sewage and industrial discharges into the surface water and land. Drinking water contamination owed to inter-mixing of effluent with water supply lines and contamination of surface water reservoirs due to mass scale penetration of unexhausted matter in deep strata of earth. Biological and chemical contamination of surface and subsoil water resources is due to contamination of organic matter and industrial chemicals respectively.

According to Suleiman et al. (2013) contaminated water has become a serious environmental and public health problem everywhere in the world. Human presence depends to a great extent on accessibility of water both in astounding and manageable supply. Enhanced quality of drinking water can enhance our way of life, decreases death rates and bleakness connected with water conceived sicknesses like gastro, diarrhea, hepatitis and others.

Acute respiratory diseases and water borne diseases are the leading cause of human death. Lack of access to safe drinking water and sanitation facilities and poor hygiene are associated with skin diseases and acute respiratory infections (World Health Organization, 2002). UNEP (2002) estimates that almost1.1 billion people are living

without the access of clean drinking water and 2.2 million are dying because of the diarrhea every year and. Out of the 2.2 million 1.6 million are from the developing countries including Pakistan. There is a 200% increase in waterborne diseases in Sialkot City during last 4 years. UN (2002) conclude that if clean drinking water provide to the citizen we can decrease the figure of death up to 75 percent. Poor population cannot afford the clean drinking water because private sectors charges 20 times of the cost (UN 2006). Pricing of water is the key component of an appropriate incentive for efficiency so there is need to examine the demand and willingness to pay for clean drinking water in the areas where tanneries polluted the groundwater. In such a way clean drinking water can be provided to households by using their willingness to pay.Groundwater is the most suitable fresh water for the consumption of human being because of the concentration of minerals and salt.Broad examination is required on water contamination issues and people willingness to pay for reducing of water contamination. The purpose of this study is to analyze the clean water supply system and its willingness to pay (WTP) in Sialkot. More specifically, the objectives of this study are:

- To find out the amount that households are WTP for clean water supply system.
- To analyze the determinants of WTP for clean water supply system.

2. LITERATURE REVIEW

Belay (2010) explain that how tannery effluents especially chromium effects human beings, animals, plants and general environment. He found that chromium is highly toxic and primary threat to the humans and chromium remain in waste water after treatment of leather. It was also discussed that which are the cleaner technologies and how different technologies remove chromium from the effluents of leather tanneries. Treatment options are highly costly and can only use in some part of the world because of the temperature. Strong environment regulation need to be exercised to use better treatment. Polluter should be treated according to the polluter pay principle. In general public, concerned organizations and government has to play its role for zero chromium or at least the equal to the standards recommended by EIA.

Anjum (2013) conducted a study in Islamabad to estimate the mean WTP for solid waste management and its determinants by using contingent valuation method (CVM). A random sampling technique were used to collect sample and sample size was 500 households. Logistic regression and multivariate regression model were used to elicit the determinants of WTP and to estimate the mean WTP respectively. In this study he found that 64.5% respondents are willing to pay for improved services while on the other hand Rs. 289 is the mean WTP by different socio-economic and environmental variables. Income, education and environmental awareness are highly significant variables for the determination of willingness to pay.

Fasakin et al. (2010) tries to estimates the parameters of WTP for improved water services in city of Nigeria. In order to fulfil they used primary data based on household

survey. Different socio-economic variables are used in logit model. The most significant variable is distance from house to the water services, quantity of water used by per person per day and quantity of water purchased by house from vendor. Mean WTP is $24 per year per house.

Khan et al. (2010) conducted a study in Hayatabad, Peshawar to estimate the WTP for improved water quality. They use Contingent valuation method CVM to estimate and apply the multinomial logit model to elicit the household's WTP and as well as their averting risk behavior. In order to analyze prevailing situation they use 150 household randomly selected. They found that income, level of education and awareness significant determinants of the household's WTP for improved of water quality. They also found that the residents of Hayatabad WTP more than the bills they are paying to City Development and Municipal, Peshawar.

Lohano&Asim (2014) highlight the issue of contaminated tap water and estimated the household WTP for improved water services in Karachi, Pakistan. To fulfill this they used two towns of Gulshan -e- Iqbal colony in Karachi. Total 373 households were randomly selected for the survey. Contingent valuation method is used to elicit the WTP and its determinants. Average WTP is Rs. 604 per month whose monthly income is less than Rs. 20,000 and total overall average willingness to pay is Rs. 1922 per month. They concluded that as income increases WTP also increases.

Mustafa et al. (2007) highlight the water borne diseases and effects of these diseases meanwhile they observed that Pakistan is facing 365 billion loss of GDP which is equivalent to 6% GDP of Pakistan every year because of poor sanitation and less access of clean drinking water. They tries to investigate the households WTP for improved water

services in Abbottabad by using contingent valuation method and multinomial logistic model and used 450 sample size and they found that people who fetch water from outside the houses are more WTP for improved water services and people living in urban areas have also higher WTP. Education level is also a significant variable as level of education increases willingness to pay also increase which indicates that people who are educated have more awareness. Income is also a significant variable as income increases WTP also increases.

Mustafa et al. (2007) evaluated the householdWTP for safe drinking water Abbottabad region by applying contingent valuation method through multivariate logistic model. Three classes of therespondents were made in view of income level and the entire study test of 455 was differentiated in two parts as per territory as urban and rural territories results uncover that education level has direct relationship between diverse classes of WTP and also significant. The income level of family has insignificant impact on willingness to pay, this demonstrates that WTP of the individuals for safe drinking water is not straightforwardly impacted by their pay levels. Results demonstrate that urban population has more ability to pay than that of ruralrespondents.

3. DATA DESCRIPTION

This section discusses the sample selection and survey methodology adopted for the study.The descriptive analysis of the collected data is organized on the basis of offered bid prices to different respondent's samples. STATA software is used to analyze the data through cross tabulation of the variables to check the responses of the variables.

3.1. Profile of the Study Area

Sialkot is one of the biggest industrial city of Punjab as well Pakistan. The projected population of city was 999449 person during 2014 and it covers an area of 3016 km^2. The city dominated with male population (52%).

The Sialkot city has its own administrative authority which is known as Tehsil Municipal Administration (TMA) Sialkot, having co-units and to manage the different departments. It is the key responsibility of TMA to enforce all Municipal law and proper dispose of liquid waste of industries and provide water supply and development of water sources. This household survey was conducted in all clusters of leather tanneries and nearby residential area. This study showed that only 3% of total leather tanneries in Sialkot meet the international standard of tanning rest of the tanneries do not follow the internationalstandards and dispose contaminated water in ground water and in open spaces.

3.2. Sample Selection and Survey Methodology

This study is conducted in district Sialkot. Sialkot have four tehsils "Sialkot", "Daska", "Sambrial" and "Pasrur". The data used in the study was collected by author through

questionnaire based survey from district Sialkot during 2015. This household survey was conducted in all clusters of leather tanneries and nearby residential area. Stratified random sampling technique was adopted for the collection of data. Two hundred and sixty nine households, which consist of 1622'households' members, were interviewed at their premises through a well-structured and pre tested questionnaires.

This study applies Contingent Valuation Method (CVM) to estimate the household's WTP per month for the clean water supply. Qualitative choice questions were asked to all respondents like "are you ready to pay for new and better system of water supply?" if the respondent accept the starting bid then we offered a new bid which is higher than the previous bid. If respondents are not WTP for first bid then we asked an open ended question "what is the maximum amount you are willing to pay for this service?" the highest amount which respondent gave us we considered it is the maximum amount of WTP for services. Three different bids are offered which are Rs. 100, Rs. 200 and Rs. 300. The discrete choice analysis are done through logit regression, for maximum amount of WTP we used multiple linear regression.

3.3 Data Analysis

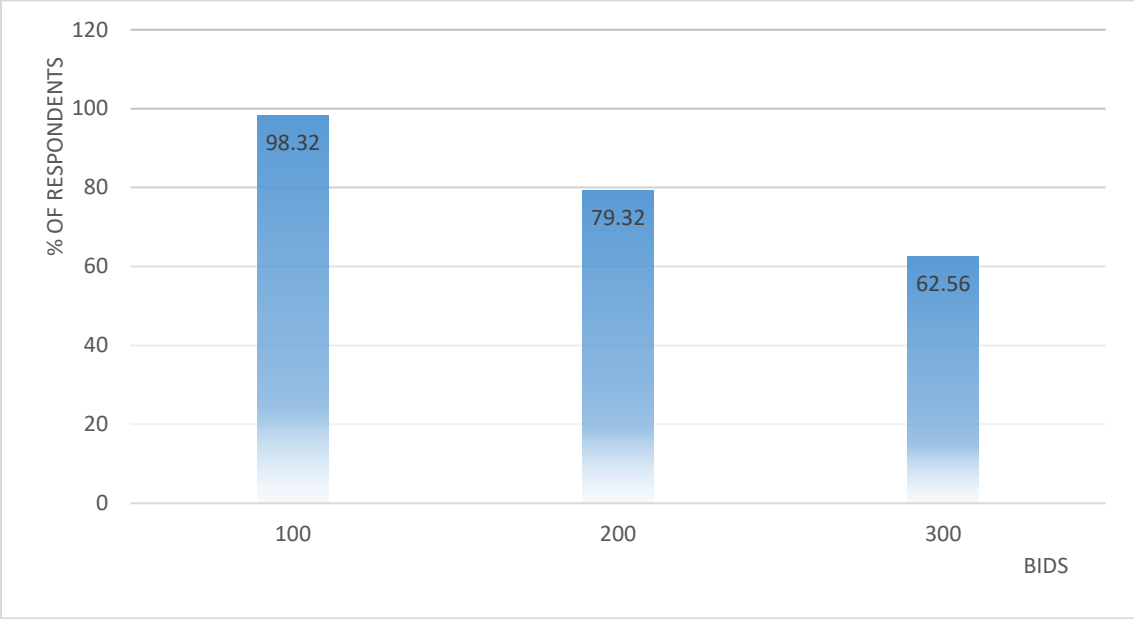
The data of two hundred sixty nine households collected through survey from the field is analyzedto see the responses of variable to the corresponding socio-economic characteristics. Furthermore STATA software has been used for analysis.

3.3.1 Owned House Response for WTP

In figure 3.1 the X-axis shows that the amount of bid offered for the clean water services, amount start from 100 and increase to 200 and then increase to 300. While on the Y-axis

shows that the percentage of households who have their own house and they are also WTP for clean water services.

Figure 3.1: Owned House Response for Willingness to Pay



Source:*Field Survey by Author*

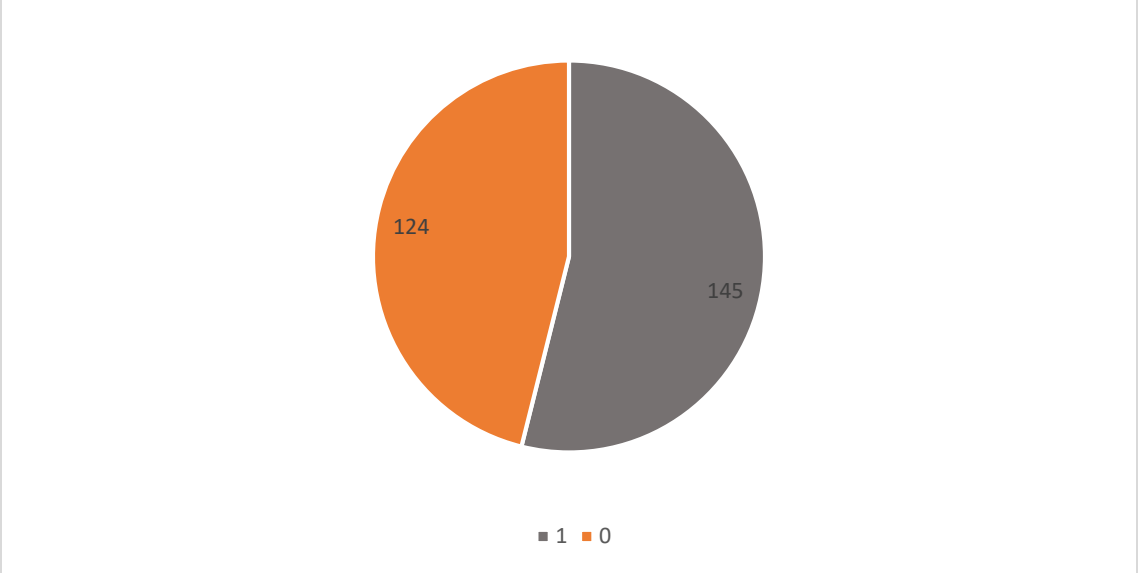
In figure 3.1, the percentage of households who have their own house and theirWTP is presented. For the bid Rs. 100 which is the lowest bid there are 98 percent who have their own houses and they are willing to pay for clean water services and there is only 2 percent responses who have their own houses but they are not willing to pay. For the bid Rs. 200 which is second bid almost 80 percent responses who have own houses are WTPRs. 200 for clean water services and 20 percent responses who have their own houses are not willing to pay for the second bid. For the third bid which is Rs. 300 almost 63 percent responses who have their own houses are willing to pay and 37 percent responses who have their own houses and they are not WTP that amount for clean water services.

From the above descriptive analysis we can easily see that the responses are changing from bid to bid. As the bid offered increases the respondent percent is also change. As the bid increases the respondents who are WTP decreases which shows the negative relationship between bid offered and percent of people who have their own houses. The demand for clean water services decrease as the bid increases. The demand decreases may be because of the burden of other expenditures.

3.3.2 Environmental Awareness

The figure 3.2 pie chart illustrates the environmental awareness about impact of tanneries on water response of respondents and also shows the number of respondentswho are not environmentally aware.

Figure 3.2: Environmental Awareness



Source:*Field Survey by Author*

In figure 3.2 the number of respondents who have environmental awareness and not is presented. We depict this variable through binary response questionnaire ‘0’ and ‘1’. ‘1’ is taken if respondent is environmentally aware and ‘0’ if respondent is not

environmentally aware. This graphs shows that 145 out of the 269 which is almost 54 percent respondents are environmentally aware and they have a knowledge about environmental. On the other hand 124 out of 269 which is equals to 46 percent respondents don't know about environment and they are not environmentally aware. Almost half of the respondents are not environmentally aware this is because of the respondent's education. It might be possible that those who are not literate or they are not well educated they are not environmentally aware.

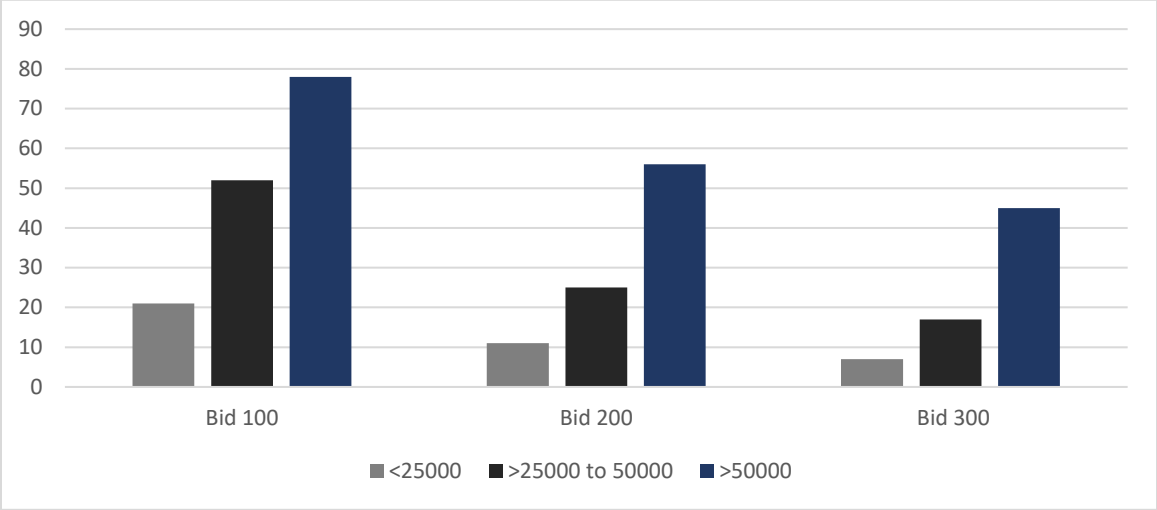
3.3.3 Income Groups Response for Willingness to Pay

The descriptive analysis of income group and willingness to pay for water services has a vital position in the analysis because we are dealing with the price of a service that is being offered and respondents shows their willingness and unwillingness regarding their income position and other characteristics.

In this graph the per month income of the respondents are divided into three different levels[2], those earning less than or equal to 25 thousand are included in the first income level, the respondents earning more than 25 thousand and less than or equal to 50 thousand are included in the second income level and those earning more than 50 thousand are included in the third income level.

[2]First income group: Earning less than or equal to 25 Thousand.
Second income group: Earning more than 25 Thousand to 50 Thousand.
Third income group: Earning more than 50 Thousand.

Fig. 3.3: Income Groups Response for Willingness to Pay



Source:*Field Survey by Author*

For the first bid of Rs. 100 per month there is 21 respondent from the first income level willing to pay for the services, there are 52 respondent from the second income level willing to pay for these services, regarding the third income level the elite class of the society 78 respondents of this income level are willing to pay this price.The second bid price offered of Rs. 200 per month the response from the first income level respondent received as 11 respondents are willing in this group. From the second income level 25 respondents are willing to pay and the 56respondents of the third income level are willing to pay this price also. For bid price of Rs. 300 per month the first income level responded that only 7are willing to pay and, the second income level responded that 17 respondents are willing to pay and the 45 of the third income level are willing to pay for clean water services.

Other socio-economic characteristics of respondents are presents in below table 3.1.

Table 3.1. Socio-economic Characteristics of Respondents

Variables	Frequency	% of Respondents	Mean
Male	260	96.65	-----
Female	9	3.35	-----
Employed	215	79.92	-----
Student	38	14.13	-----
Retired	13	4.83	-----
Unemployed	3	1.11	-----
Age	-----	-----	33.37
Monthly Income	-----	-----	27215.38
Household Size	-----	-----	6.03
Diarrhea	47	17.47	-----
Hepatitis	42	15.61	-----
Typhoid	34	12.63	-----
Education	-----	-----	10.31

Source: *Field Survey & Computed by Author*

Out of the total sample 260 respondents are male while the rest are female. Out of 269 respondents 215 were employed, 38 were students, 13 were retired and only 3 are unemployed. The average age of respondents are approximately 33 years and the average income of households is approximately 27000. Out of the 1622 households 47 are facing diarrhea disease, 42 are hepatitis patients and 34 faced typhoid disease. Average education of respondents is 10.31 years which is equal to matric and the average household size is approximately 6 which is very closer to the 1998 census.

4. METHODOLOGICAL FRAMEWORK

In this section of the study the methodological framework is briefly discussed. To fulfil the primary objective of this study socio-economic factors are included to calculate the mean willingness to pay and determinants of willingness to pay. Consideration of socio-economic characteristics of respondents increase the reliability and validity of CVM results and also increase the practical application these of results.

4.1 Logit Model

The logit model is used by many studies like Khan et al. (2010) to elicit WTP in Hayatabad Peshawar, Fillipis (2005) also used logit model to find the determinants of willingness in Greece. Lal and Takau (2006) used to estimate willingness to pay in Tonga and Arene and Mbata (2008), Chuen-Khee and Othman (2010) used logit regression analysis for capturing the effects of determinants of the farmers for their willingness to pay for the use of metropolitan organic waste as manure Logit regression model is specified bid as dependent variable and bid is the function of other variables such as household size, household income, owned house, distance from tannery, environmental awareness of the respondent, use of electric filter in house for drinking purpose, boiling of water, education of the respondent, and age of the respondent and marital status of the respondent.

$$WTP = f\ (H\_SIZ, HHI, H\_OWN, DFT, E\_FIL, E\_AWA, B\_W, EDU, AGE, M\_STA)$$

Where;

(WTP) willingness to pay, the dichotomous choice of the respondents taking value “1” for yes otherwise “0”. The other variables are considered as independent variable

includes (H_SIZ) household size, this variable has taken as total number of family members in house and this variable is expected to have negative relation with dependent variable. (HHI) total household income taken in thousand rupees and it is expected that as household income increase WTP for such services also increase. (H_OWN) house ownership, used as a dummy variable value "1" for owing a house otherwise "0". (DFT) distance from tannery, the entries for this variable are made by coding "1" for who are living in the radius of 500 meter to the tannery otherwise "0". (E_FIL) electric filter, value "1" for households used electric filter of water and "0" for not using. (E_AWA) environmental awareness, this variable is used to show that respondent is environmentally aware or not as value "1" for environmentally aware and "0" for environmentally unaware. (B_W) boiling of water, specify as "1" for use of boiling water for drinking purposes otherwise "0". (EDU) education of respondent has been taken in years. (AGE) age of respondent recorded in years. (M_STA) marital status of respondent, value "1" for being married and "0" for single.

$$WTP = 1 / 1 + e^{ln\ z}$$

$$ln\ z = \beta_0 + \beta_1 HHS + \beta_2 HHI + \beta_3 H\_OWN + \beta_4 DFT + \beta_5 E\_FIL + \beta_6 E\_AWA + \beta_7 B\_W + \beta_8 EDU + \beta_9 AGE + \beta_{10} M\_STA + ui$$

4.2 Multiple Regression Model

Multiple linear regression model is used by Chodhury (1999), Begum, Siwar, Pereira, &Jaafar (2006) to estimate the maximum WTP. The maximum amount which a household is willing to pay for clean water supply is the function of other independent variables which are describes below as.

$$Max_{WTP} = \beta_0 + \beta_1 HHS + \beta_2 HHI + \beta_3 H\_OWN + \beta_4 DFT + \beta_5 E\_FIL + \beta_6 E\_AWA + \beta_7 B\_W + \beta_8 EDU + \beta_9 AGE + \beta_{10} M\_STA + ui$$

Max_{WTP} = Maximum willingness to pay, this variables is describe as the respondent mentioned the maximum amount which he is willing to pay for new service. Other independent variables are already explained in above paragraph.

ui=error terms, also called disturbance term is utilized to catch the imperceptible influence of specific variables.This additionally represents the informationmistakes, undoubtedly how good the model is determined, there dependably exists possibilities of error. This error term is ordinarily dispersed with “0” mean and has a constant variance.

5. RESULTS AND DISCUSSION

While estimating the demand for clean water supply services in Sialkot the respondent's response are for the three different bids are mentioned. To evaluate that whether increase in the bid leads to decrease the number of respondents who are WTP for lower bid or not.

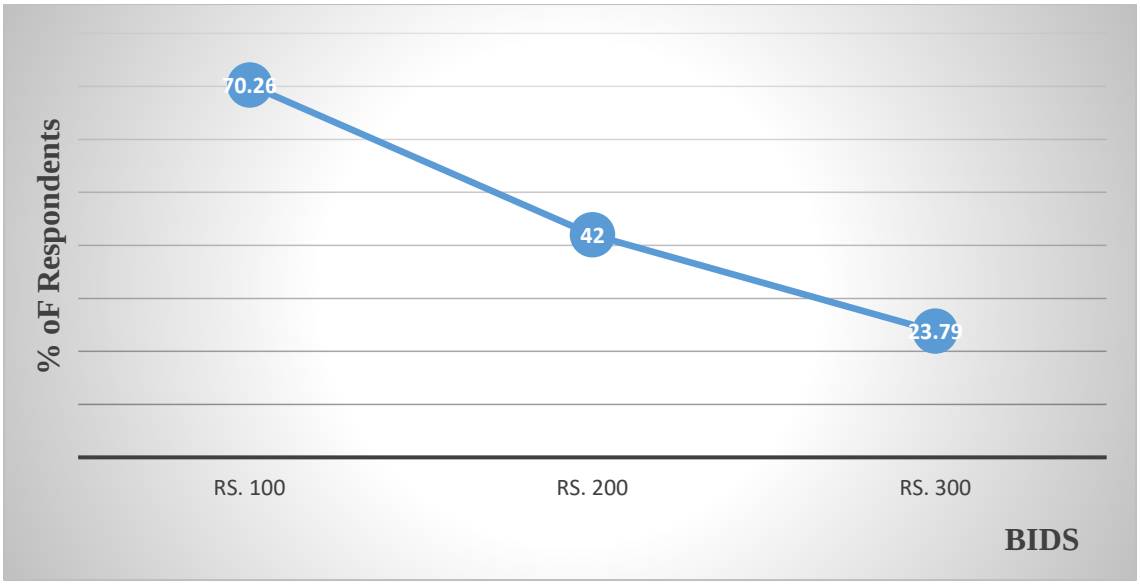
After creating hypothetical market the first bid offered was Rs. 100 to the respondent for clean water supply services in an area. The analysis of first bid responses shows that 189 householdswere agreed to pay for this new service which is about approximately 70 percent of total sample.

The second bid to get the response of 'YES' or 'NO' offered to the respondent was Rs. 200 which is higher bid than the previous bid and 42 percent respondents are WTP at this bid also.

The third and last bid was offered to the households which is Rs. 300 and more than the previous bid and at this bid approximately 24 percent respondents are willing to pay for clean water supply services.

Figure 5.1 shows a negative relationship between bid and number of respondents which is according to the Economic theory of Contingent Valuation i.e.as the bid increases number of corresponding respondent's decreases (Figure 5.1).

Figure 5.1: Demand Curve for Water Supply Services.



Source: *Field Survey by author*

The figure 5.1 presenting a negative trend of demand curve. On the X-axis bids are presented and number of respondents are presented on the Y-axis. This graph is clearly showing us that as the bid increases the number of respondents with 'YES' response decreases. This graph has a traditional downward sloping trend.

5.1 Determinants of WTP using Logit Model

The variables that explain HouseholdsWTP different bids in district Sialkot are highlighted in below section. The results of these variables are shown in Table 5.1 presents at which level these are significant are also shown in this Table. Gujrati (2004) interpreting the given regression results and each of the results of coefficients showing partial slopes of coefficient.

In our empirical findings the H_SIZE (Household Size) coefficient is -0.0224 for the bid Rs. 100 shows that by keeping other things remain constant if there is one unit increase in household size then it means there will be a 0.0224 unit decrease in WTP, and it is

significant at 10 percent level. For the bid Rs. 200 household coefficient has value -0.1166 which indicate that if HHS is increase by a unit then WTP is decrease by 0.116 unit showing a negative relationship with WTP but this variable is statistically insignificant in this model. Dependent variable bid Rs. 300 has the values of the coefficient - 0.0136, if we kept other variable constant then it increases by a unit then WTP will decreased by 0.013 unit and it is statistically significant at ten percent level.This shows a negative relation between household size and WTP. This negative relation might be because of an increase in the expenditures of house by an increase in the size of household. If there is an increase in household size then people are more concerned about the education expenditures and other expenditures rather than these services.Similar results were found by Moffat et al. (2001)and Lema et al. (2012).

The variable named as HHI (Household income) has a coefficient value is 0.00001, 0.0000001 and 0.000001 for the bid Rs. 100, Rs. 200 and Rs. 300 respectively which shows that while other variables kept constant household income statistically affects the household's WTP for clean water supply services. All the three coefficients have significant positive affect on the willingness to pay. The findings are consistent with Lema et al. (2012), Moffat et al. (2001), Khan et al. (2010),Gnedenko et al. (2009), Whittington et al. (1990)andKenneth et al. (2005).

Table 5.1: Logit Results of bid 100 for the Determinants of WTP.

Method: Binary Logit			
Independent Variable	**Dependent Variable**		
	Bid Rs. 100	**Bid Rs. 200**	**Bid Rs. 300**
Variable	**Coefficient**	**Coefficient**	**Coefficient**
H_SIZE	-0.0224**	-0.1166	-0.0136**
HHI	0.00001*	9.62e-06*	3.25e-06*
H_OWN	0.2413*	0.1935*	0.0975*
DFT	-0.0039	0.0179	0.1239*
E_FIL	0.0179	0.0697	0.1687*
E_AWA	0.0381	0.0021	0.0001
B_W	0.0442	0.1040	0.1112
EDU	0.0266*	0.0490*	0.0107*
AGE	0.0015	-0.0041	-0.0214
M_STAT	0.0578	0.0066	-0.0181
Pseudo R^2	**0.5891**	**0.5667**	**0.5616**

In parentheses probabilities of critical values are reported.
* = significance at 5 percent level.
** = significance at 10 percent level.

The variable of the ownership of house labeled as H_OWN has the coefficient value of 0.2413, 0.1935 and 0.0975 for dependents variables respectively which indicate that if a respondent has its own house then WTP for Rs. 100 will increase by 0.2413 unit and WTP will increase by 0.1935 unit for Bid Rs. 200 and 0.0975 unit for Bid Rs. 300 for the services of clean water supply. This variable is statistically significant at 1 percent level. Similarly Anjum (2011)and Yasuoa (2005) found the same results. So it seems that this variable has effect in our study because it is statistically significant and has a positive relation with willing to pay and house ownership.

Regarding the variable DFT (Distance of house from tannery) coefficient value -0.00394, 0.0179 and 0.1239 for the dependent variables Rs. 100, Rs. 200 and Rs. 300 respectively. These result suggests that if a respondent is living with in the area of 500 meter from tannery then his WTP decrease than those respondents are living outside the radius of 500

meter. This variable is statistically insignificant in all three regressions and showing negative relation with WTP but it has no effect in our study.

E-FIL (Electric Filter for the purification of water) coefficient value is 0.0179, 0.0697 and 0.1687 respectively for all dependent variables and showing a positive relation with WTP. Those respondents are using electric filter for purification of water for drinking purposes are more likely to willing to pay than those who don't use electric filter. This variable is only statistically significant at 5 percent level in the Bid Rs. 300.

E_AWA (Environmental Awareness) coefficient 0.03817, 0.0021 and 0.0001 means that if other things remain constant and environmental awareness increase by one unit then WTP for hundredalso increase by 0.038, 0.002 and 0.0001 unit but this variable is statistically insignificant and have a positive impact on WTP. This may be because respondent know the consequences and benefits of clean water supply services.This show that the environmentally aware people are willing to pay and it also increase concern about their surrounding environment. In accordance to theory and logic they will be aware of all the threats, diseases and damages that are caused because of dirty drinking water. To have such sort of activities we need to aware our population. Anjum (2011) and Mustafa et al. (2014) also found the positive relation of environmental awareness.

The variable B_W (who boil water for drinking purpose) coefficient value are 0.04426, 0.1040 and 0.1112 which shows that by keeping other variable remain constant if B_W increase by one unit then WTP for this service also increase but this variable is also statistically insignificant in this study. Households who are boil water for drinking purpose are more likely to pay for such service than those who don't boil water. Likewise Khan et al. (2010) found the same results of boiling of water.

EDU (education of the respondent) coefficient value has 0.02678, 0.0490 and 0.0107 indicating that there is a positive relation between education and WTP. Coefficient value means that if education level is increase by a year then WTP is also increase by 0.00412, 0.049 and 0.010 unit bykeeping other variable constant. This variable is highly statistically significant at one percent level. If respondent's education increases WTP also increase for this service this might be because respondents know the benefits of this services and respondent is environmentally aware because of education. Same results found by Moffat et al. (2001), Khan et al. (2010) and Hite et al. (2002).

The variable AGE (age of respondent) has coefficient value 0.0015, -0.0041 and -0.0214 means if age increase by a year then WTP also increase by 0.0015 unit for the Bid Rs. 100. Coefficient value -0.0041 and -0.0214 indicates if age increase say by a year respondents are less willing to pay for such services but these variable is statistically insignificant in this study. This shows a positive relation between age of the respondent and WTP of Bid Rs. 100 and negative for others Bid. Moffat et al. (2001), Martin (1997) and Adenike (2009) revealed that age has a positive relation.

M_STAT (Marital Status) of the respondent coefficient value has 0.0578, 0.0066 and -0.0181, these result suggests that if the respondent is married are more likely willing to payRs. 100 and Rs. 200 for such servicesthan those respondent who are unmarried but this variable is also statistically insignificant in this study.Adenike (2009), Anjum (2011) and Amoah&Adzobu (2013) also found similar results of this variable.

5.2. Determinants of Maximum WTPusing Multiple Linear RegressionModel

A multiple regression model was used to estimate the maximum amount that people are WTP for clean water supply services in Sialkot (Table 5.2).

The regression coefficient of H_SIZ (household size) is -7.95 which indicate that as H_SIZ increases say by a unit on average maximum WTP will decrease by 7.95 unit. The variable is showing a negative relationship between house hold size and maximum WTP for clean water supply services in Sialkot.

However, the variable is statistically irrelevant but basedon the previous studies it is proven that household size in negatively associated with WTP.Otsetswe (2001), Chowdhuri (2003) suggests the same results in their studies.

The variable of HHI(household income) coefficient value is 0.0034 shows a positive relation with maximum WTP. If HHI increase by one unit maximum WTP will increase by 0.0034 unit. This variable is highly significant at one percent level. However this variable affect is very small as we can see from the coefficient value this proves that WTP is not dependent only HHI there could be other variables which are affecting the maximum WTP.Sidrat&Lohano (2014) and Noor et al. (2010) results are consistent with the result of this study.

Variable H_OWN (house ownership) has the coefficient value is 39.350 which indicate that if H_OWN increase by a unit maximum WTP also increase by almost 40 unit. This variable is statistically significant at ten percent level. This variable shows a positive association with maximum WTP.

Table 5.2: Multiple Linear Regression results for the determinants of Maximum WTP.

Dependent Variable: MAX_WTP				
Method: Least Square				
Observations: 269				
Variable	**Coefficient**	**S.E**	**t-statistic**	**Prob.**
H_SIZ	-7.951	4.885	-1.63	0.104
HHI	0.003	0.0006	5.23	0.000
H_OWN	39.350	22.343	1.76	0.080
DFT	35.950	18.659	1.92	0.055
E_FIL	92.735	33.935	2.73	0.007
E_AWA	8.011	15.183	0.53	0.596
B_W	49.335	24.81	1.99	0.048
AGE	-0.209	0.719	-0.29	0.769
EDU	4.842	2.924	1.66	0.098
M_STAT	14.963	17.600	0.85	0.398
CONSTANT	-68.922	47.364	-1.45	0.147
R-SQUARED	0.599	**Mean Dependent Variable**		234.54
ADJ R-SQUARED	0.581			

Coefficient value of DFT (Distance from tannery) is 35.950 means a positive relation with maximum WTP. If DFT increase by one unit maximum WTP increase by approximately 36 unit and this variable is statistically significant in this study. Similar results were found by Kanayo (2013).

E_FIL (electric filter in house) value of coefficient is 92.735 indicate that if there is an increase in electric filter by one unit maximum WTP will also increase by approximately 93 unit showing apositive relation with dependent variable maximum WTP and this variable is statistically significant at one percent level.

The regression result of coefficient of E_AWA (environmental awareness) is 8.011which shows that if environmental awareness increase then dependent variable which is

maximum WTP also increase by 8.011 unit showing a positive relation with maximum WTP but this variable is statistically insignificant in this study and has no affect in this study.Spash (2006)also suggest the positive relation of environmental awareness and WTP because the people who are environmentally aware are also more aware of the results of pollution and contaminated water that is why they are more WTP for environmental services.

Coefficient value of B_W (boiling of water for drinking purpose) is 49.335 which means that if there is an increase of boiling of water for drinking purposes with in the household by one unit then maximum WTP will also increase by 49.33 unit. This variable is statistically significant and having a significant relationship with maximum WTP.

AGE (age of the respondent) has the coefficient value is - 0.209 means that a negative relation with the dependent variable of this variable. If there is an increase in age say by a year then respondent maximum WTP will go down by 0.209 unit. This variable is statistically insignificant but theory suggest that it is proven a negative relation with maximum WTP. Anjum (2011), Noor et al. (2010) and Amoah (2013) results are consistent with this study results.

Variable for education is EDU (education of the respondent) has got the coefficient of 4.842 which showing us that if education increase says by a year then on average maximum WTP will increase by 4.84 unit. This variable has a positive relation with dependent variable and also statistically significant at ten percent level. Similar results were found bySattar& Ahmad (2007), Yacob et al. (2013) and Mustafa et al. (2014).

M_STA (marital status) variable has the coefficient value is 14.963 means if marital status increase by a unit which means if a respondent is married then his WTP will also

increase by approximately 15 unit showing a positive relation with maximum MAX_WTP. Although this variable has insignificant affect in this study. Theresults of this are consistent with Adenike (2009).

The variable adjusted R-squared is 0.58 indicate that the model is good and 58 percent of the total variation is explained by the explanatory variables in maximum WTP.

We applied Breuch- Pagan test to check the heteroscedasticity and results[3] showingus that there is a problem of heteroscedasticity but we removed heteroscedasticity by using robust regression in STATA.

VIF method has been adopted to check the multicollinearity among the variables in this study. The results[4] of this method indicates that there is no multi-collinearity in this regression because as tolerance value which is 1/VIF approaches to one it shows that there is no multi-collinearity in this regression. If tolerance value is less than 0.5 then we say there is a weak multi-collinearity and if tolerance values is closer to zero then we can say that there is strong multi-collinearity in the regression.

The model estimated the mean maximum WTP which is Rs. 234.54 per month, if we want to analyze our average WTP with previous studies then we can see that mean WTP of this study is fall in range. To compare our estimated mean WTP with international available literature are converted to American dollars to easily understand the comparison process. Our mean estimated willingness is Rs. 234.54 which is equals 2.31 USD per month and the values quoted by some international literature as; as Moffat et al. (2011) investigated a mean WTP in Maun and found average value is 3.56. Fujita (2005)

[3] See Appendix
[4] See Appendix

conducted a study in Iquitos city and found mean WTP for water services in 1.46 USD. Otsetswe (2001) a Vietnam study found 148000 VND which is equals6.86 USD per month. Martin E., (1997) revealed a mean WTP in western United States and also compare the four cities mean WTP and he found 4.43 USD per household per month. Wei et al., (2007) used a contingent valuation method to measure the value of mean WTP in Situ, China and found only 0.20 USD per household per month which is surprisingly low. Noor et al., (2010) conducted a study in Lahore to estimate the find the mean WTP and found 1.41 USD per month per house for new water services. Sidrat&Lohano (2014) conducted a study to estimate the average WTP for improved tap water which can be used without boiling and without the use of electric filter and they found average 6.03 USD per month per household for this service. Olajuyigbe et al., (2010) estimated WTP in medium sized cities of western Nigeria and found mean WTP is 2 USD per household per month.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This research has been done with the objectives to find out the determinants of WTP for safe drinking water in district Sialkot. A Contingent valuation methodology (CVM) was employed following the logit model and multiple linear regression model is used for econometrics analysis. The major results of this research are given as, mean age of the respondent's is 33 years, monthly income average isRs. 27 thousand, and the mean education of the respondent is 10 years in other words matriculation. Almost 54% respondents are aware of the consequences of these leather tanneries in residential areas. The average household size of this sample size is 6.03. This study found 18% cases of diarrhea, 16% cases of hepatitis and 13% cases of typhoid. This is also found that those who are more environmentally aware are more WTP for clean water supply system.

Household size is negatively associated with WTP for clean water supply system, respondents are less willing to pay as the household size increase. The total monthly income of the household has positive association with WTP and it is statistically significant in all of the models. Education is also positively related with the WTP and also significant. As education level increases people are more aware of the environment and WTP increases. The regression which we use to find the maximum amount of WTP is multiple regression model, and this model showed us a mean WTP is Rs. 234 per month per house.

The Logit model results indicate us that the respondents who are living in their own place are positively related with WTP. The households are using electric filter are also more

WTP it could be because of high cost of electric filters and other associated costs of filters. Households used to drink water after boil are more WTP because opportunity cost could be high.

Concerning impact of determinants of WTP, the variables are in line with economic hypothesis and desire as the age of the people show negative association with WTPfor clean water supply, as this could be because the older respondent think that it should be government's duty to provide clean water supply at door step. Level of education is positively associate with the dependent variable because higher the education higher the concept of diseases and benefits of clean water system.

6.2 Recommendations

- The multiple regression model results gave mean WTP is Rs. 234 per house per month. If this amount is collected by the government and provide safe and clean water to household the cost of the services can easily be recovered.
- Through providing clean water supply government can decrease the prevalence of diseases in the city and can also make the area environmentally good.
- This study findings showed a positive association of individual's level of education, awareness of environment, monthly total income of household with WTP for clean water supply system. If any governmental or non-governmental organization want to enhance the WTP first of all they should address these variables to achieve the desired results.
- The water supply system can easily be privatized as other sectors are privatized such as sanitation services. If government covered the initial cost of the water

pumping plants and implementation of the pipe lines we can run these projects through participatory approach.

- Through participatory approach the cost of transportation can be reduce, timely collection of charges and operational cost will be minimum because this will be a shared responsibility of community.
- Government should move all of the tanneries which are near by the residential areas to the far away open area which is not near the residential areas.
- Government should implement the environmental standards, rules and regulation on these tanneries and there is a great need of check and balance.
- Government should implement all of the international standards in leather tanning process, through this we can reduce the cases of diseases and we can also increase the revenue by exporting good form of leather wears.
- Government should impose tax on these tanneries and invest this amount in installation of filtration plants of water.
- Government can generateRs.8566740 per monthif charge Rs. 234 from each house for the services of water.

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Annexures

Vector Inflation Factor used to detect Multicollinearity in Maximum Willingness to pay regression and the results are presented below.

Table 5.5: Test Results of Multicollinearity.

Variable	VIF	1/VIF
Household Size	1.63	0.613497
Household Income	1.72	0.580530
Owned House	1.72	0.581133
Distance from tannery	1.56	0.642007
Electric Filter	1.52	0.657154
Environmental Awareness	1.23	0.810285
Boiling of water	1.18	0.844107
Age	1.17	0.855741
Edu	1.10	0.907836
Marital Status	1.04	0.964425
Mean VIF	1.39	

Tanneries Clusters in Sialkot and total tanneries in each cluster is presented below in table 3.1.

Table 3.1: Tanneries Clusters in Sialkot and Total Tanneries in each Cluster.

Sr. No.	Cluster Name	Area	Total
1	Head Marala Road	Rural	55
2	PulAik& Haji Pura	Urban	37
3	Defence Road	Urban	28
4	Sambrial Road	Rural	37
5	Pasroor Road	Rural	18
6	Daska Road	Rural	17
7	Khadim Ali Road	Urban	28
8	S.I.E	Urban	16
9	Naika Pura	Rural	10
10	Bharth&RhimPur	Rural	18
		TOTAL	**264**

Source: *Sialkot Chamber of Commerce, 2014*

Projected Population of this study sample and selection of sample size using stratified random sampling technique detail is presented below in table 3.2.

Table 3.2: Projected Population and Sample Size.

Sr. No.	Union Council	Town / Village	Cluster	Projected population	projected Household	Sample Size
1	Bharth	Bharth	Said PurGondal	12059	1723	12
2	Bharth	Rahim Pur	Said PurGondal	2698	385	5
3	Bharth	Habib Pura	Said PurGondal	2167	310	5
4	PindiArayian	PindiArayian	Naika Pura	9560	1366	10
5	PindiArayian	Naika Pura	Naika Pura	2901	414	5
6	Miani	PakkiKotli	Daska Road	7463	1066	8
7	Miani	Shatabgarh	Daska Road	7304	1043	8
8	Bounkan	Malkekalan	Sambrial Road	7111	1016	8
9	Bounkan	Murad Pur	Sambrial Road	15196	2171	15
10	Jaurian Kalan	ChitiSheikhan	Marala Road	6017	860	7
11	GohadPur	GohadPur	Marala Road	29227	4175	30
12	GohadPur	KotliBehram	Marala Road	4321	617	6
13	Haji Pura	Block 1	PulAik	9276	1325	10
14	Haji Pura	Block 2	PulAik	12003	1715	12
15	Miana Pura	Block 1-3	Defence Road	14387	2055	14
16	Miana Pura	Block 4-5	Defence Road	13831	1976	14
17	FathehGarh	FathehGarh	Defence Road	11148	1593	12
18	AdalatGarh	AdalatGarh	Defence Road	16580	2369	16
19	Model Town	Block 1	Khadim Ali Road	11463	1638	12
20	Model Town	Block 2	Khadim Ali Road	10908	1558	11
21	Shahab Pura	Block 1	S.I.E	12319	1760	13
22	Shahab Pura	Block 2	S.I.E	15857	2265	16
23	Naikapura	Block 1	Pasroor Road	11404	1629	12
24	Naikapura	Block 2	Pasroor Road	11069	1581	11
				Total	**36610**	**269**

Source:*DCO office Sialkot & computed by author.*

Detail description of qualitative and quantitative variables is presented below in table 3.3.

Table 3.3: Description of variables

Variable	Description
Dependent variables	
Bid Rs. 100	1=if respondent is willing to pay the said amount, 0= otherwise)
Bid Rs. 200	1=if respondent is willing to pay the said amount, 0= otherwise)
Bid Rs. 300	1=if respondent is willing to pay the said amount, 0= otherwise)
Maximum willingness to pay	Maximum amount that respondent is willing to pay for said services
Independent variables	
Household monthly income	Household monthly income from all sources
Gender	gender (1=if male, 0=otherwise)
Age	age of the respondent in years
education	education of the respondent in years
Water source	water source (1= if Source of Drinking-water Piped/Motor-pump, 0=Otherwise)
Water quality	water quality (1= if water quality is satisfactory, =0 otherwise)
Distance of tannery from house	Distance of tannery from house (1= if distance of tannery from house is within 0.5km, 0=otherwise)
Use of Electric Filter	Use of Electric Filter (1= household use electric water filter,0=otherwise)
Water container cleanliness	water container cleanliness(1= if Water container cleanness done, 0=otherwise)
Boiling Water	Boiling Water (1= if household drink water after boil, otherwise 0)
Marital Status	1= if respondent is married, 0= otherwise