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RESEARCH / INVESTIGACIÓN

Contingent valuation of the hydric resource: the Case of the Ecological Reserve of Cuxtal, Yucatán

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Abstract: *The Cuxtal Ecological Reserve (CER) provides environmental services to the city of Mérida, Yucatán, one of which is the provision of water. In recent years problems of pollution and demographic growth have threatened the stability of the reserve and therefore, through the contingent valuation method, the willingness to pay on the conservation of water resources from CER was estimated. The study had a quantitative and cross-sectional approach used a sample of 298 households from different areas of the city of Merida, Yucatan. For data analysis, descriptive statistics and a regression model for censored variables were used. Results indicate that 64% of the population is willing to pay for the conservation of the resource with an estimated monthly amount of $ 151.00 MXN, being the variables such as age, family size, size of the house and geographical location of the house the ones that have the greatest influence on the willingness to pay.*

Keywords: *Contingent valuation, ecological reserve, hydric resource, tobit, willingness to pay.*

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INTRODUCTION

Access, availability and quality of the water worldwide are part of the main challenges faced by the society of the 21st century. This is due to the fact that the water resource is closely related to human health, the stability of ecosystems and economic growth (UNESCO, 2015). The relevance of this issue has been taken for granted by being included in the 2030 Agenda and the Sustainable Development Goals of the United Nations, particularly in objective 6, which is focused on sustainable management of water and sanitation for all (PNUD, 2016).

Within the framework of sustainable development, reference is made to that development which is capable to meet current needs without compromising the capacity of future generations to do the same. Additionally, it is essential to observe that integration of environmental, social and economical dimensions in a harmonious way is the key to achieve human well-being.

In this order of ideas and in the local context due to the karst-type soil conditions of the Yucatan Peninsula, the supply of drinking water in the city of Merida, Yucatan depends entirely on groundwater (supply wells). This supposes a potential negative impact on the general well-being of the population due to the increase in their contamination by the filtration of surface contaminants (Pacheco, Calderón & Cabrera, 2004). In particular, in the city of Merida, approximately 50% of the water that is extracted for its distribution in the south of the city comes from the area subjected to Cuxtal Ecological Conservation (REC), being the natural reserve one of the main focus of attention to ensure the supply and quality of drinking water.

Considering the above, CER was established in 1993 in order to create a protection area that safeguards the natural resources and ecosystem services offered. On the one hand, as a source of food for wild species (because of the recovery of flora due to the abandonment of henequen areas), which is a source of biodiversity conservation; but also for being part of the main aquifer recharge area that supplies water to practically 50% of the city (Pinkus, Pacheco & Lugo, 2013; Ayuntamiento de Mérida, 2018).

Notwithstanding the foregoing, studies carried out in CER (Ortíz, Celis & García, 2016; Bautista, Aguilar & Batllori-Sampedro, 2011) expose the alarming situation in which the reserve is, due to the demographic pressure, impact of economic activities and lack of environmental education, Specifically, Bausita, Aguilar & Batllori-Sampedro (2011) mention that in the Yucatan Peninsula the land uses that most influence groundwater pollution are: urban industrial, urban housing, agricultural with agrochemicals and livestock poultry and swine farms, in addition to wastewater (because of its magnitude).

Taking into account the above, the main objective of the present study was to calculate the willingness to pay of the city of Merida, Yucatan for the conservation of the water resource from the Cuxtal Ecological Reserve through the contingent valuation method and to determine the variables that affect it.

The composition of the article has the present structure, being the following focused on describing what characterizes the CER, such as its location, extension, and social and economic aspects. Subsequently, the third section is focused on the theoretical explanation of the economic model in which the present study is based, that is the Valuation contingent method and how this can be specified in the econometric model. Section four is related to the materials and methods that were used to carry out the research, such as composition of the sample and the software used for calculations. Section four is focused on the results of the study, firstly with the descriptive statistics analysis, and then the results of the censored logit and probit models. Finally, in the last section there is a general discussion about the data obtained and their comparison with the existing literature. Additionally, the conclusions of the document are also presented here.

Cuxtal Ecological Reserve

The so-called Cuxtal Ecological Area subject to conservation was constituted in 1993 in the Official Gazette of the Yucatan State Government, which was decreed as a protected rural area under the modality of area subject to ecological conservation. It has a surface of 10,757 hectares and is located south of the Municipality of Merida. Within its territory the locations of Dzununcán, Molas, San Ignacio Tesip, Xmatkuil, Santa Cruz Palomeque, San Pedro Chimay, Hunxectaman, Dzoyaxché and Tahdzibichen are included (Ayuntamiento de Merida, 2004).

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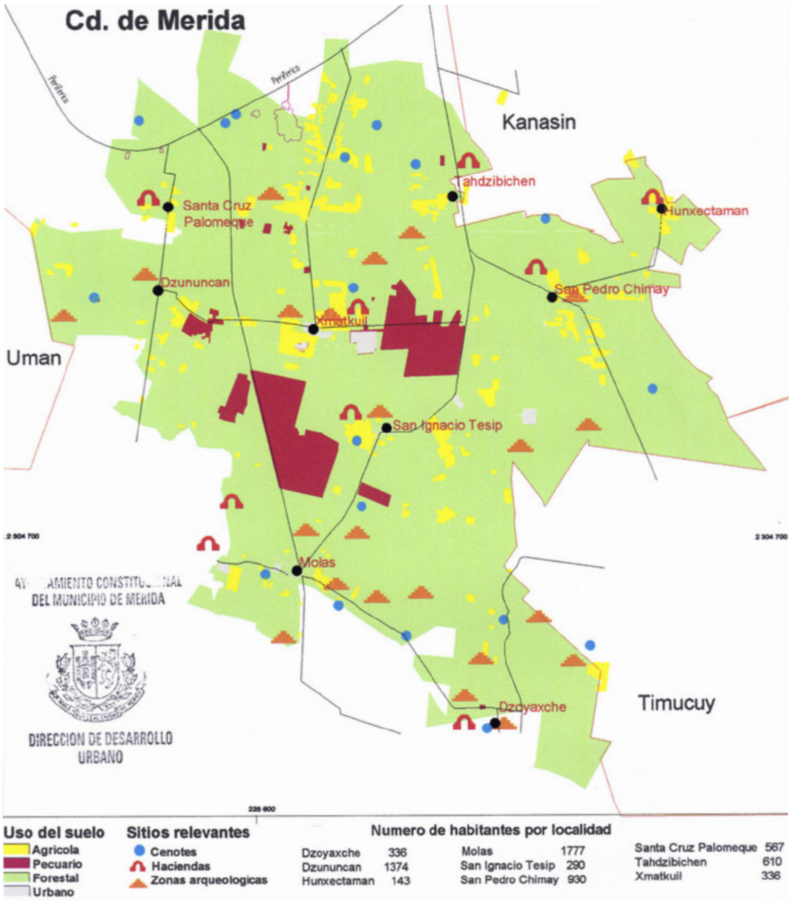
Figura Nº 1. Reserva Ecológica de Cuxtal.



Source: Merida City Hall (2001-2004).

Source: Merida City Hall (2001-2004).
The purpose of CER is to create a green belt that provides environmental services to the Municipality of Merida and works as a regulator of the urban growth, as well as serves as a "green" recreational area (Ayuntamiento de Mérida, 2018).

In that order of ideas, CER offers the following environmental services to society:

• Protection of the water catchment area for the supply of the city of Merida.

• Conservation and promotion of biodiversity by protecting the ecosystems of the region.

• Scenic beauty through the promotion of ecotourism and nature tourism.

Table 1 is shown to contextualize the social situation of the population belonging to CER in which it can be observed that 100% of the localities are in a state of high marginalization, where there is illiterate population without access to piped water in the house. The locality of Dzoyaxche has the highest indicators.

Table 1: Sociodemographic characteristics of CER (2010)

Locality in CER	Total population	% population aged ≥15 years illiterate	Inhabited houses	% houses without piped water	Degree of marginalization
Dzununcán	1,802	15.99	397	2.58	High
Dzoyaxché	454	24.19	108	20.56	High
Hunxectaman	156	10.66	38	16.22	High
Molas	2,014	10.34	504	3.99	High
San Ignacio Tesip	359	15.23	84	0.00	High
Xmatkuil	526	17.76	122	12.30	High
Santa Cruz Palomeque	835	17.13	190	5.32	High
San Pedro Chimay	1,241	17.48	276	12.68	High
Tahdzibichen	724	11.17	164	5.49	High

Source: Own, with data from the National Risk Atlas (2018).

Economic valuation of ecosystems services and contingent valuation method

The economic science has studied environmental problems through its different sub-disciplines and one of them is the environmental economy, which is focused on identifying the variations in the level of well-being that individuals experience in the face of a change whether positive or negative, of some environmental good. The analysis tools proposed through neoclassical economy are diverse, although one of the most used to analyze the water resource is the Contingent Valuation Method (CVM).

CVM belongs to the classification of direct method of valuation, that is, they try to discover the value that individuals give to different environmental resources by simulating a hypothetical market. Its objective is to find out the economic valuation that an individual has on a particular environmental resource, where a situation is raised regarding what the person is willing to pay to maintain it, improve its quality or any other positive compensation proposed or the compensation required to waive it (Azqueta et al., 2007).

The central focus of this method is the satisfactory obtaining of the maximum willingness to pay and the operative base of it resides in the adequate design of the questionnaire to be applied. This is performed in such a way that it is capable to identify the personal valuations of the respondents, against the growth or reduction of the amount of a given good, a contingent in a hypothetical market (Sánchez, 2008).

The economic model behind the CVM resides has previously mentioned in the fact that the consumer who has a preference function for which he orders combinations of alternative goods, according to the welfare received with these combinations. Therefore, the problem is to maximize profit or satisfaction subject to the budget constraint available for consumption. Then, the solution to the profit maximization problem can be represented by the indirect utility function, which is defined as the maximum level of utility that an individual can acquire given the vector of prices and the available monetary income. According to Labaideira, León & Vázquez (2007), the indirect utility function can be expressed as:

$$V = V(p, y; z, S) \ldots (1)$$

Where p is the price of a compound good, y is the monetary income, z is the quality of the environmental good, and S is a vector of socioeconomic characteristics of the individual. In the case of the present study, there is a situation in which the consumer is facing a reduction in the quality of an environmental good (water resource of the CER).

Given the above, it is possible to estimate the equivalent EE surplus, which can be defined as the amount of money that the individual would be willing pay to avoid a quality reduction. That is:

$$V(p,y - EE;z^0,S)=V(p,y;z^1,S)\ z^1 < z^0 \ldots (2)$$

For the compensated variation of positive changes in environmental quality, the value function is known as the willingness to pay (WTF) function. This is:

$$DAP = G(p, z^0, z^1, y, S) \ldots (3)$$

This function has also been called income compensation function and has the properties of an expense function (Labandeira, León & Vázquez, 2007).

Specification on dichotomous probabilistic regression model on WTP

The theory mentions that the household calculates the marginal benefit/cost based on monetary profit that is willing to pay for a particular environmental good or service. To model the above, there is an unobservable variable called y* that can be denoted as:

$$y^* = x'\beta + \varepsilon \quad \ldots (4)$$

It is supposed that ε has a mean zero and comes from a standardized logistic distribution with variance $\pi^{2/3}$ or a standard normal distribution with unknown variance (Greene, 2003). In this case, it is not possible to observe the net benefit of the election (WTP) and only it is possible to observe when it is made or not. Therefore, the observations can be expressed as:

$$y=1 \text{ if } y^* > 0,$$
$$y=0 \text{ if } y^* \leq 0,$$

In this notation, $x'\beta$ is named as an index function where the information of the variance of data may be estimated. Therefore, the vector β in the model is only identified at scale (Greene, 2012). Thus, the probability equation where y=1 is as follows:

$$\text{Prob}(y^* > a \mid x) = \text{Prob}(\alpha + x'\beta + \varepsilon > a \mid x) = \text{Prob}[(\alpha - a) + x'\beta + \varepsilon > 0 \mid x) \ldots (5)$$

Where α is the assumed threshold other than 0 and α is the unknown constant term. Since α is unknown, the difference between (α - a) remains as an unknown parameter. From the above, the final result is that if the model contains a constant term, it remains with the choice of the threshold that contains 1 and 0. Therefore, the choice of 0 is an unimportant normalization. With both standardizations the following topic is obtained:

$$\text{Prob}(y^* > 0 \mid x) = \text{Prob}(\varepsilon > -x'\beta \mid x) \ldots (6)$$

A remaining element in the model is the choice of specific distribution for ε, where the literature converges on normal or logistic distribution. Therefore, if the distribution is symmetrical, then:

$$\text{Prob}(y^* > 0 \mid x) = \text{Prob}(\varepsilon < x'\beta \mid x) = F(x'\beta) \ldots (7)$$

Where $F(t)$ is the cumulative distribution density function of the random variable ε.. It should be noted that it is possible to state a functional model from the linear probability. However, with these models it is not possible to restrict $x'\beta$ in the 0-1 interval, which provides meaningless probabilities, as well as negative variances. Therefore, using the linear probability model is not adequate (Greene, 2012).

As the requirement is to establish a model that produces predictions consistent at the given intervals for a regression vector, it is expected that:

Considering the above, any distribution of adequate and continuous probability on the real line will be sufficient, being the normal distribution one of the most popular in many econometric analyses and giving rise to the probit model:

$$Prob(Y = 1|x) = \int_{-\infty}^{x'\beta} \phi(t)dt = \Phi(x'\beta) \ldots (8)$$

Where $\Phi(t)$ is a common notation for the normal distribution function. Now, the estimation of models with binary variables is generally based on the maximum likelihood method, where each observation is treated as a single "raffle" of a Bernoulli distribution. Here, the probability of success model is $F(x'\beta)$ and the independent observations lead to the joint probability, or likelihood function:

$$Prob(Y_1 = y_1, Y_2 = y_2, \ldots, Y_n = y_n|X) = \prod_{y_i=0}[1 - F(x_i'\beta)] \prod_{y_i=1}(x_i'\beta) \ldots (9)$$

Specification of the Tobit censored regression model for WTP($)

Additionally, monetary values of the willingness to pay of

the interviews were obtained. However, this dependent variable presents a particular characteristic as it is censored in 0 for all the responses of the individuals who decided not to be willing to pay and because there is no charge for this situation. In other words, WTP must take positive values.
The solution to this particular situation is to propose a hybrid model that uses Probit specification to identify why some observations take a zero value and other do not, The same occurs for those observations in which y*>0, a regression model that identifies the relation. The Tobit model is the one indicated for this case, because they meet the conditions described above, where regression is obtained by making the average in the precedent corresponds to a classical regression model (Greene, 2012). The general formulation is commonly given in terms of an index function such as equation (4). Given a distribution for u, the probability of observing a censored data is:

$$\Pr\,(y_i = 0\,|x_i) = \Pr(y_i^* \leq 0|x_i) = \Pr(u_i \leq -x_i'\beta) = \Phi(-z_i) = 1 - \Phi(z_i) \quad ...(10)$$

Being the probability of uncensored observations:

$$f(y_i) = \frac{1}{\sigma}.\phi\left(\frac{y_i - x_i'\beta}{\sigma}\right) \quad ...(11)$$

Thus, the tobit method estimates the model by incorporating all households in the sample through the use of a likelihood function (Avilés-Polanco, et al. 2010; Greene, 2012), where the parameters that are chosen are those that maximize the joint probability that the households that are not willing to pay to conserve the water resource of the CER do not, and those willing to pay do so in the maximum amount of availability to be paid.

Con: $y = \frac{\beta}{\sigma}$ y $\theta = \frac{1}{\sigma}$

$$\ln L = \sum_{y_i>0} -\frac{1}{2}[\ln(2\pi) - ln\theta^2 + (\theta y_i - x_i'y)^2] + \sum_{y_i=0} ln[1 - \Phi(x_i'y)] \quad ...(12)$$

To obtain the original parameters through the marginal effects, it is necessary to use the delta method, using the asymptotic covariance matrix for the estimations, where $\sigma=1/\theta$ y $\beta = y/\theta$.

MATERIALS AND METHODS

The present study has a quantitative approach, of non-experimental and cross-sectional design, because the data were collected in only one period between November 2017 and March 2018.

Regarding both population and sample, according to the INEGI (2015), the municipality of Merida, Yucatan has a total of 564,613 private homes inhabited and from this data, the sample was calculated with 95% confidence, 6% error, and a positive and negative response percentage of 50% respectively, resulting in a total of 267 homes. However, it was considered to add an additional 10% of the sample to compensate situations in which key informers declined to participate in the Surrey. In total, 298 interviews were collected in the city of Merida, Yucatan, which were supplied electronically and answered in person, through Google Docs® forms.

The design of the study considered having representativeness of the areas of the city of Merida, which was divided into six areas.

1. North (Montes de Amé, Villas la Hacienda, Col México, Altabrisa, Montecristo, North México.)
2. Center (Catedral, Paseo de Montejo, García Ginerés, Itzimná, Villas la Macarena)
3. West/east (Brisas, San Pedro Cholul, Pinos, San Pablo Oriente)
4. West/west (Fco. de Montejo, Pensiones, Chuburná, Juan Pablo)
5. South (Venustiano Carranza Airport, Santa Rosa, Dolores Otero)
6. After the limits of the Peripherals ring

However, due to economic constraints, it was not possible to collect abundant information corresponding to the southern area. Therefore, the sample interviewed was structured as follows:

Table 2: Distribution of the study sample

Merida area	Frecuency	Percentage	Accumulated
Center	46	15.44	15.44
North	77	25.84	41.28
East	47	15.77	57.05
West	86	28.86	85.91
South	6	2.01	87.92
Post-peripheral	36	12.08	100.00
Total	298	100.00	

Source: own.

A questionnaire that included a total of 37 questions divided into four sections was used: Sociodemographic data, housing, perception of water quality and willingness to pay about the water resource.

Collected data were stored in a spread sheet and subsequently imported into STATA®, statistical software. Here, descriptive statistics calculations and logistic regression (Logit) and censored regression (Tobit) were performed.

LRESULTS

As can be observed in Table 3, people interviewed were 48% men and 52% women, who have a joint average age of 35 years, and have average families of almost four members. With regard to their homes, they have almost five rooms, with 2.77 bathrooms.

Tabla Nº 3. Sociodemographic data

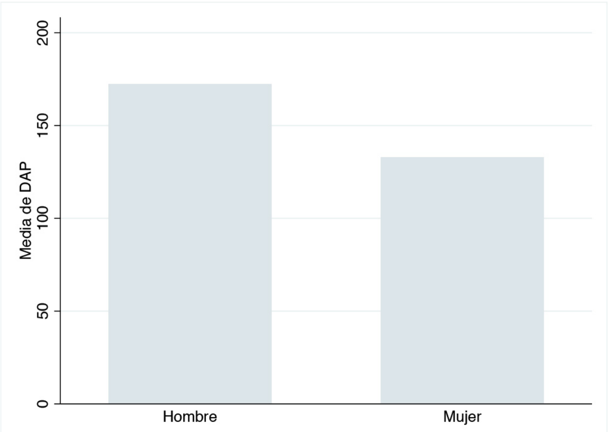
Concept	Frecuency	Mean	Standard deviation
Man	146	0.48	0.50
Age	298	35.04	13.67
Family size	298	3.81	1.47
Housing rooms	298	4.98	2.20
Housing bathrooms	298	2.77	1.72
Willingness to pay	192	150.99	181.89

Source: own with survey data

The main objective of the study is to calculate the WTP. From Table 2 it can be observed that of the 298 interviewees, only 64.42% was willing to pay for the conservation of the water resource, being the possibility to pay a bimonthly average of $150.99 MXN with a minimum of $5.00 MXN and a maximum of $1,000.00 MXN.

In order to have a better idea about the WTP, graph 1 is presented, which is grouped by gender, where at first glance, male gender tends to have a WTP greater than the females gender.

Gráfico Nº 1. Disponibilidad a Pagar por Sexo.



Source: own, with STATA®

Table 4: Differences of means between WTP and gender

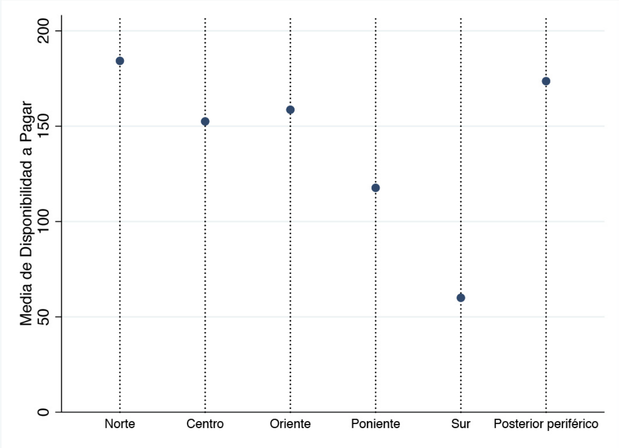
	WTP average		
	Man	Woman	| t |
Willingness to pay average	$172.34	$132.93	1.50

Source: own, with STATA®

Although Graph 1 shows a favorable trend in the monetary amount willing to pay for the conservation of the water resource from CER, the mean difference test of Figure 3 is not capable to affirm this difference, as it is not statistically significant (t<1.69).

Of the positive responses about the willingness to pay, Graph 2 illustrates the WTP averages per area of the city of Merida. The data corroborate a lower WTP for the southern area of the city, which has been characterized by having higher rates of poverty and marginalization. The highest average WTP is in the north area, followed by the area corresponding to the subdivisions that are after the peripheral ring of the city.

Graph 2: Willingness to pay per area of the city of Merida



Source: own, with STATA®

To further characterize the WTP found, it was decided to perform a mean difference test through the Student's t, where the groups that were willing to pay and those that were not were compared.

Table 5: WTP mean difference test (n=298)

Concept	Willingness to pay		|t|
	No	Si	
Gender (1=male)	0.54	0.46	1.24
Age	37.20	34.14	**1.76**
Years of study	13.40	13.42	0.04
Family size	3.64	3.88	1.27
Housing levels	1.56	1.68	1.34
Housing rooms	5.03	4.97	0.22
Number of bathrooms	2.80	2.75	0.20
Pool (1=Yes)	0.28	0.30	0.27
Washing machine (1=Yes)	0.87	0.87	0.02
Know the origin of cuxtal water (1=Yes)	0.20	0.27	1.29
Average monthly household income	$25,351.16	$29,959.33	1.08
Average payment for bimonthly water	$222.10	$273.93	0.77

Source: own with survey data

Results in Table 4 show that only the study years are a statistically significant element among people who are willing to pay for the water resource and those who not, being the youngest group with an average age of 34.14 years, the one who is willing.

However, to determine the probability that a person is willing to pay (dependent variable), a probabilistic regression analysis (probit) was performed with 18 independent variables and their respective marginal effects. These effects can be observed in Tables 5 and 6.

Table 6: Parameters of the probabilistic regression model (probit)

Variable	Coefficient	Estimated error	z	P>|z|
Gender (1=male)	-0.3055	0.1717	-1.78	0.075*
Age (years)	-0.0090	0.0064	-1.39	0.165
Education (years)	0.0107	0.0258	0.41	0.678
EAP in the home	0.1233	0.0921	1.34	0.181
Students in the home	0.1695	0.0800	2.12	0.034**
Housing levels	0.2822	0.1414	2.00	0.046**
Housing rooms	-0.0250	0.0420	-0.59	0.552
Number of bathrooms	-0.1405	0.0735	-1.91	0.056*
The person waters (1=Yes)	0.1869	0.1893	0.99	0.324
Water tank (1= Yes)	0.2251	0.3107	0.72	0.469
Pools (1=Si)	-0.0106	0.2294	-0.05	0.963
The person lives in north area (1= Yes)	-0.1862	0.3149	-0.59	0.554
The person lives in west area (1= Yes)	-0.7286	0.2984	-2.44	0.015**
The person lives in east area (1= Yes)	-0.6175	0.3197	-1.93	0.053*
The person lives in south area (1= Yes)	-0.9927	0.5983	-1.66	0.097*
The person lives in central area (1= Yes)	-0.5801	0.3236	-1.79	0.073*
Water origin in Cuxtal (1= Yes)	0.3630	0.1951	1.86	0.063*
Bimonthly water payment ($MXN)	0.0001	0.0002	0.50	0.619
Constant	0.4925	0.5710	0.86	0.388

n=298; LR chi2 (18) =29.62; Prob<chi2=0.0413; Pseudo R2= 0.0819; *, **
Source: own in STATA®

Tabla Nº 7. Efectos marginales sobre la variable WTP (n=298).

Variable	dy/dx	Error Est.	z
Gender (1=male)	-0.1021	0.05702	-1.79*
Age (years)	-0.0030	0.00217	-1.39
Education (years)	0.0035	0.00864	0.41
EAP in the home	0.0412	0.03081	1.34
Students in the home	0.5669	0.02673	2.12**
Housing levels	0.0943	0.04717	2.00**
Housing rooms	-0.0083	0.01408	-0.59
Number of bathrooms	-0.0469	0.02451	-1.92*
The person waters (1=Yes)	0.0633	0.06481	0.98
Water tank (1= Yes)	0.0792	0.11412	0.69
Pools (1=Si)	-0.0035	0.07695	-0.05
The person lives in north area (1= Yes)	-0.0638	0.11039	-0.58
The person lives in west area (1= Yes)	-0.2592	0.10878	-2.38**
The person lives in east area (1= Yes)	-0.2117	0.12257	-1.84*
The person lives in south area (1= Yes)	-0.3779	0.22153	-1.71*
The person lives in central area (1= Yes)	-0.2117	0.12401	-1.71*
Water origin in Cuxtal (1= Yes)	0.1143	0.05729	2.00**
Bimonthly water payment ($MXN)	0.0000	0.00008	0.50*

(d) dy/dx is for the discrete change of the dummy variable from 0 to 1; Sig. 0.90*, Sig. 0.95 **
Source: own in STATA®

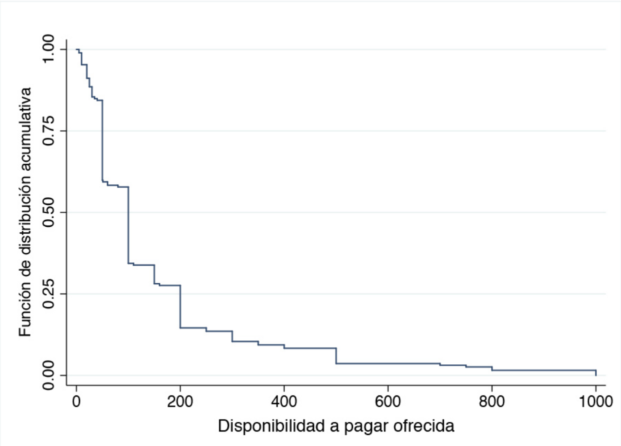
Table 7 is quite revealing and at the first glance it is observed that the male gender reduces the probabilities of being willing to pay for the conservation of CER ($p<0.10$. On the other hand, the negative sign of the variable "age" suggests that the probability of WTP is reduced at older age. Unfortunately, this variable was not statistically significant. A variable that was significant, with $p<0.05$ was the number of students in the home, indicating that the greater the number of people living in the home, the greater the likelihood of contributing to the likelihood. In this same order of ideas. The variable housing levels was statistically significant ($p<0.05$), but not the number of bathrooms in the home ($p<0.05$). This, with the negative sign reduces the probability of choosing WTP.

A variable of great importance is the "water origin". In this case, the results of the model are strong and statistically significant ($p<0.05$), indicating that the more people are aware of the precedence of the water resource, the greater the chances of WTP on the conservation of the water resource in the CER.

Regarding the analysis by area of residence, the five studied areas have negative sign and statistically significant, with the exception of north and central area. These results contribute to the theoretical debate between the improvement and investment or contributions to improvements in the environment. Despite the fact that they all resulted with negative sign, a greater strength in the possibilities of not choosing WTP is observed in the south, west and east areas of the city, classified as low-middle income areas.

In addition to the above, the calculations of the marginal effects confirm the results described above, validating the strong and statistically significant econometric model.

Graph 3: WTP survival



Source: own with STATA®

Additionally, having the monetary amounts declared by the individuals interviewed about their willingness to pay, it was decided to perform a censored Tobit regression model in order to identify the effects of the variables previously analyzed on the WTP. The Tobit model is adequate because there was part of the sample that was not willing to pay for the conservation of the water resource. Therefore, several responses for this variable were of $0.00 MXN. In total, 18 independent variables were used and the results of the model are presented in Table 8.

Table 8: Parameters of the Tobit rWTP ($) regression model

Variable	Coef.	Error Est.	z	P>|z|
Gender (1=male)	-9.9861	25.6320	-0.39	0.697
Age (years)	-0.5581	1.0064	-0.55	0.580
Education (years)	0.7262	3.8448	0.19	0.850
EAP in the home	18.5178	13.9088	1.33	0.184
Students in the home	31.8742	12.0810	2.64**	0.009***
Housing levels	34.5316	20.1459	1.71	0.088*
Housing rooms	-8.1017	6.4285	-1.26	0.209
Number of bathrooms	0.5516	10.9582	0.05	0.960
The person waters (1=Yes)	5.7036	28.7265	0.20	0.843
Water tank (1= Yes)	73.5980	47.9578	1.53	0.126
Pools (1=Si)	-54.1472	34.8744	-1.55	0.122
The person lives in north area (1= Yes)	-68.5228	43.3597	-1.58	0.115
The person lives in west area (1= Yes)	-162.9022	42.2739	-3.85**	0.000***
The person lives in east area (1= Yes)	-97.7466	45.9924	-2.13**	0.034**
The person lives in south area (1= Yes)	-175.5178	99.7746	-1.76	0.080*
The person lives in central area (1= Yes)	-79.9426	46.2306	-1.73*	0.085*
Water origin in Cuxtal (1= Yes)	53.7804	28.0845	1.91*	0.057*
Bimonthly water payment ($MXN)	0.0873	0.0162	5.38**	0.000***
Constant	-40.8990	86.3533	-0.47	0.636

n=298; LR chi2(189) =63.29 Pro > chi2 = 0.000; Pseudo R2=0.227; * Sig. 90; ** Sig. 95,*** Sig.99
Source: own in STATA® with survey data

The parameters of the Tobit model offer results that expand the comprehension of the willingness to pay in monetary terms in the first instance, although the sign of the variable Gender (1=male) is consistent with the results previously obtained with the logit model. In this case, it was not statistically significant.

However, the variable "number of students in the home" resulted statistically significant as in the previous model. This is reliable evidence about the possible influence in raising awareness of the water resources in households. In this order of ideas, households with higher levels in their homes also positively affect the monetary WTP, as well as those who make a greater volume of bimonthly payment for piped water. In this sense, the results allow clarifying that the material improvement of the home is associated with higher consumption rates, but also in the retribution and monetary valuation of it. This last scenario raises an important area of opportunities given the hypothesis of the environmental Cuznets curve, which argues that as per capita income growths, the pollution levels will reduce. If it is only focused on this specific scenario, it consumption is expected to be more efficient and lower.

Table 9: Marginal effects of the Tobit model on the WTP($) variable

Variable	dy/dx	Error Est.	z	P>|z|
Gender (1=male)	-5.7492	14.7514	-0.39	0.697
Age (years)	-0.3213	0.5789	-0.56	0.579
Education (years)	0.4180	2.2130	0.19	0.850
EAP in the home	10.6611	8.0015	1.33	0.183
Students in the home	18.3507	6.9349	2.65	0.008**
Housing levels	19.8806	11.5807	1.72	0.086*
Housing rooms	-4.6643	3.6979	-1.26	0.207
Number of bathrooms	0.3175	6.3093	0.05	0.960
The person waters (1=Yes)	3.2837	16.5356	0.20	0.843
Water tank (1= Yes)	42.3720	27.6238	1.53	0.125
Pools (1=Si)	-31.1738	20.0722	-1.55	0.120
The person lives in north area (1= Yes)	-39.4501	24.9569	-1.58	0.114
The person lives in west area (1= Yes)	-93.7864	24.1798	-3.88	0.000**
The person lives in east area (1= Yes)	-56.2749	26.4131	-2.13	0.033**
The person lives in south area (1= Yes)	-101.049	57.3968	-1.76	0.078*
The person lives in central area (1= Yes)	-46.0247	26.5508	-1.73	0.083*
Water origin in Cuxtal (1= Yes)	30.9625	16.1288	1.92	0.055*
Bimonthly water payment ($MXN)	0.0503	0.0094	5.32	0.000**

n=298; (d) dy/dx is for the discrete change of the dummy variable from 0 to 1; Sig. 0.90*, Sig. 0.95 **
Source: own in STATA®

CONCLUSIONS

The implementation of two regression models to determine in the first instance, the probability of being willing to pay for the water resource WTP (logit) and in the second term, to determine its effects on the monetary amount willing to pay (tobit) allow a better understanding the behavior of consumers who demand a public good such as drinking water. The water resource, despite being necessary for life, which does not exclude and does not rival its consumption, and because of the favorable geophysical conditions of the Yucatan Peninsula, may be undervalued and therefore, making an inefficient use of it, limiting its availability in the future.

In this sense, the results on willingness to pay are revealing and alarming in the sense that only 64% of the interviewed sample would make a payment in order to improve the current conditions of the CER. This situation is very different to the results obtained by Sánchez (2005) where very favorable results with 99% were found in the Botanamo Basin in Venezuela, and similar to those reported by Chávez (2008) in a basin in Tempisque, Costa Rica, with 71%. These elements denote the imminent invisibility of the contamination problem of the water resource and the disclaimer of third parties, in this case, state authorities.

Achieving sustainable development is a major challenge for municipal and state administrations, both in the proper design of public policies that affect the behavior of economic operators and the participation of economic operators. <however, the participation of consumers is also required in the visualization and importance of environmental services, specifically the water resource discussed in this document.

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[i] Economically Active People is referred to people over 15 years, who reported having a job or at least having sought one during the interview period.
[ii] Economically Active People is referred to people over 15 years, who reported having a job or at least having sought one during the interview period.
[iii] Economically Active People is referred to people over 15 years, who reported having a job or at least having sought one during the interview period.
[iv] Economically Active People is referred to people over 15 years, who reported having a job or at least having sought one during the interview period.