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The Qualitative Model Provides to the Creation of a Hypothetical Water Market in Tunisia

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Abstract

This paper aims to estimate a willingness to pay (WTP) model from a Logit and Tobit regressions. The purpose of these estimates is to study the behavior of Tunisian consumers following their consumption of drinking water by calculating the marginal and elasticities' effects. Empirical results show that the differentiation intra and inter-physical nature of the quality of water supplied to a major consequence to cause reactions in the strategy for consumer consumption. Indeed, in case of poor or average quality households are paying nearly a WTP to benefit from improved quality. In case where the drinking water's quality is not a problem of satisfaction among households, the payment of WTP will depend on the awareness's level of the questioned agent. Therefore, households those who recognize the scarcity are paying nearly.

Keywords: Drinking water quality; WTP; Elasticity effects; Marginal effects.

Introduction

Among the studies which have focused on the analysis of the function's demand of drinking water are those conducted by Gibbs, Danielson, Foster and Beattie [1-3]. The main objective of this work is to determine the principal components of the demand function. Indeed, the price, the income, the socio-economic characteristics of the household can appear as the fundamental factors that determine the choice of household consumption in well water. In the specification of the demand function of drinking water, Opalach, Shin, Chicoine et al. and Naugs and Thomas [4-7] have tested the problem of the consumers' reaction price. However, Shin [5] has proposed a test of perception of price. By adopting this test, Nieswiadony and Molina [8] have showed that the perceived price differs depending on the tariff adopted. Some other drinking water studies, including those leading by Point, Hansen, Agthe and Billings, Hoglund, Renwich and Archibald [9-13] have proposed new aspects of regulation to conserve drinking water and to improve the well being of users. In the same guideline, the purpose of the regulation could be to create a principle that no user could be provided with a sufficient quantity of water to meet their basic needs. This principle means that the household should have access to a water supply of acceptable quality and at a reasonable price which depends on the social situation. Studies by the OECD [14] show that in most member countries, the government must intervene in the field of water especially to protect the access to water for poor households and to improve the quality of drinking water in the most disadvantaged neighborhoods. In Tunisia, for example, the quality of drinking water is in an intra and inter-regional differentiation Bouchrika [15]. In this situation, the schedule rates which have been proposed by Burtless and Hausman, Shefter and David, Moffitt, Hewitt and Hanemann, Corral et al. and Martinez [16-21] are not checked. In order to ensure the objectives of the social equity, the quality of drinking water variable must be included in the based model of the drinking water demand, and subsequently the price of this resource is no longer linear Bouchrika [22].

In the absence of a market's concept of quality, and to provide an acceptable means of the economic value of water measure, hypothetical or simulated market concepts are used. The contingent valuation (CV) adopts the method based on consumer surveys. The theoretical basis of the contingent valuation method (CVM) is based on the economic utility and welfare theory which consist directly to ask individuals to reveal their preferences in terms of willingness to pay (WTP) under different scenarios presented to them. In this context, various studies in developing countries on the economic assessment of drinking water have concluded that the CVM is significantly effective Whittington [23,24]. However, several government agencies and international

organizations exploit the information provided by these studies to make their decisions (U.S. Environmental Protection Agency, World Bank). In case where the reaction of households is needed to improve the management of drinking water, the CVM is the most appropriate technique to reveal consumer preferences Georgiou [25]. Previous research showed that the CVM could be applied to estimate the willingness to pay to benefit from an improvement in the physical quality of an environmental goods or to allow price changes without changing the well-being of users quality [26-30]. This method offers intensive information on consumer behavior and evaluates their demand functions. It also allows at estimating the economic value of water in a given location. In Tunisia, although its pricing is uniform across the country and social classes, the quality of drinking water is characterized by a differentiation in terms of quality between regions and even within the same region. The purpose of this paper is to estimate the WTP models using qualitative regression to observe the behavior of Tunisian consumers by calculating the marginal effects and the elasticity's of the drinking water's quality.

The rest of the paper is organized as follows. The second section focuses on the theoretical methodology that addresses the problems existing in the management of water resources and making the CVM, and the determination of households WTP. The third section presents the empirical methodology based primarily on the results of estimating different econometric models, as well as the results discussion. The fourth section concludes.

Theorical Backgrounds

Management of Water Resources

In Tunisia, the general field which supports current strategies in the management of water resources is characterized by a high variability in the time of the water resource, the poor distribution of this resource in the territory for different users and strong heterogeneities in the spatial distribution of the saline quality of water resources. Because of the growing demand for water for the country's development, the strategy adopted by industry leaders is primarily to stabilize this trend. Indeed, the maximum technical mastery search of all water resources by mobilizing and regularization of most flows and establishing an interconnection network, aims to pool at the national level the problems of the evolution of consumption.

In addition, strategies for water management, seeking to maximize the resources available, highlight the importance of a national decision optimal resource allocation between uses and between regions. Currently, the Tunisian potential water resources, including groundwater, are limited to 47 km3 of which only 4 km3 are mobilized by hydraulic fittings. Surface runoffs are more irregular and the rainfall over a period of 20 years is very uncertain. In fact, there are a three wet years, average six years and eleven years of losses including five which are dry. Moreover, despite the scarcity of water resources, they are unevenly distributed across the country. In addition, only 50% of these resources have a salinity of less than 1.5 g\l and 23% of these resources are characterized by poor quality, where the salinity is higher than 3g\l.

On the other hand, Tunisia has strengthened its centralized national water management model of resource. However, the policy underlying this model has shown its ineffectiveness for the results mentioned above. Hence, if decision makers in the sector have been forced to implement such a model of decentralization, such management would break with the current centralized model. In fact, the decentralization of water management aims to build a control system against the degradation of the quality of the resource, to reduce the growth of urban water consumption and to control samples in order to achieve a system more efficient management.

Quality of Drinking Water

In Tunisia, the drinking water supply is a centralized decision which arise problems that are often related to poor distribution between regions and between users. In the short-term, consequences of this principle are clear on the distribution and access to water throughout the country based on the location of users. In the long term, this principle can, however, focus on other users in terms of quantitative and qualitative satisfaction. Thus, such decentralized resource management can provide the link between the short-term equity and the long term planning of territory development. Indeed, for a decentralized management style, interaction between sartorial and regional policies is very important for the management of water demand in the long term, especially between territory policy planning and the management of water.

In addition, changes in socio-economic characteristics and changes in the physical nature and the property of goods are steps that must be taken into account. Ensuring the quality of water is not based solely on the audit of the values set by the standards, but also on the measures to be taken at all levels of the production and distribution of whether technical, legal and informational successively. The treatment of surface waters in Tunisian north results in a water quality which is conforming to the quality required by the standards. Nevertheless, this quality can cause problems in Central and especially in the South. Although the Tunisian strategy recommends serving nationwide water salinity less than 1.5 g / l, this goal is not fully observed between different regions of the country and even within the same region.

In a part of a process to improve the quality of service to its customers, NWDU have guided a satisfaction survey in April 2003 by means of a questionnaire. This survey was designed to assess customer perception on the level of service provided by NWDU and measure the expected level of quality. For this reason, the selected sample have covered 2,100 domestic

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subscribers spread over 33 districts and centers and affected all users and social levels. The results have shown that 19% of customers felt that the quality of the water supply is excellent, 30% is good, 32% is average and 19% is poor. Indeed, low levels of satisfaction recorded especially in the south of Tunisia are explained by the relatively high salinity in the amount of water distributed by NWDU Bouchrika [22]. In other words, the water available in Tunisia easily exceeds international standards of salinity which is around an average salinity of 1g/ l. Indeed, only 50% of Tunisian resources have a salinity of less than 1.5g/ l and 16% of these resources have salinity higher than 3g/l. Thus, the problem of the development of water resources is derived by varying qualities of water resources for applications users. Therefore, this variation in the quality of drinking water is a problem that applies in the consumption structure of Tunisian households. In this context, it becomes necessary to solve this problem by upgrading programs in the services of potable water consumption. Indeed, the value of the environmental good (drinking water) by a suitable method is a goal to ensure customer satisfaction.

Contingent Valuation and Household's Willingness to Pay

The contingent valuation consists to ask people directly through a survey. The objective is to test how many individuals are able to pay ex ante for a quantitative or qualitative assessment of an environmental good. In this case, individuals are placed in a hypothetical situation and the responses are intentions. This occurs, generally in the form of a transaction in a hypothetical market between an individual and a policymaker Stiglitz [31]. In the practical case, we construct a scenario by writing all the information necessary for the individual as well as his choice for statement is effective. In addition, the property in question must be described accurately (quantity, quality, measures to increase the quantity and to improve the quality). To complete the transaction, the surveyors need to know how the amount that the states in the survey will be taken (compulsory levy or access). The study of Tversky [32] has shown that individual responses can be changed depending on the structure of scenario or the questionnaire form itself.

To determine the optimal amount of the public good, economic theory offers a number of models. The calculation of this amount is based on the individual utilities. For this reason, two methods are used. The indirect method based on observed actions and the direct method based on individual statements. In addition, the indirect method is to meet the utilities from the observed behavior and the direct method is to ask the agents using a survey. It is implemented when the shares are difficult to observe. The objective of CVM is to construct a hypothetical market. Thus, the method is based on a household's survey. During this investigation, we appreciate the maximum amount that consumers are willing to pay to receive an improved environmental good quality or to participate in a program for sustainable management to ensure limited resource. To assess the willingness to pay (WTP) in the case of improvement or preservation, it is necessary to identify its determinants. For this reason, a set of econometric regressions were used. Indeed, the revelation of willingness to pay generally leads to null values or to refuse disclosure of WTP. In addition, some respondents reported zero WTP because they feel their utility levels remain constant with any change in its state of consumption. However, even if the quality and availability of the resource remain to increase, the WTP still poses some problems that are justified in most of the time the income factor which is generally insufficient to support such payment.

To evaluate the behavior of Tunisian households in relation to their consumption of well water we are interested in qualitative Logit and Tobit models to derive the fundamental variables which have impact on household's marginal effects and elasticities willingness. In this issue, econometric modeling WTP model is given by the following equation:

$$WTP_i = f(X_i, Z_i, e_i)$$

Where *WTP*,*X*,*Z* and e are respectively willingness to pay as dependent variable[2] , Vector of socio-economic characteristics of households, Vector of other explanatory variables of the *WTP* and Standard error.

Empirical Methodology

Data Collection

The data used in this study comes from a survey of Tunisian consumers. This survey has allowed us to better understand the behavior of households with respect to their drinking water consumption and reactions which are the main variables indicating their consumption strategies. We also found that the difference in the behavior of different groups of consumers can be justified by estimating the value of the WTP independently of the significant explanatory variables of households WTP. The survey was conducted according to the procedure of direct interview.

To meet the ratio of 10% of the population base as a minimum sample size, the total size of the sample is 1,200 households in neighborhoods that are randomly taken to cover all categories of households. The questionnaire is structured to put the respondent at ease starting with less personal issues consumption and water quality, before we go to questions on the WTP and the socio-economic characteristics of households. The economic problem is explained in a very easy way to interviewer. Thus, the questionnaire In the Logit model specification, this variable takes 0 and 1 value. In the Tobit model or in the censored regression model, the model structure is given by: $WTPi=WTPi^*=f(X_i,Z_i,e_i)>0$and 0 elsewhere. was divided into three parts. The first sets of questions have focused on the management of drinking water by households. The second set of questions that reveals the willingness to pay for drinking

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water has two channels. In the first, we asked the interviewee if he is willing to pay quarterly to benefit from improved drinking water in case of an average or poor quality. In the second way and if the household believes that the quality is good, we ask if the interviewee agrees to pay quarterly to allow NWDU to implement the program for the sustainable management of the resource water. The last set of questions relates to information on socio-economic characteristics of households.

The basic unit of our sample is the "household" defined by the set of agents living in the same dwelling. Income and quality of drinking water are important variables in determining the willingness to pay. They are the basic criteria in determining our sample. Also, buying bottled water, type of rental, household size and the instruction level are important criteria for selection. The detailed descriptions and measures of variables used in the econometric regressions are shown in the (Table 1).

Table 1: Variables Description.

Variables	Label	Description
Invoice amount of drinking water	AMIN	The amount of the quarterly water bill paid by the household
Alternative source of water resources	AS	1 if the household has an alternative source
0 if not		
Buying bottled water	Purchase	1 if the household buys bottled water
0 if not		
The quality of tap water	Quality	2 if the quality is good
1 if the quality is average		
0 if the quality is bad		
Household's willingness to pay	WTP	1 if the household agrees to pay to benefit from increased if an average or poor quality or to participate in a program for sustainable management of water resources in case of a good quality
0 if not		
The household is owner	HOC	1 if the household is owner
0 if not		
Household size	Size	Number of people in the household
Level of education of the interviewed agent	EDIN	0 if illiterate
1 if primary		
2 if secondary, the first cycle		
3 if secondary, the second cycle		
4 if top-level		
Household's Income	Income	The net monthly household's income including all salaries
Number of workers in household	Active	The number of people of the household who are skilled in professional life

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Results and Discussions

The consent to pay (WTP) of the interviewed agent is an essential factor in the analysis of consumer behavior. The WTP is related to several criteria such as the management of drinking water resources, the quality and the social-economic characteristics of the households fed by water supplied by the NWDU. Consequently, the WTP estimate procedures are determined in part by a Logit regression which relates the probability of answering yes to a willingness to pay depending on a number of exogenous variables, and in second part by a censored or Tobit regression.

Table 2: Good and Bad Drinking Water Quality Case.

Estimation of the Logit model			Marginal effect		Elasticities	
Variables	Coefficients	T-Statistique	dy/dx	T-Statistique	ey/ex	T-Statistique
Intercept	-24.12	-11.83				
Size	-0.35	-5.23	-0.06	-5.35	-0.51	-5.15
Income	5.38	12.62	1.03	12.17	9.11	9.69
AS	- 0.98	- 2.75	-0.20	-2.61	-0.06	-2.72
Purchase	2	6.84	0.41	6.78	0.33	5.75
Quality	- 0.76	- 2.91	-0.14	-2.97	-0.09	-2.99
AMIN	-3.30	-8.37	-0.63	-8.18	-2.88	-7.26
HOC	2.10	6.67	0.45	6.97	0.41	5.92
EDIN	0.37	3.18	0.07	3.07	0.25	2.96
Khi-deux (8) = 954.85						

Logit Model Regression Results

As the quality of drinking water is a problem of satisfaction for domestic use, The Logit model regression results are the following (Table 2).

A first note to an estimated Logit model is that only the signs of the coefficients of the variables are interpreted. In addition, the income and the amount of the invoice (AMIN) variables are expressed in logarithm to reduce their dispersions. The estimation results of our model show that all coefficients of variables are significant with a risk of 1% error. The coefficient on size is negative implying that the probability of willingness to pay for big families is low. This result is consistent with reality as big families consume more water and therefore they pay more. This has an effect on penalizing that group of consumers to participate in a program to improve the quality of drinking water. The coefficient on income is positive, meaning that the probability of willingness to pay increases with household income. Therefore, households who have a higher income and are not satisfied with the quality of drinking water are able to pay much more than others. The coefficient of the variable alternative source (AS) is negative, which explains why the probability of willingness to pay is lower for households with this type of consumption source. This result is expected since in case of poor quality, alternative sources are good substitutes of drinking water. The coefficient on buying bottled water (purchase) is positive. Therefore, households that purchase this good are likely to pay higher than others. Indeed, this category of consumers is encouraged to participate in a program to improve the quality of tap water, because in any way it becomes cheaper. The negative coefficient on the variable quality shows that the probability of a willingness to pay is high if the household believes that the water quality is poor. The coefficient of the amount of the invoice (AMIN) is negative. This allows us to conclude that households with higher invoice amounts are likely to pay less than other households. This category of consumers has no interest in the importance of a program to improve the quality of water, as they bear other expenses. The coefficient of the variable housing occupancy (HOC) is negative which means to say that to make a control program in the management of water resources, owner household have a higher likelihood of paying than landlords. Indeed, it is the landlords who are rewarded with a financial penalty. The variable level of education of the interviewer (EDIN) has a positive coefficient that is to say that higher educated households have a chance to pay more than others. This may explain the level of awareness of the interviewer in our sample.

For the purposes of interpreting the results, we calculate the marginal effects of the average values of the explanatory variables. Therefore, the increase of a variable associated with a positive coefficient indicates a higher probability of occurrence of the considered event which is the willingness to pay. Conversely, the rise of a variable associated with a negative coefficient

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indicates a lower probability of occurrence of this event. In this issue, changes in income variables, Purchase, HOC and EDIN have positive effects on the sensitivity of the probability of the event willingness to pay. Moreover, these variables are affected by a positive achievement on willingness to pay. An increase in income, the number of households who buy bottled water and who own their homes and the higher level of education are factors that lead to an improvement in the probability of willingness to pay. For the variable purchase, the observed phenomenon is explained by the fact that it is cheaper to pay extra for a good quality than buying bottled water. However, the size of households, AS, AMIN and quality variables have negative variations on the probability of willingness to pay. That is, the existence of these variables has negative effects on the agent willing to pay to benefit from improved quality. The existence of an AS in households remains an obstacle to participate in such a program of quality improvement. Thus, the existence of such resources has an important effect on the choice of the interviewer.

[1]- To measure the impact of a change in an explanatory variable on the probability Pi when the explanatory variables are continued, we calculate:

$$\frac{\partial p_i}{\partial x_i^j} = f(x_i\beta)\beta_j$$

Where f(.) is the density function of the standard errors. Since by definition f(.)>0, the sign of this derivative is the same as β_j Christophe [33].

- To assess the impact of the qualitative variable on the probability of willingness to pay, the probability P_1 of the first modality that an individual is willing to pay is measured firstly. In a second step we calculate the probability P_2 for an individual to the other modality. In this case the marginal effect is measured by the difference P_1- P_2 Isabelle [34].

The quality is still a very complicated and fundamental problem in the consumption of water. Thus, households who believe that the quality is bad have a probability of acceptance to pay higher than others. This probability has been declining to participate in a quality improvement program for the group of households who have higher water bills. The owners have a significant effect on the willingness to pay which is higher for the high educated interviewers. In other words, the elasticity value is defined as the percentage change of the probability of occurrence of the event WTP followed by a variation of the explanatory variables. In this context, the value of the elasticity of the household size variable indicates that if the family size increases by 10%, the probability of acceptance to pay downs by 5%.

The willingness of payment is increasing with the level of income. In fact, a 1% change in household income increases the probability of individuals who are willing to pay 9%. The variation in the availability of alternative sources for households (AS), and the judgment on the quality show a decrease probability of acceptance of pay by 0.6% and of 0.9%. In addition, a 1% change in the amount of the water bill reduces the likelihood of paying to receive a satisfactory quality by nearly 2.8%. The variables Purchase, HOC, and EDIN have a significant and positive effect on the reaction of households who are willing to pay. Thus, changes in these three variables increase the acceptance of payment probability by 0.3%, 0.4% and 0.2%.

Tobit Model Regression Results

To deal satisfactorily with the null response, that is the WTP equals to zero, a simple Tobit model was used. The estimate with the method of maximum likelihood model gave the following results (Table 3).

Table 3: Mean or Bad Drinking Water Quality Case.

Estimation of the Tobit model			Elasticity	
Variables	**Coefficients**	**T-Statistique**	**ey/ex**	**T-Statistique**
Intercept	- 4.42	- 9.86	-	-
Size	-0.07	- 3.13	- 0.30	- 3.12
Active	0.065	1.81	0.10	1.80
Income	1.20	13.97	6.08	13.13
AS	- 0.45	- 4.56	- 0.09	- 4.53
Purchase	0.38	4.38	0.18	4.35
Quality	- 0.62	- 9.02	- 0.22	- 8.78
AMIN	- 0.60	- 6.76	-1.57	- 6.66
HOC	0.15	1.86	0.08	1.86
EDIN	0.09	2.55	0.18	2.55
Khi-deux (9) = 688.8 R2 = 0.1823				

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It appears from these results that all variables influence significantly the household's willing to pay. The coefficients of variables, Size, Income, AS, Purchase, Quality and AMIN are significant with a confidence level of 99%. The coefficient of the variable EDIN is significant at the level of 5% standard error. In addition, the coefficients of both variables Active and HOC are significant at 10%. In addition, the WTP depends positively on household income, EDIN, HOC, Active and buying bottled water variables. However, the WTP depends negatively on the Size, AS and AMIN variables. The WTP is, on the other hand, an increasing function of the income and the purchase of bottled water variables. The Active, HOC and EDIN variables also adjust positively on the WTP. Nevertheless, the household's WTP decreases with the AS, Size and AMIN variables. This result is logical, since broad household who have an alternative source found their satisfactions other than the NWDU water. In addition, a high amount of a bill presents a major constraint to produce a program to improve the water quality. The coefficient of the variable quality is negative. In fact, households that estimate that the water quality is poor meadows are paying much more than others. This variable has a positive effect on increasing the households WTP.

In the case of a simple Tobit model, predicting the latent variable is obtained by the marginal effect measured by the partial derivative of the conditional expectation with respect to any component of the vector of explanatory variables. The results show that the change in variables Active, Income, Purchase and the level of education has a significant effect on the prediction of the latent variable WTP*. Therefore, these variables can be considered as key factors in the implementation of a program to improve the quality of tap water. However, the Size, AS, and AMIN variables have a negative effect on the prediction of the latent variable. In addition, the coefficient of the variable quality is negative. This variable has a positive effect on the prediction of the latent variable which explains that the quality variable may be considered as a key factor for an improvement of a quality program. In the same guideline, a 1% change in the k^{th} explanatory variable for the i^{th} individual modifies the prediction of latent variable WTP* for these individuals by $\varepsilon_{WTPi}^{*}/x_i^k$ percent.

Therefore, we can calculate the average elasticity[5] of the whole sample. In fact, a 1% change in the Income variable increases the prediction of the latent variable WTP* by 6%. This result is also observed with the Active variable where a 10% change in this variable leads to an increase in the forecast of the latent variable by 1%. The AMIN variable has a negative effect on the prediction of the latent variable. Thus, a 1% increase in this variable leads to a decrease of 1.5% in the forecast of the variable WTP*. The variable size of households also results in a decrease of 3% at the predicting latent variable after a 10% increase. The variables, Purchase, HOC, and EDIN have a positive effect on the prediction of the latent variable. In fact, any change in these variables by 1% changes the predicting latent variable by 1.8%, 0.8% and 1.8% in a desirable direction. The variation in the availability of alternative sources for households modifies the prediction of latent variable in a reverse. That is, the existence of this type of consumption source presents a constraint to the willingness to pay. Quality variable is a good indicator that works on the prediction of the latent variable. Thus, households that are fed a better quality do not accept the construction of a control program of the drinking water resource.

[4]The marginal effect of a unit change in the k^{th} explanatory variable ($x_i^{(k)}$) on the prediction of the latent variable WTP* is measured by the quantity: $\frac{\partial E(WTP_i^* / x_i)}{\partial x_i^{(k)}} = \beta^k$

[5]The average elasticity $\varepsilon_{WTPi}^{*}/x_i^k$ is given by:

$$\bar{\varepsilon}_{WTP_i^*/x_i^k} = \frac{1}{N}\sum_{i=1}^{N}\varepsilon_{WTP_i^*/x_i^k} = \frac{1}{N}\sum_{i=1}^{N}\frac{x_i^k\beta^k}{x_i\beta}$$

Consumer response to the problem of scarcity

In the case where households consider the quality offered is good for their needs and to allow NWDU to implement the program for sustainable management of the resource, we will specify the variables that will hold a significant willingness to pay. In this sense the estimation of a model of the WTP by the Logit function has given the following results (Table 4).

Table 4: Case of a good quality.

Estimation of the Logit Model			Marginal Effects		Elasticity	
Variables	**Coefficients**	**T-Statistique**	**dy/dx**	**T-Statistique**	**ey/ex**	**T-Statistique**
Intercept	-54.57	-3.94				
Income	11.31	3.72	1.32	2.82	62.57	2.95
AMIN	-7.32	-3.21	-0.85	-2.81	-22.07	-2.64
HOC	4.25	3.05	0.49	3.29	2.03	2.59
EDIN	1.44	2.80	0.16	2.24	3.04	2.45
Khi-deux (4) = 188.66						

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These results show that all the estimated coefficients of variables are significant with a confidence level of 99%. The coefficients on Income, HOC, and EDIN are positive, implying that owner households, with a high income and satisfying intellectual level will have a probability of higher payment. Indeed, this category of consumers is near to participate in a program for sustainable management of water resources that can meet the needs of the present and future generation. The coefficient of the variable AMIN is negative which means that the probability of willingness to pay in this case is low. For this, there are households whose water bills are lower which accept to be membership in a social welfare policy.

To measure the impact of a change in one of the explanatory variables on the probability of acceptance, we calculated the marginal effects. In the observed results, we note that Income, HOC, and EDIN variables are assigned a positive coefficient. Thus, increasing the level of income, the occupation of a housing owner and the high level of education of the interviewed agent induce an increase of the probability of occurrence of the event willingness to pay. The coefficient on the invoice amount is negative. Thus, the rise of a change in this variable leads to a decrease in the probability of the event willingness to pay. Indeed, the increase in this variable finally leads to a poor specification of this probability.

In addition to the marginal effects, we calculated elasticity's. The results showed that a 1% change in income leads to a 62% increase in the probability of willingness to pay. The same interpretation is valid for both HOC and EDIN variables but with a lower proposal, respectively 2% and 3%. Regarding the variable AMIN, a 1% change in this variable causes a 22% decrease in the probability of willingness to pay. This variable therefore has therefore a negative effect on the implementation of a change in the management of the water resource NWDU program.

In the same analysis context, processing the response of households to a willingness to pay with a simple Tobit model, gave us the following results (Table 5).

Table 5: Tobit estimation results (the case of good quality).

Variables	Coefficients	T- statistique
Intercept	-15,6	-9,82
Size	-0,13	-2,07
Income	2,96	10,05
AMIN	-1,2	-4,26
HOC	0,58	2,59
EDIN	0,27	2,38
Khi- deux (5) = 207,05		R^2 =0,4990

These results show that the coefficients of two variables Income and invoice amount are significant at a confidence level of 99%. The coefficient on income is positive. That is, the willingness to pay of households increases with a shift to the increase in the Income variable. Thus, the richest households are willing to pay for the conservation of water. The coefficient of the variable AMIN is negative, which means that households who do not give any interest in a willingness to pay are those who see their invoices relatively high. The coefficients of variables Size, HOC, and EDIN are significant at the 5% standard error. The coefficient associated with the variable size is negative, implying that this variable has a negative effect on the willingness to pay. This result is expected since in principle consumption increases with the number of family members. Both variables HOC and EDIN influence positively the willingness to pay. In fact, there are the owners who are willing to pay much more than the tenants, since for the latter the additional fees will necessarily lead to additional charges in their spending. The intellectual level of the interviewed agent also has a positive effect on the WTP. Indeed, as soon as an agent is characterized by a high level of education, he is able to participate in a program to fight against waste and ensure the use of the present and future generation.

In the Tobit regression, the marginal effects of a unit change in an explanatory variable on the prediction of the latent variable WTP* have shown that changes in unit Income, HOC, and EDIN variables on predicting the latent variable WTP* have a positive effect. Thus, these three variables can be run as fundamental factors for the development of the water sector in Tunisia. Instead, the variable size and AMIN have a negative effect on the prediction of the latent variable. Therefore, these two variables have a constraint against social solidarity.

Policy Implication and Conclusion

The contingent valuation method (CVM) applied in this work has create a hypothetical market to solve the problems existing in the resource management of drinking water in Tunisia aims. Note that the different results from the method are close to reality. The project of improvement of the quality of tap water is sensitive to the variation of several very significant factors. On the one hand, the existence of alternative sources for households is one unfavorable factor to the realization of a regulatory system in the management of the water resource factors. On the other hand, the high amount of water bill consumption and household size are two variables that explain the nature of family expenditure. Thus, for this reason the categories of consumers characterized by these two types of variables are not obliged to participate in a project to improve service water distributed by the NWDU.

Willingness to pay of households is sensitive to the amount of purchased bottles of water. In fact, households that consume large quantities of this type of property, think it better to participate in a program to improve the quality of water to drink bottled water, since in any case it becomes cheaper. But this does

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not mean that some respondents believe it is impossible to have equivalent to those of mineral water quality. In addition, the income variable is the basis of any change in the variation of the willingness to pay of households.

This result confirms the economic theory which asserts that the WTP is limited by the income constraint. Therefore, when income increases, the possibility of accepting a proposed price by the consumer becomes higher. In addition, tenure and education level of the household seem to positively affect the willingness to pay. Indeed, for the variable level of education, the effect on the WTP becomes important, if the respondent has reached the university level.

The huge differentiation in the quality of water provided by NWDU between different regions of Tunisia and sometimes even within the same region can cause problems of social justice. In addition, it is difficult to completely solve the problem of the same quality as in the case of a project to improve the water quality, it is difficult to have a similar good quality and uniform throughout the country. Indeed, it is legitimate to think of even partial control modes to provide at least some measures of economic efficiency and social equity. In this context and to ensure these objectives, the variable quality must be built in the model of drinking water pricing.

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