

HOW USEFUL IS CONTINGENT VALUATION OF THE ENVIRONMENT TO WATER SERVICES? EVIDENCE FROM SOUTH EAST, NIGERIA

Ukwueze, Ezebuilo R.
**Department of Economics,
University of Nigeria, Nsukka,
Enugu State, Nigeria.**
eezebee@yahoo.com

Oguiuba, Kanayo K.
**African Institute for Applied Economics
128 Park Avenue, G.R.A Enugu, Nigeria**
kannyog@yahoo.com

Adenuga, Adeniyi.
**Research and Statistics Department
Central Bank of Nigeria
Abuja**
adeniyiadenuga@yahoo.com

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1 INTRODUCTION

Is the world without an end? The subjugation of the earth through the exploitation of both human and natural resources has degraded the harmonious or cordial interaction, which existed between man and his environment. To reduce poverty and improve the standard of an average man, economic growth has remained a legitimate objection of the world community. Painfully through, people are now aware that pursuing economic growth devastates the environment (e.g. Pollution) – unlikely to be sustainable: it cannot last, (Pearce and Warford. 1993:3). The issue then is, how, not whether to grow.

Sustainable growth can be achieved if developmental activities fall within the ambit of the carrying capacity of the environment. The supply of water in Nsukka area is problematic. The focus of this paper uses the contingent valuation methods (CVM) to value the non-market good – water supply. The questions posed in this study include: What should constitute the appropriate pricing for water in a rural community? Will the willingness to pay (WTP) for the community water be enough to support the government in the face of deregulation? What are the effects of deregulation of water supply in a rural community? If water supply is deregulated and the pricing of water is made to reflect economic values, of what price will rural community members pay? Will the willingness to pay (WTP) reflect economic values of water?

2. Review of Relevant Literature

The science of Economic has always had something to say about the relation between economic welfare and the stock of natural assets (Pearce and Warford 1993). To ensure that the welfare of the people is maintained, there should be an improvement in the environmental conditions. This can only be done when the environmental goods and/or assets are made more sustainable. Thus, the sustainability of these assets is to ensure intra – and inter-generational equities.

Most environmental goods are public goods and are communally owned; and such, are provided by the state. Most states have taken the responsibility of providing these public goods, e.g. defense, education, electricity, water, transport and communication systems, etc, either because they cannot be provided

efficiently by the private sector or because of the inherent characteristics attached to them. In the changing context of contemporary world development, water resources continue to play a key role of sustained significance. This has made natural resources in general and water resources in particular, attain recognition as a fundamental component of national development. This was revealed in the evolving international outlook toward environmental standards and ecological balance at the Stockholm Conference in June 1972 – Committee for the United Nations Conference on the Human Environment – (United Nations, 1974:3). A follow – up conference was held at Mandel Plata, Argentina, in March 1977, with the statement that people have the right to have access to drinking water in quantities and quality equal to their needs. International Drinking Water Supply and Sanitation Decade Directory 1981). The 1981 –1990 decade declaration for drinking water and sanitation for the whole world was done with the intention to ensure that adequate attention be paid to water supply and sanitation by all nations and hence reduce the adverse effects associated with inadequate safe water supply and sanitary conditions. This decade placed every nation (governments) in a strategic positive to take the responsibility of providing potable water, thus confirming that it should be provided by the state.

Nsukka is in the Northern part of Enugu State in Southeastern Nigeria. It can be found in what is known as Nsukka plateau, which lies 350M above sea level, with isolated peaks, reaching over 545M. The people of Nsukka are predominantly farmers. They cultivate food crops like yam, cassava, cocoyam, etc, though at subsistence level. Access to potable water in Nsukka is serious and problematic. Out of the 16 communities in the area, only 7 have functional boreholes, even in those who have the boreholes, the taps are not extended to remote villages, to the detriment of the residents there. The sitting of the University of Nigeria in Nsukka seems to compound this problem. Although the University community has its own sources of water, these sources cannot cater for the large population in the University. The result is that the search for water is extended to the neighbouring communities, thus compounding their problems. The people travel about 2 or 3 miles to their neighbours to get water, at times without success. The price of water charged by vendors is too high to be afforded by the poor rural dwellers.

To obviate this problem, there is need to know how the consumers of water value the good by posing questions to them how much they would pay to have the source (taps) close to their houses. This method is known as Contingent Valuation Method (CVM).

There exists a plethora of research works on the use of the Contingent Valuation Method. After its advocacy by Ciriacy –Wantrup, (1952) as quoted in Blore (1996) and Cummings, et al (1986), early

applications of this technique to environmental goods commenced vigorously in the 1970s and 1980s. Samuelson (1954) published in a seminal work, which made people believe that information about consumer preferences could not be obtained by direct means due to strategic behavior bias on part of the respondents. Consequent upon this publication, investigations were rife with the existence of biases in CVM methodology. Vernon Smith (1988) published a report of empirical evidence, which belied the proposition of strategic bias. Brookshire, et al (1976), Bishop and Herbelein (1979), Bishop, et al (1983) Thayer (1981:32), Mitchell, et al (1981), Shulze, et al (1981:158) Shulze, et al (1983a), etc, all conclude that the results of CVM Surveys do not lead to strategic bias. Several tests were done for starting point and vehicle biases. Brookshire, et al (1981). Row, D'Arge and Brookshire 1983, Brookshire, et al 1980, all showed no starting point bias with the application of CVM. However, the tests carried by Randall, et al (1978a, 1978b), Brookshire, et al 1980, Doubert and Young (1981 and Cronin and Herzeg (1982), showed evidence of vehicle bias with CVM.

These tests stimulated the advocacy of the usefulness of the CVM to determine compensation and equivalent variation measures of costs and benefits. This was the theme of the state of Arts Assessment of the contingent valuation method in 1984 (Palo Alto Conference) see Comings, et al (1986). Consequent upon this conference, several studies have been done by researchers to accentuate its applicability and reliability in public policy-making. These include: Whittington, et al (1988, 1988, 1990, 1992); McConnell and Ducci (1989); Randall (1991); Shultz, et al (1998); Echevarria, et al (1995), Shulze, et al (1998), Shulze, et al (1996) Brown, et al (1996) Onwujekwe, China, et al (2001), Kohlin (1997) Mekonnen (2000), etc. A number of theoretical and methodological issues and criticisms have been raised about the application of the CVM in general and in valuation in developing countries in particular. Criticisms at the theoretical level are rife, especially those related with economic theory which are linked with the problems of how questionnaire is prepared and data collected and analysed, see Mekonnen (2000:292); and the doubt about the usefulness of CVM in a developing country context [Dixon and Sherman (1990)]. It has been shown that CVN can be applied to developing countries [Whittington (1996), Georgiou, et al (1997)]. Another criticism is the choice of response format to adopt during the exercise. As the choice of response format – to employ depends on the problem under consideration and the context of applicability (Hanemann, et al (1991), there is a consensus among researchers that willingness to pay (WTP) format performs better than willingness to accept (WTA) format (Cummings, et al (1986), Mitchell and Carson (1989)). Similarly, it is generally accepted that a binary question with open-ended follow up questions provides more information on

WTP than alternatives, such as dichotomous choice format and double-bounded referendum methods (Mitchel and Carson (1989), Shulze, et al (1996), Brown, et al (1996), etc].

Another issue in the CVM literature is related to test of validity of the contingent valuation estimator. An issue which has received limited attention is the treatment of invalid responses – missing bids, protest zeros, and outliers – from the empirical analysis. Mekonnen (2000:294) concludes that discarding the invalid responses may result in sample selection bias.

However, criticisms and controversies on the use of CVM as being too hypothetical and imaginative should be taken with caution. Using hypothetical scenarios and imagination, far from being a distraction from reality is probably both closer to the way many people think about environment and a necessary step to problem solving. A policy that engages in a dialogue to achieve such an objective changing people's preference – may, however, have a better chance of success than one that is imposed by government, (Blore, I an 1996:231).

3. Methodological Framework.

Water supply in Nsukka area of Igboland is a serious concern, just as any other place in the south East of Nigeria. This is because out of 16 communities in Nsukka Urban, only 7 have functional boreholes the rest do not have. Even in those where boreholes exist, the taps are few and concentrated in few places. With the establishment of University of Nigeria, in Nsukka, the problem seems to worsen because even though the University community has its own sources, they are not enough to cater for the large population. The residents in the communities without boreholes travel about 2 or 3 miles to their neighbours to get water at times without success. To solve this problem, they resort to buying water from vendors –tankers drivers and retail vendors. Most people cannot afford to purchase all the water needed by the household through out the year. They therefore, resort to the purchase of local pots, which they fill with mud water collection from holes dug around their houses during rains. This serves their water needs during the dry season, but poses a threat to their health: they are exposed to the attack of mosquitoes and other water-borne diseases like dysentery, cholera and diarrhea, etc. This scenario observed at Nsukka area similarly applies to other parts of Igbo land.

Four out of the seven communities that have functional boreholes were selected for study and include, Nsukka, Opi, Ede-Oballa and Obukpa. A sample of about 2.1% of the sample population was selected and assuming an average household size of 6 people, we have about 23287 households in the sample area. That is, a sample to population ratio was set at 1:49, which implies that about 480 households involving about 2880 people were sampled. A two-stage sample design was adopted. The first stage involved the selection of the clusters to be sampled – the villages become the first stage (primary unit).

The second stage was the selection of the families (house holds) to be interview (secondary unit) (Nwabuokei 1986). Based on this, holds the households sampled for Opi, Ede-Oballa, Obukpa and Nsukka were respectively 89, 53, 70 and 268.

The use of OLS in this type of study could lead to sample selection bias. This is because consumers of water already pay a rate charged by the Water Corporation and hence the amount which the pay should form the basis upon which they are asked about how much they would be willing to pay. Edwards and Anderson (1987) suggested that Heckman's (1979) analysis of censored samples was germane to sample selection bias in contingent valuation research. For the purpose of this work, we used Tobit (censored) model as propounded by James Tobin (1958).

The data for this work was from primary source. The household questionnaire was the main instrument used for data collection. The questionnaire was structure to elicit information needed from the sample households, and the questions were made as simple as possible. The elicitation format used was double-bounded referendum methods with follow-up questions because of the benefits, which include: it is easy to administer and responses are simply: Yes or No; it is consistent with what the rural dwellers are familiar; and it is suitable for the analysis of Tobit (censored) methodology.

On the whole, 480 households with an average population of 2880 were interviewed. During the data cleaning about 60 households involving 360 individuals were eliminated. The remaining 420 households involving about 2520 individuals were valid. These eliminated include missing variables (75%), cut-offs (8.33%), outliers (10%) and non-response and other reasons (6.67%).

The econometric software used for the analysis (estimation) of the Tobit (censored) model was done with E-Views Version 3.

4. Discussion of the Findings

In this section, we present the results of the regression of the Tobit (censored) model and the policy recommendation. The data were censored both sides (left and right): The left truncation was the starting bid, in which any respondent who indicated a WTP below this bid was represented by zero. The right censoring indicates that zero also represented any respondent willing to pay above 10% of the stated monthly households income. With censoring on both sides, we had 69-censored observations and 351 uncensored observations, giving a total of 420 valid responses. The regression results are shown in the table below.

Table 4.1 Regression Results of the Tobit Model.

Dependent Variable: WTP

Variable	Coefficient	Std.Error	Z-statistic	Prob.
DIST	0.084889	0.092527	0.917443	0.3589
EDU	0.159582	0.062407	2.557103	0.0106
OCC	0.225451	0.059161	3.810774	0.0001
POP	-0.018275	0.091811	-0.199045	0.8422
PRICE	0.005777	0.001586	3.642536	0.0003
SEX	-0.017370	0.036242	-0.479285	0.6317
DITURE	0.000147	5.65E-05	2.606371	0.0092
INCOME	1.16E-05	5.77E-06	2.003282	0.0451

Where

DIST = Distance in km (During variable) of the household from the nearest public tap.

EDU = Level of formal education (a dummy) of the household head

OCC = Dummy variable for occupation of the household head

POP = Dummy variable for the size of the household

PRICE = Price of the alternative source of water (vending)

SEX = Dummy for the sex of the household head.

DITURE = Average monthly expenditure on alternative source of water.

INCOME = Average monthly income of the household.

The computer print out of the results could be seen in appendix A.

The variable distance shows the distance the households have to travel before getting water from the public tap. The further the household from the nearest public taps, the higher the disutility to the household involved. The variable has the a priori positive sign, indicating that households far away from the source of water would be willing to pay more. Bad roads and cost of transport could compound the problem of distance. However, the variable is not significant at 90%, 95% and 99% confidence levels, respectively.

The level of Education attained by the households head has the expected positive sign, which indicates that households whose heads have higher education indicated a higher willingness to pay than the less educated ones. Higher education shifts the demand for water services to the right, implying a higher level of welfare. A household with higher level of literacy has better chances of maximizing the utility and welfare from consuming and having access to pure water. The result is not unusual; the enlightened population has great impact on the demand for welfare facilities like water, health, education, sanitary conditions, etc. Education is significant at 90% and 95% levels but insignificant at

99% confidence level. Similarly, the occupation of the household head is a key determinant of the willingness to pay. This stems from the fact that better and more permanent jobs give more income for the households, which would influence their willingness to pay. This factor is derived from the level of education a family has attained; a household with better education has better jobs and higher income. Occupation is statistically significant at 90%, 95% and 99% levels, respectively.

Price of alternative source of water (water vending) is another key determinant of WTP. It shows that when vendors charge higher prices for water, the welfare levels of the households deteriorates, as they divert resources from the consumption of other goods to water. The welfare of the people could be increased if there is improvement in the supply of water so as to make consumers of water maintain the existing level of utility they are used to. This variable is not significant at 99% level only. Closely connected with this is the average expenditure of the households on water vending. Since expenditure on water from vendors takes a large part of the household's income, the implication is that higher expenditure on water from this source reduces the utility and increases the disutility of the rural dwellers. This poses a big problem for the low-income earners who cannot afford the hike in the price of water from vendors. This variable is statistically significant at the three levels of significant.

The average monthly income of the household is another strong factor of WTP. Higher income implies that better and higher quality goods would be preferred, *ceteris paribus*. The significance of this variable suggests that improving the income of the people in the study area would shift their demand for water services to the right, and also reduces the excessive impediment posed by the distance to the source of water, price charged by vendors, and the expenditure on water.

However, the negative influence of the sex of the household head and the size of the household on the WTP bid is rather surprising. A larger household depicts the level of education the household has attained. Enlightened households have fewer children; the larger the size of the household the less equitable the distribution of the family's resources is and, thus, the less the welfare levels. The result shows that smaller households have a more equitable distribution of resources and are in a better position to cater for the welfare of the members. The negative sign of sex of the household head shows that women feel the impact of scarcity of water more than men. Since they bear more pains than men, they expressed a higher willingness to pay for the improvement of water facilities. This arises from the fact that women use more water for household chores and can hardly bear the risk of running out of water when they are preparing food. The two variables are not statistically significant at all the confidence levels.

Using all the variables that are statistically significant we can derive the demand (WTP) function. This function is derived using the coefficients of those variables and their mean values. The variables that are significant include, education, occupation, price, expenditure and income. The bid function=

$$\text{WTP} = 0.159582 (9.8) + 0.225451 (1) + 0.005777(35.4) + 0.000147 (1499.8) + 0.0000116 (7585.4)$$

$$\text{WTP} = 2.300239$$

This implies that the mean WTP for improved water services is ₦230.02

For various communities in the survey area, the population of each community and the average number of households (assuming 6 persons per households) is shown in table 4.2.

Table 4.2 Household Distributions in the Four Communities and the Expected Revenue to the Government.

Study Area	Population Size	Number of households	Mean WTP (₦)	Total R
Obukpa	20,056	3,343	230.00	768,890
Ede-Oballa	14,368	2,395	230.00	550,85
Opi	25,384	4,231	230.00	973,130
Nsukka	79,913	13,319	230.00	3,065,6

Note: The population size of each community was based on the 1996 population data collected from National Population Commission, Nsukka Area Office.

The table above shows the possible revenue that could be generated for the government every month from each community if the consumers of water (each household) contribute about ₦23.0 for the extension and maintenance of the public taps

One of the key issues deduced from this study is that communities in Nsukka Area suffer terribly because of insufficient potable water. A way to ensure that the problem could be reduced is to make water supply more sustainable. Sustainability can be achieved by using the amount, which the households are willing to pay (mean WTP, i.e. ₦230) to extend the taps to remote villages. We suggest that since the initial capital for sinking the borehole is too large, and cannot be undertaken by each community, the government can undertake to drill it. The host community can perform the function of extending the taps to the remote villages and other min or repairs from this contribution (mean WTP) which every household should pay each month.

This revenue generated from this WTP should be divided into two parts: a smaller portion should be kept in the account of the host community in the event of major repairs; the larger percentage should

be kept in the government account, so that any serious damage could be undertaken jointly by the host community and the government. By charging a price of ₦230.00 per month, the impact of this amount from the household's monthly income would not be felt. This would serve as the appropriate price, which each household should pay so that they maximize the utility derivable from the consumption of water. Even though this does not depict the economic value of water, it is the price, which every household feels satisfied about or is indifferent to both parties are at welfare equilibrium at this price; the host households are happy that they this amount and still have regular supply of water. In the same vein, the government feels satisfied because the running cost is reduced and still large revenue is generated.

One of the contemporary public policy in the world today issues is that deregulation of the public goods. Most governments are in the habits of selling off most parastatals and corporations to private individuals. The approach suggested in this study for the improvement of water supply is in conformity with the notion of deregulation. The government can undertake the initial capital, while the host community would undertake the running costs and other expenses. This approach saves the government the problems of budgetary and extra-budgetary allocations, which do not yield returns. This approach introduces competition among the communities since each community would try to ensure that it own supply is regular so as to draw people from the neighbouring communities, and thus, swell its purse. This approach to deregulation is called "quasi-deregulation".

5 Conclusion

One of the objectives of this study is to identify the determinants of WTP for improved rural water supply in Nsukka Area Igboland. Another objective is to ascertain what consumers of water would pay to support the government. The third objective is to determine the amount of revenue that could be generated to the government. The estimation of the Tobit (censored) model showed that most of the variables included in the model individually and collectively provided basis information on the nature of household utilization of this public good- water.

However, the willingness to pay (demand) for water was sensitive to the level of education of the household head, occupation of the household head, prices charged by water vendors, expenditure on water vending and the average monthly income of the households. Most of these results are consistent and in conformity with the literature on the willingness to pay for public goods.

The policy conclusion to be drawn from this study is that of there should be a 'quasi-deregulation' of water supply. This implies that the government should undertake the initial investment, while the host communities should handle the running costs and other minor expenses. Both the government and the host communities should jointly do major repairs. The government recoups part of the expenditure on the initial investment through the monthly payment of the amount the households stated they are willing to pay, while the households have constant and regular supply very close to them.

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APPENDIX A

Dependent Variable: WTP

Method: ML - Censored Normal (TOBIT)

Date: 06/17/02 Time: 21:19

Sample (adjusted): 1 420

Included observations: 420 after adjusting endpoints

Left censoring (value) at zero

Convergence achieved after 7 iterations

Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
DIST	0.084889	0.092527	0.917443	0.3589
EDU	0.159582	0.062407	2.557103	0.0106
OCC	0.225451	0.059161	3.810774	0.0001
POP	-0.018275	0.091811	-0.199045	0.8422
PRICE	0.005777	0.001586	3.642536	0.0003
SEX	-0.017370	0.036242	-0.479285	0.6317
DITURE	0.000147	5.65E-05	2.606371	0.0092
INCOME	1.16E-05	5.77E-06	2.003282	0.0451
Error Distribution				
SCALE:C(9)	0.344953	0.013724	25.13439	0.0000
Mean dependent var	0.835714	S.D. dependent var		0.370977
S.E. of regression	0.301064	Akaike info criterion		1.001414
Sum squared resid	37.25282	Schwarz criterion		1.087991
Log likelihood	-201.2970	Hannan-Quinn criterion.		1.035634
Avg. log likelihood	-0.479279			
Left censored obs	69	Right censored obs		0
Uncensored obs	351	Total obs		420