WILLINGNESS TO PAY (WTP) FOR WATER IN URBAN GHANA: The Case of Tamale Metropolis

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ABSTRACT

In recent times, there have been calls for private sector participation in water delivery in Ghana. Such calls are propelled by the notion that public utilities are not being managed efficiently and are in most cases either grossly under-priced or heavily subsidised. Proponents of the private sector participation in water delivery have often cited the payment of higher prices to vendors by households outside the piped-water system as an indication of willingness to pay. But is this actually the case? Are households willing to pay for improved water supply? How much are households willing to pay? What are the factors that influence their willingness to pay? This paper contributes to the ongoing debate by assessing households' willingness to pay (WTP) for improved water supply in Tamale, one of the cities in Ghana with acute water supply problems. Contingent valuation is used to solicit WTP bids from respondents. Factors influencing WTP and the maximum amount households are willing to pay are estimated using the probit model and Box-Cox regression respectively. The study found that sex, age, income, regularity of water supply and the pressure of flow are factors that influence the probability of WTP. The paper concludes that though there is the need for "realistic pricing" of water so as to at least ensure cost recovery, government and other actors in water supply management should be mindful of the direct relationship between access to potable drinking water and the health of the population.

Keywords: Willingness to Pay, Subsidies on Water, Private sector participation, Contingent valuation, Box-Cox regression.

INTRODUCTION

The shortcomings in the water supply systems in urban areas of developing countries are critical problems affecting millions of people. The enormous volumes of water and extensive infrastructure required to fulfil the urban water demands have created severe environmental problems (Munasinghe, 1990; Hardoy et al, 1992; Serageldin, 1994; Drakakis- Smith, 2000). Governments in developing countries have often subsidized water supplies typically in an attempt to achieve social and health benefits for low-income households. However, a severe result arises if the benefits of subsidized water accrue primarily to wealthier households receiving reliable services, with poorer household benefiting in less than proportionate manner because they have irregular or non-potable water supplies and have to purchase water from other non-subsidized sources. When this is the case, the drain on the government revenues represented by the subsidy, can hamper its ability to expand and improve on the services provided to the urban poor.

The problem of determining appropriate water pricing strategies for large urban areas of developing countries is highly complex due to heterogeneity in terms of service conditions and socio economic characteristics in many cities. Even though in some large cities, the water supply networks are sufficient, the service standards can often vary drastically from one area to another as a result of engineering, geographic or urbanization problems. These cities also present a remarkable diversity with a relatively clear distinction between different income groups. Given the importance of water, realistic pricing should not be looked at only in terms of cost recovery but also in terms of consumer welfare since affordability of safe water is directly related to access and public health.

Public utilities in developing countries often serve only a fraction of the urban population, with the vast majority relying on alternative sources. Micro studies in urban areas such as Port-au-Prince (Haiti), Jakarta (Indonesia), and Onitsha (Nigeria) show also that the urban poor are disproportionately underserved. Poor households are almost never directly connected to the public utility and thus rely on vending systems or buy water by the 'bucket'[2] at very high unit prices, and hence consume very little water (Whittington et.al., 1991; Crane, 1994; World Bank 1994; 2003b). Poor households often pay vendors several times the unit price paid by non-poor households connected to the utility, and they use only a fraction of that amount of water. In many areas, water vending is no longer a fringe activity and vending systems account for a large proportion of total water revenues. In Onitsha, for example, the water vending system collects 24times as much revenue as the public utility during the dry season (Whittington et.al., 1991). These findings strongly suggest that the widely used and well-intentioned public policy of keeping domestic water tariffs low is not working. According to the World Bank, this policy has resulted in massive and poorly targeted subsidization of services that have helped the rich (but not the poor), hurt the financial viability of utilities, and has led to deterioration in service quality and conse-

[2]A bucket contains approximately 22.5 litres of water.

quently to low willingness to pay by users. As a result, most communities are now caught in a low-price-low-quality equilibrium (World Bank Water Demand Research Team, 1993). To break out of this low-level equilibrium, World Bank experts contend, governments need to adopt a demand-driven approach in which consumers are willing to pay (World Bank Water Demand Research Team, 1993). There are two key ideas underlying the demand-driven approach (Gulyani, 2001). First, utility providers should charge full costs for water and use the revenues to improve service and expand coverage- that is, price high-quality service for those who are willing to pay for it. Secondly, to do so, utilities and planners need to understand and respond to demand-quality, price, and preferred service types and options in every community they intend to serve because demand for water is highly location specific.

The Dynamics of Water Supply in Ghana

The problem of water supply in Ghana is a combination of poor infrastructure and ineffectve management coupled with the inability of government to solely finance the needed investment in water delivery. This problem has led to wastage mainly through unaccounted- for- water; the difference between the volume delivered to the supply system and the volume of water accounted for by legitimate consumption. Policy makers have contended that the water situation in Ghana can only be addressed by private sector participation, which they believe will inject the needed capital, promote efficient management and bring about cost recovery through realistic pricing. An international fact finding mission in August 2002, reports that only 53% of Ghana's entire population have access to pipe-borne water. Those outside piped-water system spend up to GH¢ 0.15 daily for three buckets of water, an amount far higher than what the state-owned water company charges. Proponents of private sector participation in water delivery often cite the high water-related expenditure for households and individuals outside the piped water system as their WTP for improved water supply, but is this actually the case? There have been several studies on household's WTP for improved water delivery in some developing countries. For example, Mcphail (1993) found that households in five small cities in Morocco were willing to pay on average 5% or more of total income for water. Zerah (1998) found that households in Delhi were willing to pay 50% increase in their water bill for improved services. Goldbloatt (1998) found in two informal settlements in Johannesburg that 64% of the household were willing to pay up to 5% of their income for improving the service conditions. Nkrumah (2004) found that unwillingness to pay explains the limited access to water by households in the Cape Coast Municipality. However in Ghana, little has been done in this respect. The limited information on households' WTP for improved water delivery could prove costly in the wake of calls for private sector participation in water delivery and for realistic pricing on the premise that some households are already paying higher prices to vendors. This paper contributes to filling the lacunae in the literature on households' willingness to pay for improved water delivery in urban Ghana. The paper draws heavily from a research conducted by the authors on households' preferences and willingness to pay for improved water delivery in Tamale in June 2007. Policy makers, utility companies in the urban water supply and international financing agencies would find this paper useful as it tries to highlight households' willing to pay for improved water delivery, the factors that influence the households' decision to pay for these improvements and the amounts households are willing to pay for water in Tamale.

Water Supply in Tamale

Tamale is the third largest city in Ghana after Accra and Kumasi. The metropolis covers a total land area of 70,384 square kilometres with a population over 300,000 (Ghana Statistical Service, 2002) and has been the fastest growing city in West Africa until conflict dampened its speed (ODI, 2005). Rapid expansion especially in the 1990s rendered the already decrepit water supply network incapable of supplying the city's demand for water. According to the Ghana Water Company, the Tamale metropolis is supplied 4.3 million gallons of water daily from its source in Dalong. However, only 38% of this water is accounted for by legitimate consumption due to breakdown of equipment and leakages, which has increased the volume of unaccounted-for-water (UFW). Records of the Ghana Water Company in Tamale indicate that only about 25-30% of the entire population has access to urban water supply services, a figure far lower than the national average of 53% (See International Fact Finding Mission, August 2002). As a result, there is a high demand for expansion and improvement in water supply within the metropolis, a situation that has anchored the growth in water vending activities. Construction works on a €45millin Tamale Water Supply project started in August, 2006 and the contractor is expected to complete the project in 24 months. The completion of the project is expected to boost water supply to about 9.3 million gallons per day and this will help solve the perennial water problems confronting the Tamale metropolis and its surrounding communities. Policy makers, investors and indeed civil rights organisations would be interested in examining how effective this demand is i.e. is the demand backed by a willingness to pay? If yes, how much are households in Tamale willing to pay for these improvements in water supply? These are the issues this paper addresses.

CONCEPTUAL MODELS FOR ASSESSING WILLINGNESS TO PAY

Willingness-to-pay surveys are conducted using the method of Contingent-valuation (CV) to assess demand and to estimate project benefits. It entails the establishment of a carefully defined hypothetical market for non-market commodities such as environmental quality. Introduced into environmental economics literature in the early 1970s, the CV methodology has evolved to include econometric analysis to improve the validity of WTP estimates. The CV method directly questions individuals as to how much they are willing to pay for a change in quantity or quality (or both) of a particular commodity. Economists generally prefer to use observed or revealed behaviour in markets in estimating project benefits rather than directly questioning respondents. This is because direct-questioning may result in many errors (Gunatilake;

2003, Boardman et al., 1996, Hausman and Diamond 1994, Hanemamn 1994). When direct revealed preference information (information on market demand) or indirect revealed preference information (information on surrogate markets) are not available, economists are left with two choices; either confine to cost-effectiveness analysis or estimate benefits using the CV methods. Water supply is not generally traded in the markets; therefore, no information on market demand or competitive market prices is available to value benefits hence the use of CV methods to assess WTP for water.

Willingness to pay bids for this study were obtained using two CV approaches, the dichotomous choice format in which households were asked whether they would pay **GH¢ 0.05 (GHP 5) for a bucket (22.5 litres)** of water and the open-ended question approach where households where asked the maximum amount they would pay for a **bucket** of water. The "ideal case scenario" of water supply was presented in the hypothetical market i.e. constant flow with good pressure level and piped into dwelling. The two approaches used are prone to strategic and hypothetical biases often associated with CV surveys. Strategic bias may arise when an individual thinks he may influence an investment or policy decision by not answering the interview question truthfully. Hypothetical bias arises from two main sources. Firstly, if the individual does not understand or correctly perceive the characteristics of the good being described and secondly when respondents do not take contingent valuation questions seriously. The need for calibration of WTP responses to correct for such biases has been recognized in literature. This paper adopts a transformation proposed by Schulze et al. (1996).

Schulze et al. (1996) specify the relation between the true WTP (denoted by W) and bid revealed in the survey (denoted by W_0) as

$$\ln W_0 = \ln w + \varepsilon, \qquad (1)$$

where ε is the measurement error assumed to be distributed $\varepsilon \sim N(0,\sigma_\varepsilon^2)$.
Next they consider an econometric model that explains W,

$$\ln W = X\beta + v, \qquad (2)$$

Where X is the vector of explanatory variables, β is the vector of parameters, and v is an additional source of error assumed to be distributed $v \sim N(0,\sigma_v^2)$.
Combining the two equations gives:

$$\ln W_0 = X\beta + (\varepsilon + v). \qquad (3)$$

For empirical application, Schulze et al. propose the use of a more general transformation than the log transformation, namely Box-Cox procedure which this paper applies. If skewed measurement errors are present in reported WTP, then the raw mean of the bids will be biased upwards relative to the underlying true value, and the use of Box-Cox provides a correction. Box-Cox finds the maximum likelihood estimates of the parameters of the Box-Cox transform, the coefficients on the independent variables, and the standard deviation of the normally distributed errors for a model in which dependent variable is regressed on independent variables. The researcher has the option of transforming either the dependent variable, some of the independent variables, both the dependent variable and some of the independent variables. Studies which have applied similar transformations such as Goldar and Misra (2001) found mean calibrated Willingness to accept (WTA) to be 2.5% of mean WTA estimated from raw CV data when for example the half-normal transformation is applied.

The Probit Model

The dichotomous choice format in the CV methodology yields a discrete WTP estimate with a value 1 if the respondent accepts to pay the stated amount and 0 if he does not. Usually, the assumption is that the individual's decision to pay or not to pay the stated amount is based on the principle of utility maximisation. Let improved water delivery be 'f' with $f = 1$ for a positive outcome (willingness to pay) and $f = 0$ for a negative outcome (if respondent is not willing to pay). The underlying utility function which ranks the preference of the i[th] individual is assumed a function of respondent-specific characteristics (X) such as household income and size, age and sex among others and an error term(ε) assumed to be $\varepsilon \sim N(0, \sigma_{\varepsilon}^{2})$:

$$U_{i1} = \beta_1 X_i + \varepsilon_{i1} \qquad (4)$$

if respondent is willing to pay and

$$U_{i0} = \beta_0 X_i + \varepsilon_{i0} \qquad (5)$$

if respondent is unwilling to pay the stated amount. Given that utilities are random, the i[th] individual will be willing to pay if $U_{i1} > U_{i0}$. Thus for the i[th] individual, the probability (P) of accepting to pay the stated amount is:

$$P(1) = P(U_{i1} > U_{i0})$$

$$P(1) = P(\beta_1 X_i + \varepsilon_{i1} > \beta_0 X_i + \varepsilon_{i0}) \qquad (6)$$

$$= P(\varepsilon_i - \beta X_i) \qquad (7)$$

$$= \varphi(\beta X_i) \qquad (8)$$

where φ is the cumulative distribution function for ε. The functional form of φ depends on the assumptions made concerning the distribution of ε which also have implications on the type of model that could be used to estimate the function. The paper assumes ε to be normally distributed and therefore adopts a probit model to assess the effect of socioeconomic factors on WTP (see for example, Nkamleu and Adesina, 1999). Thus for the i^{th} individual, the probability of accepting to pay for improved water delivery is given by:

$$\varphi_f(\beta X_i) = \left(1/\sqrt{2\pi}\right) \int_{-\infty}^{X,\beta} e^{-t^2/2}\, dt \qquad (9)$$

Equation (9) is estimated using the probit procedure (see Judge et al., 1984). Pindyck and Rubinfeld (1991) also suggest the use of large samples when it is believed that the underlying distribution of the sample may not be normal.

Empirical Models

Studies in some African and Asian countries have found willingness to pay for water supply and sanitation is dependent on the nature of existing services, levels of satisfaction of the consumer with the existing services and socio-economic factors such as household income, education and affordability (Altaf, 1994a, 1994b; Altaf et al, 1993; Griffin et al, 1995; Mcphail, 1994, North and Griffin, 1993; Singh et al, 1993). Accordingly, the choice of explanatory variables for the study reflected these dimensions. The socio-economic-dimension variables are sex, age, educational level and income. Frequency (per week) of water supply, water pressure and estimated expenditure on water were included to capture the dimension of cost and nature of existing water supply.

The expectations are that educational attainment and income would have positive effects on WTP. Education level of household head (EDUH) and that of the wife (EDUW) as well as income of the household head (INCO) and wife's income (INCOW) are included in the models. High income improves the individual's ability to pay, while higher education is expected to raise the individual's level of consciousness relating to health and hygiene and hence increases their value for clean water compared to the illiterate. Age is expected to have a negative effect on WTP. The assumption is that older people will stick to the convention that the state should provide and subsidise water supply while younger people will accept the concept of private sector participation in water delivery and the payment of realistic tariffs. The age variable is also decomposed into that of household head (AGEH) and age of wife of household head (AGEW). The decomposition of age, education and income by gender is aimed at capturing the contribution of women's labour, education and income to household welfare which includes access to potable drinking water. It is believed that educational attainment and income of women bear directly on the household. The sex (SEX) variable is binary with 0 and 1 denoting male and female respectively. In Northern Ghana, searching for water is mainly the responsibility of women. It is therefore expected that women will be more willing to pay for reliable supply of water within or at a reasonable distance from the household.

From the service conditions perspective, it is expected that individuals who already enjoy regular water supply with good pressure levels would be less willing to pay compared to those who do not have reliable water supply and also face low pressure problems. The expectation therefore is that frequency of water flow per week (WKFLO) and water pressure (WAPRESU) would negatively influence WTP. High water pressure is usually preferred and is denoted 1 with low water pressure denoted 0. Estimated household expenditure on water (WATEXP) is expected to have a negative effect on WTP i.e. reflect the inverse relationship between price and demand. Means and standard deviations of the variables are shown in table 1.

The probit model was used to assess the effects of the explanatory variables on the decision to pay **GH¢ 0.05 for a bucket** of water while ordinary least square was used to assess the effects of the variables on the maximum amount households are willing to pay for the same bucket of water. The empirical model for the study is specified as:

Table 1: Variables and Summary Statistics

Variable Name	Observa-tions	Mean	Std. Dev.	Minimum	Maxi-mum
AGEH	200	42.4	9.0	26	71
AGEW	200	34.7	7.1	20	53
EDUH	199	9.2	6.2	0	21
INCOW	200	223.7	271.8	24	2400
INCO	200	258.7	298.4	0	2400
ESTINCOW	200	223.7	271.8	24	2400
WKFLO	200	4.1	1.9	1	7
WATEXP	189	3.0	5.6	0	50
SEX	Male = 176	Female = 76			
WAPRESU	Low = 118	High = 82			

Source: Field Survey, 2007

DATA AND ECONOMETRIC ANALYSIS

Cluster sampling was employed in the selection of households in March 2007. The metropolis was divided into five clusters based on a scheme used by the Ghana Water Company in Tamale. A sample of 200 households was selected from eighteen (18) communities in the Tamale Metropolis. Sampling in each zone was guided by estimated proportion of residential settlements in the area. For example, the North and Central are intensely residential with higher population densities and few industrial and commercial establishments as compared to the East and West. Table 2 presents a summary of the sampling procedure.

Table 2: Summary of Sampling

Cluster	Zone	Communities	Number of Households Sampled
Cluster Number	Zone	Communities in Zone	Number of Households Sampled
1	Tamale North	Jisonayili, Kanvilli, Gumani, Yapelsi, Sagnarigu	55
2	Tamale Central	Choggu, Sakasaka, Moshe zongo, Gumbihini	40
3	Tamale East	Tutingli, Kalpohini, Kukuo and Vitting	35
4	Tamale South	Lamashegu and Zogbeli	41
5	Tamale West	Aboabo and Nyohni	29
Total			**200**

Primary data was collected from households through administration of semi-structured questionnaires. Key informant interviews as well as community fora were also conducted to obtain general information relating to water supply and service conditions in the respective communities.

As indicated above, the dependent variable in the case of the probit procedure is binary. The individual decides between two mutually excluding alternatives to either pay GHP 5 for a bucket **(approximately 22.5 litres)** in which case WTP = 1 or not pay and in which case WTP = 0. The open-ended question format produced an amount (in GH¢) that a household stated as the maximum they will pay for a bucket of water. In this case Box-Cox regression (left hand side only) was used to estimate the model. Ordinary least squares estimation of the model is however added for the purpose of comparison. Since the dependent variable is the logarithm of stated WTP (refer to equation 3), zero WTP bid (1 observation) was replaced with a small arbitrary value of GHP 1. Similar result was however obtained when the zero observation was dropped. The estimation of the models was done using standard econometric procedure provided in the 9.2 version of STATA.

RESULTS

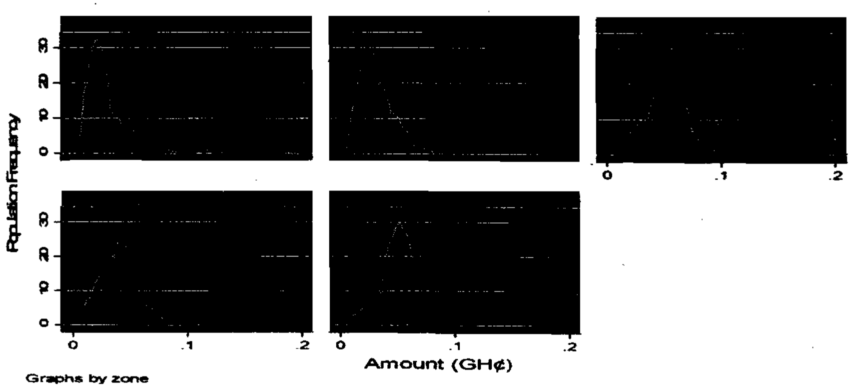
The maximum households are willing to pay for improved water supply was obtained via an open-ended question as to how much a household will pay for a bucket (kg of water) of water if piped into dwelling with good pressure and regular flow. Table 3 gives the means and standard deviations of maximum WTP from both raw CV data and Box-Cox transformed WTP bids. Willingness to pay bids is lowest in Tamale North and Tamale Central where the water supply situation is relatively good compared to the other zones. Tamale North is considered to have relatively good service level because water from the pumping station located in Dalong in the Tolon-Kunbungu District enters the Metropolis through the North and then through Central Tamale to the South, East and West. The South, East and West have irregular supply and low pressure problems. The high WTP in these three zones is out of high demand for improvement in service standard. Mean WTP bids obtained through Box-Cox transformation are far less than the means estimated directly from the CV data. For example in Tamale North, Mean WTP obtained from the transformed data is 3.5% of the mean from the raw CV data which is comparable to findings elsewhere (see for example Goldar and Misra 2001). Desperate desire for service improvements in some cases could lead to WTP bids way beyond the ability of the respondent. In such cases, mean WTP bids are affected by these outliers and could misinform policy decisions. Kernel (Epanechnikov) densities of WTP are presented in figure 1. Tamale East, West and South have relatively good distribution of WTP compared to the North and Central where the distributions are positively skewed. In Tamale North for example, quite a significant number of households are either not willing to pay or are willing to pay extremely small amounts. As already indicated this zone enjoys relatively good water supply and therefore the proposed improvements may not be highly valued as in other zones with poor service conditions like the east or south. On the average, households are willing to pay about 2% of their monthly income for reliable water supply. This is lower than WTP bids in some African countries (see for example Mcphail, 1993).

Table 3: Summary Statistics of Willingness to Pay (in GH¢) by Zone

	Raw CV Data			Box-Cox Transform	
	Mean	Std. Dev	WTP as Percentage of Income	Mean	Std. Dev
Tamale North	0.0339	0.0305	1.4	0.0012	0.0003
Tamale Central	0.0328	0.0173	1.8	0.0013	0.0002
Tamale East	0.0522	0.0166	1.2	0.0013	0.0002
Tamale South	0.0405	0.0156	2.0	0.0015	0.0002
Tamale West	0.0484	0.0143	2.0	0.0014	0.0002

Source: Field Survey, 2007

Figure 1: Maximum WTP Kernel Densities



Source: Field Survey June, 2007

Estimates of WTP models using Box-Cox and the probit approaches [equations (3) and (4) and (5)] respectively, together with the elasticities of the explanatory variables are shown in tables 4 and 5. Five of the explanatory variables were found to significantly influence the maximum households were willing to pay for improved water delivery (see table 4). The age variable is significant at a five percent level and had the expected sign in the case of females. However, it may be reasonable to regard this phenomenon as reflecting the diminishing role in searching of water as age increases rather than reflection of the position of women regarding payment of realistic tariffs. Against apriori expectations and the established trend in most WTP studies, household income and expenditure on water did not significantly influence the maximum amounts they are willing to pay. However, the variables that sought to capture the effect of service conditions were found to significantly influence the amounts individuals or households were willing to pay for water. The number of times water flows in a week (WKFLO) for example was significant at the 1% level and had the expected positive sign. Water pressure level (WAPRESU) was also found to be significant at a 10% level. Seven of the variables in the probit model were found to exert a significant influence on the probability of a household paying for water.

Table 4: Determinants of Maximum WTP

Variable	OLS Coefficients.	Elasticities	t-ratio	Box-Cox Coefficients
SEX	-0.0125 (0.0054)	-0.0396 (0.0172)	-2.31*	-0.1093
AGEH	0.0007 (0.0003)	0.7796 (0.2598)	3.02**	0.0043
AGEW	-0.0009 (0.0003)	-0.7706 (0.2685)	-2.89**	-0.0072
EDUH	0.0001 (0.0004)	0.0285 (0.0796)	0.36	0.00006
EDUW	-0.0001 (0.0004)	-0.0212 (0.0611)	-0.35	-0.0014
INCO	0.00002 (0.00001)	0.1142 (0.1003)	1.14	0.0002
INCOW	-0.00002 (0.0000)	-0.1267 (0.0954)	-1.33	-0.0003
WKFLO	0.0042 (0.0008)	0.4257 (0.0820)	5.29***	0.0419
WAPRESU	0.0028 (0.0016)	0.0482 (0.0280)	1.73*	0.0189
WATEXP	-0.0002 (0.0003)	-0.0160 (0.0200)	-0.80	-0.0018
_CONS	0.0232 (0.011)	-	2.12*	-2.2130
Adjusted R^2 F(10, 177) Predicted (WTP) Theta	= 0.1627 = 4.63*** = 0.0402 = 0.2876** (0.0933)			

Note: Number of Observations = 188. Dependent Variable (OLS) = Maximum WTP. Dependent Variable

(Box-Cox) = ln(Maximum WTP). Figures in parenthesis are standard errors. *Statistically significant at a 10% level. ** Statistically significant at a 5% level
*** Statistically significant at the 1% level. Elasticities are estimated at the mean of the explanatory variables.

Frequency of water supply (WKFLO) and pressure levels (WAPRESU) had negative signs. This is in tandem with apriori expectation as it was expected that individuals who already enjoy regular water supply with good pressure levels would be less willing to pay compared to those who did not have reliable water supply. As expected, income of women was found to exert a positive influence on the probability of WTP. The likelihood ratio statistic is significant at the 1% level indicating that the variables specified significantly influence the probability of WTP.

Table 5: Determinants of the Probability of WTP

Variable	Coefficients.	Elasticities	Z-values
Variable	Coefficients.	Elasticities	Z-values
SEX	0.9632 (0.3943)	0.0867 (0.0358)	2.44*
AGEH	-0.0450 (0.017)	-1.3531 (0.5363)	-2.57*
AGEW	0.0513 (0.0219)	1.2638 (0.5479)	2.34*
EDUH	-0.0376 (0.0247)	-0.2420 (0.1595)	-1.52
EDUW	0.0265 (0.0259)	0.1201 (0.1179)	1.02
INCO	-0.0022 (0.0010)	-0.4145 (0.1971)	-2.13*
INCOW	0.0026 (0.0011)	0.4184 (0.1894)	2.24*
WKFLO	-0.2777 (0.0551)	-0.8035 (0.1675)	-5.04**
WAPRESU	-0.2673 (0.1125)	-0.1294 (0.0549)	-2.38*
WATEXP	0.0324 (0.0231)	0.0686 (0.0488)	1.40
_CONS	1.5452 (0.7663)	-	2.02*
Observations Predicted P (WTP) Log likelihood $\chi^2(10)$	= 200 = 0.5593 = -106.2 = 46.8***		

Note: Figures in parenthesis are standard errors. *Statistically significant at a 10% level.
*** Statistically significant at the 1% level. Elasticities are estimated at the mean of the explanatory variables. Dependent variable = WTP GH Pesewas for a bucket of water,

SUMMARY AND IMPLICATIONS

It is commonplace in informal discussions to hear calls for private sector participation in water delivery in Ghana. Such calls are propelled by the notion that public utilities are not managed efficiently and are in most cases grossly under-priced if not heavily subsidised. Payment of higher prices to water vendors has often been cited as an indication of willingness to pay for improved water delivery. This paper contributes to the debate by assessing households' willingness to pay for improved water supply in Tamale. Contingent valuation methodology is used to solicit WTP bids from respondents. Factors influencing the probability of WTP and the maximum amount households are willing to pay are estimated using the probit model and Box-Cox regression respectively.

The study found that sex, age, income, regularity of water supply and the pressure of flow are factors that influence the probability of WTP. The findings confirm those of Altaf, 1994a, 1994b; Altaf et al, 1993; Griffin et al, 1995; Mcphail, 1994, North and Griffin, 1993; Singh et al, 1993). These studies found that WTP for water supply and sanitation depended on the nature of existing services, levels of satisfaction of the consumer with the existing services and socio-economic factors such as household income, education and affordability. The study also found that income of the household did not significantly influence the maximum they are willing to pay for improved water supply. Maximum WTP is rather influenced more by the prevailing service conditions and socioeconomic factors such as age and education but not income. Since water is a necessity and coupled with the fact that service conditions in Tamale are one of the worst in Ghana, such a trend is logical i.e. households are desperate to solicit improvements in the supply situation. The probit model predicted about 56% of the cases rightly and hence provides fairly reasonable grounds for use in testing the validity of the hypothesis laid down earlier. Prediction based on OLS indicates that the maximum that households are willing to pay for improved water delivery is GH¢ 0.04. It must however be noted that households are wiling to pay (and even more) if the prevailing service conditions are poor. Households that enjoy regular water supply do not value the proposed improvements being traded in the hypothetical market and thus offer lower bids. It is therefore important for policy makers, investors and other actors in water supply to be cautious in their use of prices paid to vendors as proxies of their willingness to pay for water piped into their dwellings. Under the existing water supply system, consumers bear the cost of connecting water into their dwellings, a situation that has possibly denied many poor households access to drinking water. It is important that any water pricing policy takes into account the cost of connection which is borne by the consumer.

CONCLUSION

In general households are willing to pay about 1.7% of their income for reliable water supply. This is less than half the 5% of income that households in Morocco or in

Johannesburg are willing to pay. The reason for the lower bids in Ghana is not far fetched. Water consumers in Ghana have often been shielded from cost-recovery tariffs either through regulations or heavy subsidies since independence, creating the perception that the provision of water is the responsibility of government and it should either be free or come at an extremely low (subsidised) price. This has served to discourage private sector investment in water delivery and with the inability of successive governments to solely finance the needed investment, service conditions continue to deteriorate across the country. Even though there is the need for realistic pricing so as to at least ensure cost recovery, government and other actors in water supply management should be mindful of the direct relationship between access to potable drinking water and the health of the population. Measures must therefore be put in place to ensure that water is not priced out of the reach of the poor or low income households.

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