

Willingness to Pay for Improved Water Supplies in Onitsha, Nigeria

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This is a case study of water vending and willingness to pay (WTP) for water in Onitsha, Nigeria (Whittington, Lauria and Mu, 1991). The study illustrates the use of two approaches to estimate WTP for domestic water supplies. Information on water purchases is used to define the private distribution system and revealed demand for potable water. In addition, a contingent valuation survey is used in a relatively simple, rapid manner to estimate household water demand behaviour. The data collected in both surveys provides policy-relevant information to water utility managers and can be used to help local water authorities make more informed decisions about how much to charge their customers.

Onitsha is a rapidly growing city of about 100,000 households located in Southern Nigeria. It is an important market town, and much of the population is engaged in trading. Annual average household income is probably N7,000, or about US\$ 1,630,¹ and average household size is 6–7 persons. One-third to one-half of the population of Onitsha lives in squatter settlements in one- and two-room tenements, without piped water or indoor toilets. At the time of this study, only about 8,000 households had functioning water connections to the public water supply system. In Onitsha, piped water is a public service that the local water authority provides free or for a nominal fee. Since water supply is so heavily subsidized, the water authority does not have sufficient resources to expand water service to more households.

WATER VENDING SURVEY

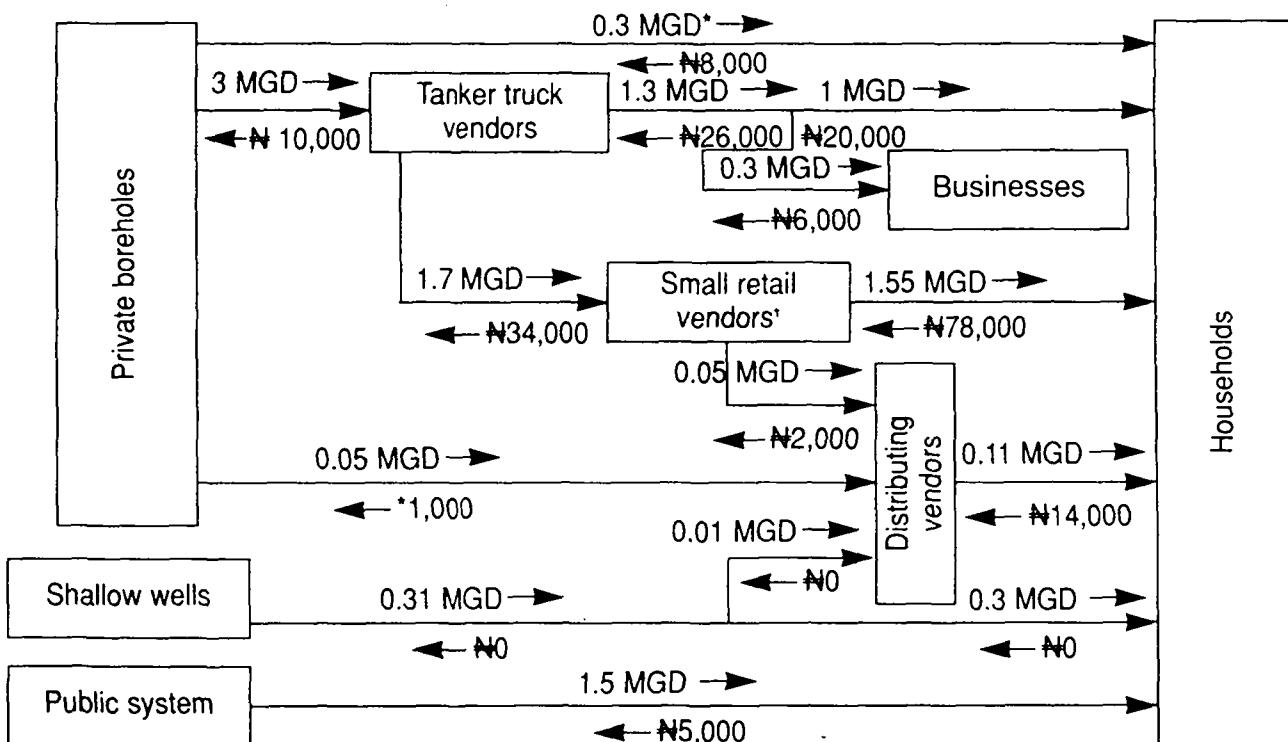
As a result of the inadequate coverage by the public water company, Onitsha has a highly developed and well functioning water vending system which has been created and is operated by the private sector. The vending system consists of private boreholes, tanker trucks, small retail vendors, and distributing vendors. Households can purchase water from several points in the system. If they live in an area accessible to tanker trucks, they can purchase a storage tank and buy water directly from a tanker truck. If they are willing to haul water by the bucket to their homes, they can buy it from a private borehole or from a small retail vendor. If the value they place on their time is high, they can have water delivered directly to their door by a distributing vendor.

Four categories of people were interviewed for the study: 12 borehole managers, 31 tanker truck drivers, 34 distributing vendors, and 235 households. Also, enumerators were placed on tanker trucks and rode with the driver all day,

¹ In August 1987, US\$ 1.00 = N4.3.

recording in a log book the time required to fill the truck at the borehole, the number of sales, the prices charged for different quantities of water, the status of each customer (resident or business), and the number of customers who would resell the water. Because of the uncertainty introduced by the lack of a well-defined sample frame, the interviews were designed to include as many cross-checks on the data as possible.

Table 38 summarizes the prices charged by water vendors at different stages of the vending distribution system. A household which purchases its water from a distributing vendor pays about eight times more per gallon than a household which buys large volumes from a tanker truck. In turn, both are much more expensive than the water provided by the public utility, the Anambra State Water Corporation, ASWC. Water vending transactions for Onitsha during the dry season are summarized in Figure 22. In the dry season households are paying on average a total of about N120,000 per day to the private water vending industry. In the rainy season the distribution system is similar, with the addition of 2.3 MGD from rain water and major increases in public supplies; as a result households purchase much less water from private vendors and only spend about N51,000 per day for water. During both seasons the public utility only manages to collect about N5,000 per day.



*MGD = Millions of gallons of water per day.

*Water input is not equal to water output because a small amount of water is consumed by small retail vendors themselves.

Figure 22 Money and Water Transaction in Onitsha, Nigeria (per day) – dry season
 Source: Whittington, D., D. Lauria and X. Mu, 'A Study of Water Vending and Willingness to Pay for Water in Onitsha, Nigeria.' *World Development*, Vol. 19, No. 2/3, pp 179–198, 1991.

Improved Water Supplies in Onitsha

Table 38 Average Prices Charged by Vendors in Onitsha, Nigeria
(naira per gallon)

Prices charged by:	<i>Rainy season</i>	<i>Dry Season</i>
<i>Private boreholes</i>		
a. to tanker trucks	0.003	0.004
b. to individuals	0.01	0.02
<i>Tanker trucks, to individuals/businesses</i>		
a. per 1,000 gallons	0.014	0.018
b. per drum	0.04	0.04
<i>Small retail vendors</i>		
a. to individuals	0.04	0.05
<i>Distributing vendors</i>		
a. to individuals	0.12	0.13

Source: Whittington, D., D. Lauria and X. Mu, 'A Study of Water Vending and Willingness to Pay for Water in Onitsha, Nigeria.' *World Development*, Vol. 19, No. 2/3, pp 179–198, 1991.

CONTINGENT VALUATION, WILLINGNESS-TO-PAY SURVEY

Following interviews with water vendors, the enumerators completed 235 in-depth household interviews throughout the city. The household interviews included questions about socioeconomic characteristics, water-use practices, willingness to pay for water, housing characteristics and household assets, and occupation and monthly cash income. The focus of the questionnaire was on the estimation of the households' willingness to pay for improved water supplies. The enumerator read each respondent a carefully worded statement that was designed to set the scene for a 'bidding game' in which respondents would tell whether they would be willing to pay certain specified amounts for water under certain circumstances. The bidding game consisted of asking each respondent whether he or she would like to be connected to the New Onitsha Water Scheme and have a meter if the price of water were N1 per drum.² If the respondent answered 'yes' to a price of N1 per drum, then the enumerator raised the price to N2 per drum, and again asked whether the respondent would like to have the metered connection. If the respondent answered 'no' to a price of N2 per drum, the enumerator lowered the price to N1.5 per drum and again asked the respondent whether he would like to have a metered connection. After this question was answered, the enumerator stopped the bidding game.

Figure 23 presents a frequency distribution of the households' willingness-to-pay bids. The price of water charged by the vendors was effectively an upper

² 45 gallons

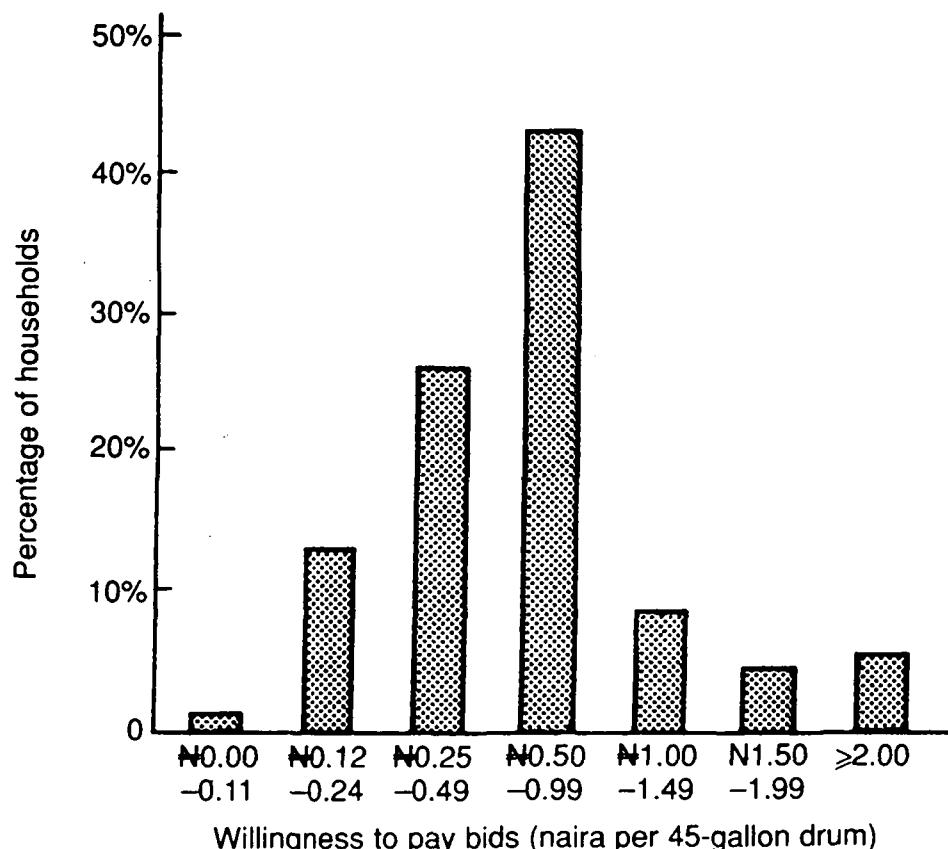


Figure 23 Frequency Distribution of Willingness-to-pay Bids (Onitsha, Nigeria)
 Source: Whittington, D., D. Lauria and X. Mu, 'A Study of Water Vending and Willingness to Pay for Water in Onitsha, Nigeria.' *World Development*, Vol. 19, No. 2/3, pp 179–198, 1991.

bound on the amount respondents would bid for water; respondents were not willing to pay more than the price of water charged by vendors because the water provided by the vendors was perceived to be of good quality and readily available. The bidding game revealed that respondents would pay substantial amounts for water from a piped distribution system. This confirmed survey results on current water use practices; in addition, the study of water vending indicated households were paying significant amounts for water. In the dry season 49 percent of the sample households report spending 5 percent or more of their income on water. In the rainy season 25 percent of the households still spent 5 percent or more of their income for water.

The poor pay a larger relative portion of their income for water in Onitsha. Households making less than N500 per month (58 percent of the total sample) are estimated to pay 18 percent of their income on water during the dry season. These results are consistent with those from the water vending study. For example, if the average family of six purchased all of its water from a small retail vendor, this would entail a monthly expenditure on water of N72. If this household had two wage earners making N200 per month each, the monthly expenditure on water of N72 would represent 18 percent of monthly household income.

CONCLUSIONS

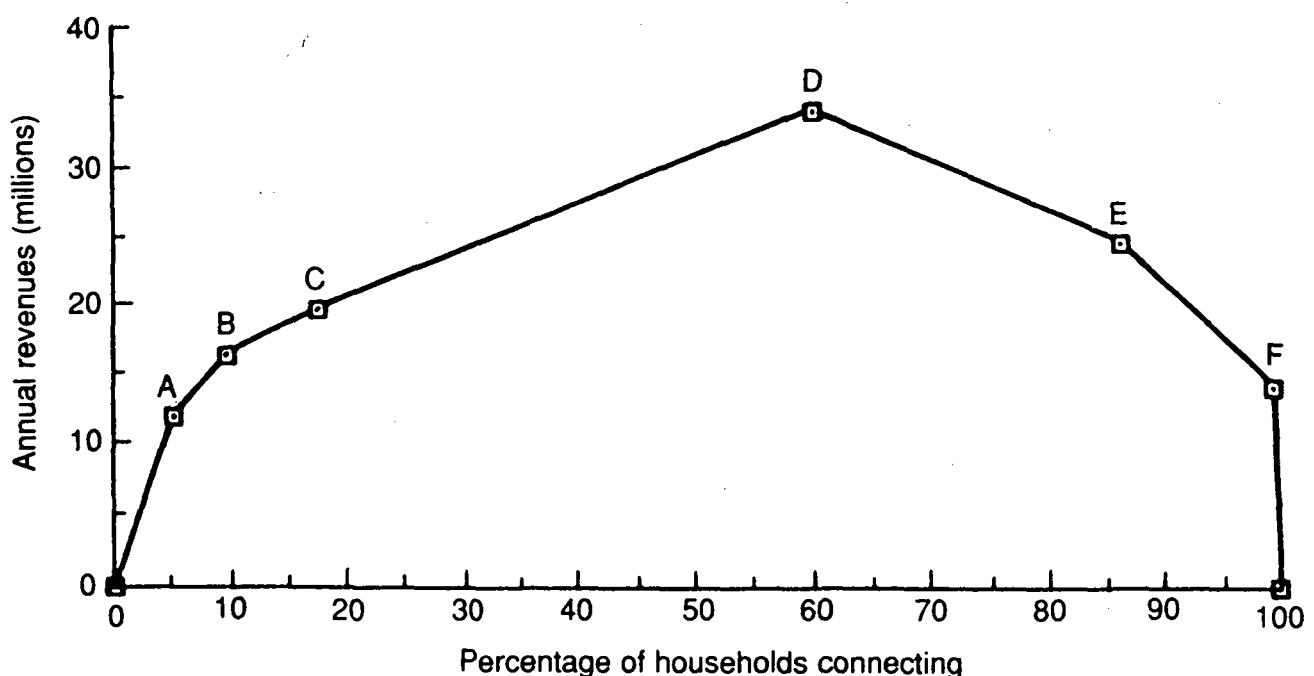
In the answers to the questions in the bidding game, each respondent expressed his or her preferences as to whether to connect to the piped distribution system as specified prices. Figure 24 presents the percentage of sample households which would choose to connect at different prices of water. At a price of N3 per 1000 gallons, 99 percent of respondents indicated that their households would choose to connect to the system, while at a price of N6 per 1000 gallons, 86 percent of the respondents reported that their households would connect. Based on the relationship between the price of water and the percentage of households that would connect to the system, it is possible to calculate the annual revenues associated with different water prices.³ This information can be used to illustrate the tradeoff that the water authority faces between financial and social objectives (Figure 25). Moving from point A to point D, both revenue and the percentage of households desiring connections increase. The 'north-east' portion of the curve (between points D and F) characterizes the tradeoffs between the water authority's financial and social objectives, and presents the management of the water authority with a hard set of financial choices.

The calculations of the relationships between the price of water, the percentage of households desiring connections, and annual revenues should only be considered indicative of the general magnitude of the tradeoffs facing the water authority, and it is important to emphasize their limitations. All of the relationships depend on the accuracy and validity of WTP bids. Also, these calculations assume that the frequency distribution of WTP bids of the sample respondent are representative of the entire population of Onitsha.

The data collected from the contingent valuation survey seem consistent with the data from the water vending surveys, and the results appear sufficiently accurate to be useful for decision making. Prices on the order of N8–10 per 1,000 gallons would be affordable by most households in Onitsha, and would result in a substantial increase in the water authority's revenues. This price would still be much less than the per gallon prices charged by private vendors (although consumption per household would definitely increase with the availability of piped water).⁴

3 It is possible, of course, that respondents may have failed to give reliable, truthful answers to the willingness-to-pay questions. For example, respondents may have bid low in the hope of influencing the water authority to set a low price for water, or they may have bid high, thinking that a high bid might convince the water authority to extend service into their neighbourhood sooner.

4 In order to increase its market share, the water authority must not only offer a lower-priced product than vendors, but also provide a better product in terms of both water quality and reliable service. This is because the household surveys indicate that people perceive the water from tanker trucks and small retail vendors to be of better quality than the water from the old public system.



*Assumes average water use of 20 gallons per capita per day

Figure 24 Percentage of Households Connecting to Piped Water System vs. Annual Revenues of Water Utility (millions of naira). Onitsha, Nigeria.

Source: Whittington, D., D. Lauria and X. Mu, 'A Study of Water Vending and Willingness to Pay for Water in Onitsha, Nigeria.' *World Development*, Vol. 19, No. 2/3, pp 179-198, 1991.

This study demonstrates that the willingness for households to pay for improved water services in Onitsha is surprisingly high. On an annual basis, households in Onitsha pay water vendors over twice the operation and maintenance costs of a piped distribution system. This indicates that households can afford to pay for a connection to a piped water system which charges full economic costs of water. Because they will receive more water at a lower price, these households will be better off as a result of connecting to the system than they would be buying water from vendors.

Source:

Whittington, D., D. Lauria and X. Mu, 'A Study of Water Vending and Willingness to Pay for Water in Onitsha, Nigeria.' *World Development*, Vol. 19, No. 2/3, pp 179-198, 1991.