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# AN ANALYSIS OF DRY SEASON WATER CONSUMPTION PATTERN OF HOUSEHOLDS IN UYO METROPOLIS, NIGERIA

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## ABSTRACT

This paper analyzed the pattern of domestic water consumption among Uyo metropolis households in Akwa Ibom State. A total of 115 households were sampled in Uyo metropolis, the capital city of Akwa Ibom State. Primary data for the study were obtained during 2002 dry season using well – structured questionnaire. The results reveal that though the number of commercial borehole taps by far outnumbers the Akwa Ibom Water company (AKWC) subscribers, there is generally high preference for water from AKWC. The results further show that household income, household size, multiplicity of use, possession of modern facilities and distance of water sources are major domestic water consumption shifters and are fairly inelastic. Also, the study reveals low per caput of 0.0309 cubic metres per person per day. To improve water consumption in Uyo metropolis, the study proffers certain conceivable suggestions, like adequate supervision of drilling of boreholes; introducing metering system etc. In a nut- shell, the study recognized the need for the authority of AKWC to step – up the water supply and distribution situation in the metropolis in particular and the state in general.

**Key words:** Potable water, Dry season, Consumption function, Uyo Metropolis, per caput.

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## INTRODUCTION

Access by all people, at all times, to safe and sufficient fresh water supply is a basic condition for economic well being, happy, healthy and active life. Clean fresh water is essential to sustain life, enable development, and support a healthy environment (IFPRI, 2000). The growing consumption of pipe borne water in recent times is because most streams and rivers have been contaminated by various human and industrial wastes. Because of population and economic growth, households, industries, and agriculture are increasing their water demands, while water sheds and irrigated land are deteriorating and ground and surface water pollution is increasing (IFPRI, 2000). The demand for water is fast outpacing its availability for consumption and the supply of domestic water is seriously constrained by the rising population. Generally, the demand for water use tends to rise with increasing population, urbanization and economic activities. As noted by Ingevall *et al*, (2003), growing populations, rapid urbanization and increasing industrial and agricultural production are combining to increase pressure on this precious and finite resource. Hinrichsen and Robey, (2000) also posited that demand for fresh water is rising rapidly as population grows and becomes more urban. According to IFPRI (2002) population and economic growth in developing countries creates intense competition for water among agricultural, industrial and household uses. Uyo metropolis, which is the capital city of Akwa Ibom State, is faced with the challenge of bridging the gap between the demand and supply of potable water. Despite the increasing demand for potable water, the quantity and quality of potable water supplied to residents of Uyo metropolis is insufficient and erratic. This is due to the inability of the Akwa Ibom Water company (AKWC) to generate and distribute sufficient water. At present, there are only seven pumping stations supplying water to residents of Uyo. This is not sufficient. The quantity of water supplied by the AKWC to the residents is not been sufficient because of leakage in pipelines which results in about twenty (20) percent losses in the course of distribution to the inhabitants of Uyo metropolis. Table 1.0 shows the estimated quantity of water pumped by AKWC between 1993 and 2000, and the per capita water consumption.

**Table 1.0 Yearly Average Quantity of water supplied by AKWC and per capita water consumption.**

Year	Average quantity (cubic metres)	Population of Uyo	Per capita availability per year (litres)	Per capita availability per day (litres)
1993	343,870.83	246,345.75	13,948.87	38.24/person/day
1994	368,481.66	252,211.125	1,460.05	40.03/person/day
1995	267,352.42	258,076.5	10,359.43	28.38/person/day
1996	288,852.92	263,941.875	8,670.58	23.76/person/day
1997	273,720.35	269,607.25	10,145.22	27.80/person/day
1998	365,538.83	275,672.625	13,259.89	36.22/person/day
1999	479,727.42	281,538	17,039.53	46.68/person/day
2000	288,347.52	287,403.375	10,032.85	27.49/person/day
Average				33.6/person/day

Source: Computed From Akwc Records, 2002.

The table shows a declining per caput over the period, except in the cases of 1998 and 1999. The swift rise in the quantities of water pumped and distributed by AKWC between 1998 and 1999 may have been attributed to the replacement of the old water pipes with new ones and extension of pipelines to peri-urban zones or suburbs of the state. However, in 2000, there was a decline in the quantity of water pumped by to 288, 347. 52 cubic metres. This reduction may have been due to the inefficient functioning of the water pumping machines coupled with losses usually encountered through leakages in pipelines at the plant station of AKWC and during daily distribution to consumers. On the per caput level, the quantity of potable water available to Uyo residents from AKWC stood on average at 33. 6 litres per person per day. This figure is much lower than the estimated per capita demand for domestic water of about 120 litres per head day (MANR, 1988). Consequent upon the short fall in the domestic water supply, most inhabitants of Uyo metropolis and its environs depend on water from privately owned boreholes. It is common to see private individuals take advantage of the water insecurity and paucity situation and arbitrarily sink boreholes without getting approval from the relevant agent. Even AKWC most often do not take into consideration the health hazards and implications involved in approving licenses for individuals to sink or drill and operate boreholes, not taking into cognizance, the safety of the water with respect to its untreated source.

Within the past years, studies have been conducted on domestic water consumption. Studies carried out by Morgan *et al* (1973), Guariso *et al* (1981) and Hansen, (1996) reveal that domestic demand/consumption of water is generally price and income inelastic. However, with regard to consumption shifters, World Bank (1993) specified joint influence of socio-economic and demographic characteristics of household, the characteristic of the existing water source and the household attitudes toward water sources on households' willingness to demand and consume potable water. On this, premise specific factors like household size, multiplicity, sources, household income and season have been identified as major demand/consumption shifters (Mu, *et al*, 1990; Danielson, 1979; Chicoine *et al*, 1986; and Briscoe *et al*, 1988).

In the parley of structural modelling, both single and simultaneous equation approaches have been estimated. For instance, chicoine *et al* (1986) through block rate pricing system estimated water demand using a simultaneous equation approach. On the other hand, Howe (1982) and Briscoe, *et al* (1988) estimated demand function for potable water via a single equation approach by utilizing mostly, a transformed Cobb – Douglas functions. In both approaches, the estimated marginal price, income and other shifters elasticities were similar in magnitude and signs. Specifically, this study utilized single equation approach in estimating households' consumption function for potable water.

**METHODS**

**Study Areas and Data Collection:** The study was conducted in Uyo metropolis, the capital of Akwa Ibom State. Uyo Local Government Area comprises 4 clans viz. Offot, Etoi, Oku and Ikono. By NPC (1991), Uyo metropolis has an estimated population of 234,615 people with most inhabitants being civil service oriented. Primary data for the analysis were sourced from a survey carried out during the dry season in year 2002 using well-structured questionnaire. Akwa Ibom Water Company (AKWC) was the source of the secondary data used for the analysis. With a total of 115 households sampled, at least 28 households from each of the four clans in the metropolis were sampled. Each clan was taken as a stratum and to ensure equal representation of the various kinds or residential housing status of households (one room apartment, two room apartment, flat and duplexes) in the sample, 28 households were purposively selected. Dividing the metropolis into four clans was based on the availability of AKWC pumping stations. At present, there are seven functional pumping stations within Uyo metropolis. Since there is uneven distribution of the seven functional pumping stations across the four (4) clans in the metropolis, it is expected that potable water demand by households will differ amongst the various clans within the metropolis. Based on the fact that there is heterogeneity within the clans and homogeneity among the clans, stratified sampling method was chosen. Also, to ensure that people from all the social strata and income levels/groups are adequately and equally represented in the study, purposive sampling method was used to select the respondents.

**Analytical Procedure:** The study employed both exploratory statistics and econometric techniques in the estimation. Specifically, the aggregate household's consumption of potable water is described by a utility function implicitly expressed as:

$$DW = DW (Hi, Hs, Ds, Mu, Mf, Sf)$$

Where DW = Average daily water consumption in litres, Hi = Household income in Naira, Hs = Household size in number, Ds = Distance of water source in metres, Mu = Multiple Usage in number, Mf = Modern facility available in the household in number, Sf = Storage facility as a dummy.

The function is however assumed to be homogenous in the exogenous variables. A household consumption function estimated on cross – sectional data as this one is likely to be bedeviled with the problem of spurious consumption curves explained by cost – based price setting rules. However, due to limitation of data as to warrant use of time series data, the authors depended on economic theories, economics and statistical criteria in making choice of appropriate functional form to fit the data set. On this premise, four functional forms were fitted. These include linear, exponential, semi –log and double –log functions.

**RESULTS AND DISCUSSIONS**

**Empirical Results:** The static theoretically assumed model is estimated through OLS to yield unbiased estimators. The empirical results are presented below:

**a) Linear Model**

$$Q = -65.267 - 3.87Hi + 14.25 Hs + 2.76 Ds + 17.14 Mu + 15.35Mf + 31.02 Sf$$

(48.97) (2.90) (3.29)\*\*\* (1.28)\*\* (11.72) (17.80) (7.97)\*\*\*

$R^2 = 0.389$ ; F ratio = 11.459

**b) Exponential model**

$$LNQ = 3.425 + 0.0040 H_1 + 0.123 H_s + 10.0068 D_s + 0.074 Mu + 0.186Mf + 0.183 Sf$$

(0.28)\*\*\* (0.003) (0.019)\*\*\* (0.007)\*\*\* (0.068) (0.103)\* (0.046)\*\*\*

$R^2 = 0.498$ ; F ratio = 25.794

**c) Double – Log model**

$$Ln Q = 1.062 + 0.248 Ln H_1 + 0.390 Ln H_s - 0.145 Ln D_s + 0.130 Ln Mu$$

(0.715) (0.066)\*\*\* (0.072)\*\*\*\* (0.079)\* (0.021)\*\*\*

$$+ 0.289 Ln Mf + 0.057 Ln Sf$$

(0.113)\*\* (0.094)

$R^2 = 0.589$ ; F ratio = 25.794

**d) Semi – Log Model**

$$Q = -321.429 + 25.230 Ln H_1 + 42.918 Ln H_s + 37.413 Ln D_s + 40.885LnMu$$

(132.822)\*\* (12.311)\*\* (13.313)\*\*\* (14.726)\*\*\* (37.363)

$$+ 58.729 Ln Mf + 0.930 Ln Sf$$

(20.970)\*\*\* (17.534)

$R^2 = 0.425$ ; F ratio = 13.281

From the estimated models, log-linear model produced parsimonious coefficients across the regressands. As such, it became the lead equation that explicitly describes the consumption function of domestic water in Uyo metropolis. This is in line with other previous studies on demand and consumption of potable water (see Frankel et al, 1973; Howe, 1982; Frederick, 1993; Hansen, 1996). The estimated equation shows that exception of storage facility, all other variables aptly contributed to consumption of potable water in Uyo metropolis. In terms of responsiveness of the estimated function, the signs and magnitudes of the significant coefficients imply inelastic nature of the factors with respect to the quantity of water consumed by Uyo residents.

**Descriptive Analysis:** Tables 2 and 3 show the available sources of water in the metropolis and the degree of household preference respectively.

**Table 2: Available Sources Of Water In Uyo Metropolis**

Sources	Oku		Ikono-Uyo		Offot		Etoi		Overall
	frequency	Percentage	frequency	Percentage	frequency	Percentage	frequency	Percentage	Percentage
AKWC	26	41	17	46	25	41	23	43	43
Commercial Borehole	31	49	18	49	31	51	28	53	51
Tanker/Vendor	1	2	2	5	4	6	2	4	4
Stream	5	0	0	0	1	2	0	0	2

SOURCE: Field Survey, 2002

**Table 3: Level Of Household Preference Of The Different Water Sources In Uyo Metropolis**

Sources	Oku		Ikono-Uyo		Offot		Etoi		Overall
	frequency	Percentage	frequency	Percentage	frequency	Percentage	frequency	Percentage	Percentage
AKWC	20	61	17	85	22	69	16	16	69
Commercial Borehole	9	27	1	5	9	28	9	35	24
Tanker/Vendor	1	3	2	10	1	3	1	4	5
Stream	3	9	0	0	0	0	0	0	2

SOURCES: Field Survey, 2002.

Table 2 shows that there are more commercial boreholes than AKWC functional subscribers within Uyo Capital City. The abundance of commercial borehole in Uyo invariably suggests that water from commercial borehole is the most readily available source of water to households in Uyo metropolis. In table 2, though, commercial borehole is closely followed by AkWC taps in terms of ranking, but table 3 shows that households in Uyo metropolis prefer water from AKWC to other sources of water. The reason for the high preference according to the respondents is the quality of water in terms of treated source. The variability in the available sources of water and the level of preference by households with respect to the types of sources of water available in Uyo metropolis

have some influence on the quantity of domestic water available per person per day. Table 4 shows that, in Uyo metropolis, the quantity of water per day available to each person is about 30.9 litres (0.0309 cubic metres per person per day). The figure shown on table 4 reveals that the average quantity of water available per person per day of 30.9 liters is grossly below the recommended quantity of 120 litres per person per day.

**Table 4: Per Caput Water Available For Consumption In Uyo Metropolis**

LOCATION (CLAN)	QUANTITY (LITRES)	HOUSEHOLDS SIZE	PER CAPUT (LITRES/DAY)
Oku	3,450	115	30.0
Ikono	2,695	86	31.3
Offot	5,955	177	33.6
Etoi	4,400	153	28.7
Average	4,125	132.75	30.9

*Source: Field Survey, 2002.*

The Patronage given to commercial borehole operators who charge higher average pump price per litre than the average tariff charged by AKWC could account for the low per caput water consumption. In strict sense, the amount spent in consuming domestic water from commercial borehole is by far higher compared to average amount expended as tariff to AKWC in consuming domestic water. Borehole operators charge average of N3.00 per 20 litres of domestic water. This means that for a household that consumes about 100 litres of domestic water daily, N666.87 will be spent on domestic water consumption monthly, whereas AkWC charges about N160 per residential quarters per month. This may also be one of the fundamental reasons for high preferential value of water from AkWC. The problem facing residents in the metropolis is the non – functioning of AKWC taps thereby causing divergence to commercial borehole operators who have been patronized by residents despite their higher litres prices compared to AKWC. Aside from their high unit charge, the low capacity of the overhead surface reservoir tanks and constant disruption of power supply by National Electric Power Authority (NEPA) impedes the ability of commercial boreholes operators to increase the daily quantity of water supply. This shortcoming may also account for the low per caput water consumption within the metropolis.

**Summary and Conclusion:** The study has highlighted a number of factors, which affect the consumption pattern in a well-behaved function. It is however, revealed from the study that though, there are more commercial boreholes than AKWC subscribers within the metropolis, households still prefer consuming water from AKWC taps to commercial boreholes due to a number of reasons ranging from safety and good quality of water to low water tariff. The break down and non-functioning of AKWC taps has constrained households from enjoying the treated water from AKWC. Since households demand for water is insatiable, residents have resorted to patronizing private boreholes for their daily water requirement. With a low per caput water of 0.0309 cubic metres per person per day available in the metropolis, there is a compelling need for efforts to be geared by the relevant authorities towards providing appropriate intervention measures to step-up the water supply situation in the metropolis. Measures suggested include the introduction of a metering system; replacement of old pipes with new ones to reduce leakage; privatization of AKWC; strict supervision of boreholes before drilling to prevent indiscriminate drilling and to ensure suitability; provision of functional public taps; and creation of more pumping station and treatment plant.

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