E C O N O M I C S B U L L E T I N

Who pays the most for water? Alternative providers and service costs in Niger

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Abstract

Despite water being subsidized in most developing countries, poorer households end up paying more per unit of consumption because they are generally not connected to the network and, as a result, are forced to buy water from public fountains or street vendors at a higher price. In this note we use a unique survey of Niamey households including information on water consumption and expenditure from different sources to estimate unit costs of service provision for water, looking at differences in costs according to both service provider and household poverty status. Our results indicate that the poor pay much higher unit prices for the water they consume than better off households who are connected to the network.

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1. Introduction

Achieving higher levels of access to basic infrastructure services such as piped water and electricity is a key objective of many governments in developing countries. Basic infrastructure services help in improving human development indicators related to education and health (for a review of some of the evidence, see for example Fay et al., 2005). However, infrastructure services are costly, and many households in sub-Saharan Africa have difficulties to afford the services. This is why water and electricity are subsidized in most countries (Komives et al., 2005, 2007) The subsidies are typically implemented through inverted block tariff structures, whereby households who consume lower amounts of water or electricity pay less per kWh or cubic meter of water than households who consume more. Yet the subsidies are often not well targeted to the poor because the poor tend not to be connected to the electricity or water network to the same extent as other groups in the population, not only because they may live far away from existing networks, but also because connection costs tend to be high (see for example Kayaga and Franceys, 2007, on Uganda).[1]

Paradoxically then, we may have situations whereby better off households who are connected to the network pay less per unit of consumption than poorer households without access who, in the case of water, need to rely on public fountains or street vendors. Even when public fountains are subsidized by benefiting from a low tariff, as is the case in Niger, the lack of regulatory oversight on the operators of the fountains is such that households using the fountains end up paying high unit prices for their consumption. The fact that the poor may have to pay more for water is often alluded to, but few studies have been able to use detailed survey data to demonstrate that this is indeed the case. There is some work on unit costs of alternative service providers (see Kariuki and Schwartz, 2005), but the link with the poverty or wealth status of households is rarely made. This is because in typical household surveys, the questionnaires are not detailed enough in order to measure unit costs for households using different types of service providers. The contribution of this note is to estimate in detail the unit costs of service provision for water not only by service provider, but also by household poverty or wealth status in Niger.

Niger is one of the poorest countries in the world. Access rates to piped water have remained very low. According to Demographic and Health Survey data, only 10 percent of households had access to piped water within their residence in 1992, while the access to electricity was 11 percent. By 1998, access rates had fallen to 8 percent for water, and 10 percent for electricity, due to high levels of population growth and limited investments to expand the utility networks. Niger's urban water network covers 52 urban centers and SPEN (*Société de Patrimoine de l'Eau du Niger*) is in charge of the management of water in urban areas as a national resource.[2] The price of water for residential customers is governed by a classic inverted block tariff structure, so that the prices depend on the level of consumption of the household, with lower amounts charged when consumption is low.[3] The operators of public fountains

[1] On the targeting and impact of subsidies for connection or consumption costs, see among others Whittington (1992), Maddock and Castano (1991), Estache et al. (2002), Gomez-Lobo and Contreras (2003), Angel-Urdinola et al. (2006), and Angel-Urdinola and Wodon (2007). On tariff reforms, see Boland and Whittington (2000).

[2] For historical reasons, a few small centers that are not classified as urban centers are also included in the network. As for the rural system, the water distribution is managed by the Ministère de l'Hydraulique et de l'Environnement.

[3] In November 2000 for example, the price per cubic meter was FCFA 115 for consumption below 15 cubic meter, FCFA 208 for consumption between 16 and 40 cubic meter, FCFA 312 for consumption between 41 and 75 cubic meter, and FCFA 349 for consumption above 75 cubic meter. Prices have increased since then, but the structure of the tariff has remained basically the same.

benefit from the price applied to the lowest consumption block. For households connected to the network, there is also a small monthly fee that must be paid for renting the meter.

In this note we use a 1998 household survey on access to water and water consumption in Niamey, the capital city of Niger, to assess the prices paid by households depending on the type of service provider used. Section 2 provides our results, and a brief conclusion with policy implications follows.

2. Data and Results

This section relies on household survey data collected in June-July 1998 in Niamey by GOPA-Consultants under contract for Niger's Privatization Committee (*Cellule de Coordination du Programme de Privatisation*). The dataset includes observations on 533 households and is representative of the population of Niamey.[4] The questionnaire, to be answered by the head of the household or his/her spouse, included questions on the sources of water used by the household, the consumption of water from each source, the prices paid, and the level of satisfaction with water services. Opinions about priorities (where new public investments should be made) were also asked. A separate section included questions aimed at estimating the price elasticity of demand and eventually the willingness to pay for water. Finally, the questionnaire included questions about household composition and socio-economic characteristics, including the education level of the head and the spouse, the number of people employed in each of eight different occupations and in four different states other than employed (beggers, *marabouts*, people receiving aid, and unemployed), whether children are working, the structural characteristics of the house (quality of the door, roof, walls, etc.), the housing tenure status of the household, the amount of the rent paid if the household is a tenant, the ownership and number of items owned of several consumer durables (television, radio, fridge, stove, air conditioning unit, chairs, sofa, car, bicycle, land, animals, etc.), and the monthly cash income of the household.

Our objective is to estimate the prices paid for water for different service providers, and also to provide basic statistics on consumption levels and prices paid according to the level of well-being of households. To conduct this analysis, we categorize households according to their level of wealth. Even though the survey questionnaire includes data on monthly cash income there were many missing values (for about 50 percent of the sample). Moreover, it is well known that income is often poorly measured in such surveys and is not necessarily the most appropriate measure of well-being in very low income countries. While we could (and did) impute household income for missing values based on a regression for the logarithm of per adult equivalent income using a range of predictors available in the survey, we present most of our results according to an index of wealth obtained using factorial analysis, as has been done in recent years in a number of countries. For this purpose, we use information collected on all households about the characteristics of their dwelling and define variables indicating 'good quality' items (e.g. good quality doors, walls, roof, windows). We also use data on the ownership (and on the number of items owned) for various goods, as well as a few other socio-economic status variables.[5] Note

[4] For details on the implementation of the survey and the characteristics of the sample, see Lauria and Kolb (1998).

[5] The list of variables included in the factorial analysis is as follows: number of rooms; good quality walls (cement, semi-solid mat, wood); good quality roof (concrete, wood and mud, tiles); good quality door (wood or metal); gas or electric hot plate or cooker used to cook; windows have glass panes; house has electricity; ownership and number of following items: house, car, TV, motorbike, boat, telephone, VRC, sewing machine, land, chickens, cows, fridge, fan, kerosene stove, radio, A/C, sofa, chairs, improved hall (*foyer amélioré*).

that we did not include among the items used for the computation of the index of wealth any information about access to water, or the availability of a toilet or bath because these variables are clearly endogenous (it is precisely the access to water, and to a lower extent the priorities regarding access to sanitation that we want to study in this note.)

The factorial analysis allows us to compute for each household an index of wealth. Individuals are then ranked based on their household's index of wealth and grouped in quintiles. Table 1 shows the access to piped water by quintiles of wealth. Overall, more than 55 percent of the sample does not have access to piped water in their dwelling, while 21 percent share the connection with other households living in the same dwelling, and 24 percent of individuals live in households with a private connection of their own. The existence of a private connection in the household is strongly correlated with wealth – while among the poorest 20 percent nobody has a private connection, in the top quintile some 65 percent of individuals have such a connection. The last column in Table 1 shows how connected households are distributed across quintiles. Out of the 55 percent of individuals living in households with no connection, only 2.8 percent are in the top quintile, while 38 percent are in the bottom quintile. It can also be shown that the percentage of individuals with a flush toilet or a private shower or bath in their dwelling is much lower (8 percent have a flush toilet and 13 percent a private shower or bath, with concentration of access in the top quintile).

Table 2 shows the households' main sources of water by quintile of wealth.[6] The table distinguishes between households who have a private connection and those who share one, and also between those who sell (or give for free) part of their water to a neighbor and those who do not. As it was reported in Table 1, 45 percent of individuals are in households with access to piped water in the sample. Slightly more than one third of these individuals, concentrated in the top two quintiles of the distribution, live in households who sell part of their water. After piped water, the second most important source of water are street vendors (*porteurs d'eau*). More than 31 percent of the sample indicate that this is their main source of water. Provision from vendors is especially important for households in the three bottom quintiles (accounting for access of about 40 percent of all individuals in this part of the distribution). The very poor (those in the bottom quintile of wealth) rely heavily also on water from the public fountain (38 percent). The use of fountain water as the main source declines very rapidly with the level of wealth, so that almost no household in the top of the distribution relies on this source. Although water bought from the neighbors does not represent a substantial share of all sources of water (about 4 percent), 10 percent of the individuals in the bottom of the distribution use this source as their main option. Finally more than 10 percent of the very poor use unsafe water sources (rivers and wells).

A few important characteristics of the households using each alternative source of water are shown in Table 3. Individuals sharing a connection to the water network live in dwellings with on average about four households living together or sharing the connection. This implies that for these households, even if each household's consumption is low, the total price paid for water may be higher because the total consumption of the households living together or using the same meter is higher. On the other hand, the majority of households sharing a connection tend to be of relatively small size (less than seven members, which in the case of Niger is not a large household size). Households connected to the water network, in particularly those with an

[6] A household's provision of water can be obtained from more than one source – this is often the case for households without a connection to piped water. The household is asked to indicate which is its *main* source, realistically the source where it obtains the largest quantity of water, and this is what is tabulated in Table 2.

exclusive connection, are markedly richer than the others. This is true when measuring wealth using either factorial analysis (as shown with the wealth index in the 3rd column of Table 3) or the predicted household income (as shown in the last column of Table 3).[7] The poorest households are those who are getting water from the public fountains as well as rivers and wells.

Table 4 shows the average prices and the average consumption of water from each source. We derive the prices per cubic meter by dividing total household expenditure for water for each source by the corresponding level of consumption (each household is asked about its water consumption and the total amount paid separately by source). This is the amount we show in the first column. We derive also an alternative price by dividing the total amount spent by the household to buy water from any source by the total household consumption of water of any source – this is the amount we report in the second column; these prices do not differ much from those reported in the first column. We also compute the average household consumption of water from any source, in cubic meter per month (3rd column) and in liters per day (5th column), as well as the average household per capita consumption in cubic meter per month (4th column). The results are computed and shown separately by main source of water. Although many households use more than one source of water (especially those not connected to the network) the main source of water generally represents by far the largest percentage of water bought by the household (as the similarity between the two sets of prices reported in columns 1 and 2 of Table 4 suggests).

Table 4 shows that, at 182 FCFA per cubic meter on average, piped water is by far the cheapest source among all alternative options. Despite the fact that the water sold at the fountain benefits from the social tariff for the fountain operator or *concessionaire* (i.e., the operator pays the same social tariff as that paid by households who consume less than 15 m^3), the actual price paid by consumers of fountain water is much higher – about 3 times as high as the average price paid for piped water, not all of which is sold at the social tariff.[8] Even more expensive is a cubic meter of water bought from street vendors (*porteurs d'eau*), at an average of five times more than the mean cost of piped water. While we do not have data on the operating costs of the private operators of the public fountains, the very high prices paid by those households using the fountains suggest that these prices are likely to more than compensate the operators for the costs incurred and allow for high profits as well.

The differences in prices are associated with large differences in the consumption levels. The consumption of piped water (both per household and per capita) for households that are connected to the network is about five times higher than the consumption of water from other sources. On average, households that do not have a connection to the network consume much less than 15 m^3/month, but they have to pay a much higher price for the water that they consume. The low level of consumption of this group of households is probably due in part to the high price they face. The result is that many among the poor have to pay more for water than the better off that are connected to the network, although their level of consumption is much lower. Some among the better off who are able to pay for a connection to the water network while benefiting from a subsidized price (for the first 15 m^3 sold at the social tariff, and even for higher

[7] Household income was estimated based on the results obtained from an OLS regression of log-household income on a set of explanatory variables for the sub-group of households with non-missing income (271 observations out of 533). The regressors were chosen based on the 'best fit' criterion – our aim here is not to explain the determinants of income, but to find a good predicted value.

[8] The agent of the public fountain is required to pay the VAT over all water bought, while the first 15 cubic meters per month of water sold through private connection are exempt from VAT. Even so the price per cubic meter of water from the public fountain is remarkably high, suggesting the existence of large margins for the fountain agent.

brackets of consumption) even may make a profit by selling part of their water to households who are not connected and tend to be poorer. Table 5 shows the average price paid for per cubic meter of water and the consumption levels by quintiles. The highest price is paid by households in the bottom quintile (645 FCFA/m^3); these households have also the lowest consumption level (6.3 m^3/month). The unit price steadily decreases with the level of wealth while consumption increases.

Interestingly, additional data in the survey suggest that the marked differences in the price paid and the level of consumption along the distribution of wealth are not associated with similarly marked differences in satisfaction. The share of richer individuals[9] (in the top quintile) declaring being fully satisfied with the quantity and quality of the water is higher than the corresponding share in the poorer quintiles, but the percentage of those who declare to be fully satisfied is not much lower in the bottom of the distribution and certainly not as low as we could have expected based on the analysis presented in the previous tables. Ironically, only 10 percent of the richest individuals declare being fully satisfied with the price per m^3 they pay for their water, versus 31 percent among the poorest. While these results suggest that households' perceptions about specific aspects of water provision are to some extent inconsistent with the actual opportunities they face, the levels of overall satisfaction seem to be more coherent with these opportunities. Indeed, more than 50 percent of individuals in the top two quintiles declare that their level of overall satisfaction with water is good, and only 5 percent is poorly satisfied. In the bottom quintile, these percentages are 33 and 12 percent. Along the distribution, the percentage of those who are fully satisfied increases with wealth, and the percentage of those who are poorly satisfied decreases monotonically.

Finally, Table 6 reveals that improving water supply is a big concern among the poor. About two thirds of those in the two bottom quintiles indicate that the first priority of the Government of Niger (among a list of options including also improving sanitation, storm water drainage, disposal of solid waste, health system, and education system) should be to improve water supply. In the top quintile this percentage is much lower, at about 39 percent. Yet improvement of the water supply is the top priority in each quintile group, indicating the importance of the issue (although answers to this type of questions often depend on the ways questions are asked, and the options provided for the answers themselves).

3. Conclusions

Access to piped water in Niamey is uneven across quintiles of wealth, the rich being much more likely to be connected to the water network than the poor. Moreover, households who are connected to the network pay a much lower price per cubic meter of water. This means that the poor have to pay much higher unit prices for the water they consume than better off households. At least two types of policy interventions may help to remedy this situation. First, in the medium term, an expansion of the network would lead to help to have more households benefiting from access, and it can be shown that this would probably be a more pro-poor policy than the current practice of subsidizing the consumption of households that are already connected. Second, better regulatory oversight of the prices requested at public fountains could help in reducing the very high prices that users must pay in order to get their water there, while also probably leading to

[9] While questions about satisfaction on quantity and quality of water are only asked to the household head, the results presented in Table 6 are weighted by the number of individuals living in the household.

lower prices from street vendors, who also purchase their water from public fountains. Despite the fact that the water sold at public fountains is subsidized by the water utility, the prices requested by the private operators of these fountains are very high, and probably well above what would be required in order for the operators to make a profit.

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Table 1 – Connection to the piped water system, by quintile of wealth, Niamey 1998 (% of individuals)

Quintile group	No connection	Shared connection	Private Connection	Total	Distribution of non-connected across quintiles
1 (poorest)	97.1	2.9	0.0	100.0	37.9
2	70.2	18.3	11.5	100.0	24.4
3	56.7	27.9	15.4	100.0	21.0
4	39.4	30.8	29.8	100.0	12.9
5 (richest)	11.5	24.0	64.4	100.0	2.8
All	55.1	20.7	24.2	100.0	100.0

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998. 'Wealth' index computed using factor analysis. Included in the index are number of rooms in the house; quality of roof, doors, and walls; presence of glass windows; number of items owned by the household: houses, cars, TV, motorbike, boats, telephone, video, sewing machines, fridge, electric cooker or stove, fan, kerosene stove, radio, AC, sofa, chair, hall, land, chickens, cows..

Table 2 - Main source of water, by quintile of wealth, Niamey 1998 (% of individuals)

	Quintile group					
	1 (poorest)	2	3	4	5 (richest)	All
Piped water	2.9	29.8	43.3	60.6	88.5	44.9
Private connection, exclusive, not sold	*0.0*	*10.6*	*11.5*	*20.4*	*36.5*	*15.8*
Private connection, exclusive, sold	*0.0*	*1.0*	*3.9*	*9.7*	*27.9*	*8.5*
Private connection, shared, not sold	*1.0*	*9.6*	*19.2*	*17.5*	*13.5*	*12.1*
Private connection, shared, sold	*1.9*	*8.7*	*8.7*	*12.6*	*10.6*	*8.5*
Fountain	38.1	19.2	10.6	5.8	1.0	15.0
Vendors	39.1	42.3	39.4	26.9	7.7	31.1
Neighbors	9.5	3.9	2.9	4.8	1.0	4.4
Wells/river	10.5	4.8	3.9	1.9	1.9	4.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998.

Table 3 - Household characteristics by main source of water, Niamey 1998

	Average number of households in the concession	Average household size	Average index of wealth	Average estimated per adult equivalent income (FCFA/month)
Piped water	2.41	9.14	2.89	17154
Private connection, exclusive, not sold	*1.26*	*10.13*	*3.11*	*16815*
Private connection, exclusive, sold	*1.27*	*10.91*	*3.51*	*20333*
Private connection, shared, not sold	*3.98*	*6.56*	*2.49*	*17677*
Private connection, shared, sold	*3.43*	*9.25*	*2.45*	*13905*
Fountain	2.85	7.47	1.59	7332
Vendors	3.34	8.00	1.88	9414
Neighbors	2.21	7.92	1.75	8866
Wells/river	2.30	9.56	1.77	7259

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998. See note to Table 1 for information on variables used to compute the index of wealth.

Table 4 - Unit prices and average consumption by main source of water, Niamey 1998

	Average price (FCFA/m^3)		Average household consumption (m^3/month)	Average per capita consumption (m^3/month)	Average household consumption (lt./day)
	by source	by consumer			
Piped water	182	182	30.6	5.2	1006
Private connection, exclusive, not sold		*176*	*26.9*	*3.4*	*883*
Private connection, exclusive, sold		*184*	*32.9*	*4.3*	*1082*
Private connection, shared, not sold		*186*	*32.3*	*8.3*	*1061*
Private connection, shared, sold		*186*	*33.6*	*5.3*	*1106*
Fountain	534	545	6.7	1.0	222
Vendors	926	848	6.8	1.1	223
Neighbors	591	496	6.4	0.9	210
Wells/river	250	202	8.9	1.1	292

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998. The average price per m^3 'source' is computed considering the consumption of water from each corresponding source (e.g. FCFA 534 is the average price of water from fountain computed over all households that bought water from fountain). The average price per m^3 'consumer' is the average price paid by each corresponding category of consumers, and it is computed by dividing the total household bill by the total household consumption (e.g. FCFA 545 is the average price of water paid by those whose main source is the fountain; this average includes not only water from fountain but also from other sources used by this category of consumers)

Table 5 - Unit prices and average consumption by quintiles of wealth, Niamey 1998

	Average price (FCFA/m^3)	Average household consumption (m^3/month)	Average per capita consumption (m^3/month)	Average household consumption (lt./day)
1st quintile group (poorest)	645	6.3	1.1	206
2nd quintile group	541	13.2	2.6	435
3rd quintile group	509	18.7	3.8	614
4th quintile group	422	20.3	3.2	668
5th quintile group (richest)	249	29.4	3.8	965

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998.

Table 6 - Main priorities, by quintile of wealth, Niamey 1998 (% of individuals)

Quintile group	Improve storm water drainage	Improve water supply	Improve sanitation	Improve disposal solid waste	Improve health system	Improve education system	Total
1 (poorest)	8.6	62.9	4.8	2.9	18.1	2.9	100.0
2	8.7	62.5	3.9	3.9	18.3	2.9	100.0
3	10.6	55.8	6.7	4.8	13.5	8.7	100.0
4	14.4	50.0	6.7	5.8	16.4	6.7	100.0
5 (richest)	14.4	38.5	10.6	4.8	23.1	8.7	100.0
All	11.3	53.9	6.5	4.4	17.9	6.0	100.0

Source: Authors' estimation based on GOPA-Consultants Household Survey data 1998.