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WATER SUPPLY AND SANITATION SECTOR BOARD DISCUSSION PAPER SERIES

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OCTOBER 2006

Getting the Assumptions Right: Private Sector Participation Transaction Design and the Poor in Southwest Sri Lanka

Caroline van den Berg, Subhrendu Pattanayak, Jui-Chen Yang and Herath Gunatilake

THE WORLD BANK GROUP

Water Supply & Sanitation Sector Board

BNWP Bank Netherlands Water Partnership

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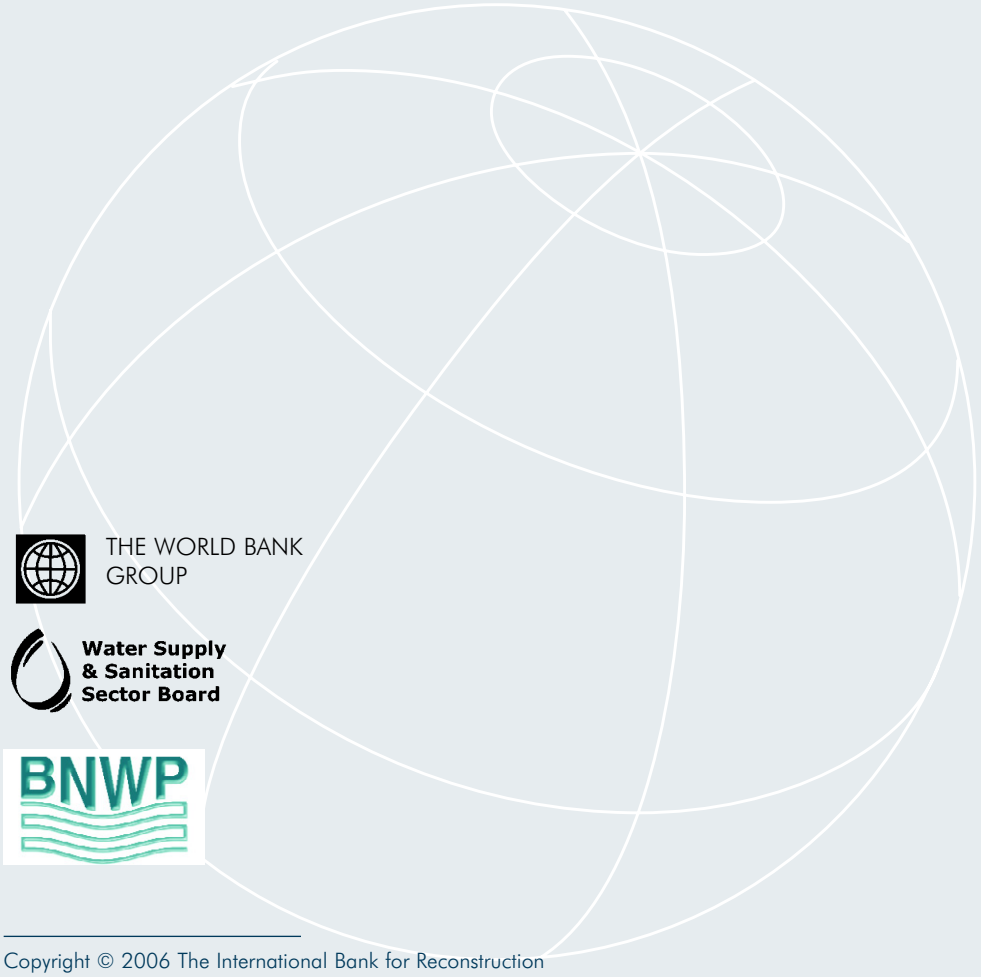

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FOREWORD

Many sector reform programs are often decided with scant knowledge of the demand for piped water services in the service area. This often results in too optimistic assumptions on the actual revenues that such a sector reform program can generate. In the case of private sector participation (PSP) transactions, renegotiations often become necessary when demand lags behind expectations. Guasch et al. (2003) report that 63 of the 89 water concessions in 5 countries in Latin America had to be renegotiated during the 1990s. Such renegotiations can result in tariff increases or other changes in the contract that increase the costs to consumers and/or taxpayers, often undermining the political commitment for sector reform programs in general and PSP arrangements in particular.

We illustrate these features through a case study of water, sanitation, hygiene, and poverty from coastal towns of Southwest Sri Lanka, where about 1,800 households were surveyed to gain a better understanding of the demand for piped water services by poor and non-poor households.

The results of the study showed that many of the standard assumptions that are used when determining the viability of sector reform programs – and that tend to be rather uniformly applied across many such programs – do not always accord with consumer preferences. The study also demonstrated that different groups of consumers have different preferences and perceptions, and that insight into the various market segments that the utility is serving may be useful as it can result in a more efficient delivery of water supply services.

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1 INTRODUCTION

About 725 million people living in urban areas lack access to either safe water supply or sanitation (WHO-UNICEF Joint Monitoring Program, 2004). Yet these numbers do not reflect the often low quality water supply and sanitation services that many urban households have to cope with. The need for reform in urban water and sanitation service delivery is therefore urgent. Many countries are making moves to achieve these reforms, bringing in changes to the way they manage utilities, charge for water, and regulate the sector (World Bank, 2004)

There is often significant pressure to complete reforms in a short period of time. For instance, moves towards reform may be accelerated at a moment of political opportunity. The pressure of an ambitious timeframe often does not allow decision makers to plan the extensive preparatory work – research, consultation, participatory design – which would allow the needs of the poor to be adequately taken into account. In addition, the challenge of increasing efficiency and improving governance often seem so huge that the specific interventions required to make reform beneficial to the poor are overlooked or consciously "deferred" to a later stage.

It may be politically difficult to adjust tariff structures and contracts before the private sector transaction has been concluded, but it tends to be no easier to plan and introduce them after the transition to a private operator has been made. Experience from around the world already shows us that such a deferral may make it more difficult to make changes to the way services are delivered to the poor after a PSP transaction has been concluded. Neglecting the interests of the poor has, in some private sector transactions, derailed the reform process as advocacy groups are, justifiably, quick to bring public attention to the fact that the poor are being ignored.

Two proposed PSP transactions in Sri Lanka provided an opportunity to demonstrate how the "upstream" work of preparing pro-poor approaches could be undertaken in parallel with the main transaction design. The government of Sri Lanka was proposing to engage private operators to manage water and sewerage services for two separate service areas: one in the town of Negombo, north of Colombo, and one stretching along a coastal strip south of Colombo, from the town of Kalutara to the town of Galle. Since then, the government has abandoned the idea of setting up a public-private partnership in these two areas.

In this paper, we will investigate how a set of basic assumptions on service coverage, service levels, tariffs, and subsidies in the proposed transactions in Southwest Sri Lanka held up against consumer preferences. If the assumptions underlying the transaction design are flawed, the distribution of benefits between the different stakeholders will be affected and transactions can run into problems (van den Berg, 2000). We then propose, in a case where the basic assumptions underlying the PSP transaction differ from actual preferences, how the transaction design could have been adjusted to especially ensure that the poor will benefit from a PSP transaction.

Section 2 of this paper provides the background information and describes the main features of the survey data. Section 3 discusses a set of features that were used in the initial transaction design. Section 4 shows the impact of the different household preferences on these transaction features, and what this means in term of redesigning these features to ensure that the transaction would be more pro-poor. Conclusions and policy recommendations follow in Section 5 of the paper.

2 SURVEY RESULTS

A quantitative demographic and willingness-to-pay survey fieldwork was started in August 2003 and completed in September 2003. The survey teams interviewed 1,818 randomly selected households from the two project areas (812 in Negombo; 1,006 in the Kalutara to Galle area). While the study was commissioned primarily to collect data on the poor, it was not possible to create a random sample of the poor only. The sampling frame was instead based on the population as a whole, meaning that the results shed light on the characteristics, current service levels, preferences, and willingness to pay of all households in the two service areas.

The survey showed that the two areas were relatively prosperous and poverty, where it existed, was not severe. Housing was generally of good quality, with 86 percent of the sample living in single-story, single-family houses that had cement floors, brick walls, and tiled roofs. As is common in Sri Lanka, the area had very high levels of education. Over 90 percent of households had adults who had completed primary education and almost all households reported sending their school-aged girls to school.

Socioeconomic Characteristics

Of the households surveyed, those in the bottom consumption quintile (20 percent) were identified as poor (365 households) . Sixty-seven percent of these poor households were living on less than US $1.00 per capita per day. Analysis was then carried out on the sample as a whole, and on the subset of poor households.

Poor families were found to have the following characteristics compared to the total sample:

- Families were bigger, with more children, and more families having children under 5
- They lived more than twice as far from piped water networks and main roads as did rich households
- They were only slightly less likely to have a literate household head or girls attending school
- They included disproportionately high numbers of Tamils and Muslims
- A higher proportion of households were found to be poor in the Kalutara to Galle Coastal Strip (24 percent of the households compared to 15 percent in Negombo)
- About 47 percent of the poor were receiving payments from the Samurdhi program (the government's flagship welfare program)

1. The calculation of the consumption quintiles was calibrated to be consistent with that used by the Government of Sri Lanka, allowing the researchers to define poverty in a manner that was compatible with official statistics.

Table 1: Access to House Connections Water by Income Category and Location

Access to piped water	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile	Total
Greater Negombo	24.2%	24.1%	26.8%	28.6%	27.0%	26.4%
Kalutara — Galle Coastal Strip	32.0%	45.0%	56.6%	52.6%	66.5%	28.9%

Water and Sanitation Characteristics

Of the households surveyed, 38 percent had a connection to the piped network. As expected, poor people were less likely to have a connection to the piped water network (28 percent of poor households vs. 38 percent overall). The access rates for piped water services delivered through house connections differ significantly per location as can be seen in Table 1. In addition, connected poor were more likely to have yard taps (rather than in-house connections) than the non-poor. The poor households reported lower hours of supply than the non-poor. They were only slightly more likely to complain that the monthly bill was too high than the non-poor.

The survey showed a very high prevalence of private wells, which were the most common source of water for the remaining households (66 percent used them). There was a significant difference, however, between the two project areas, with private wells more prevalent in Negombo. Water consumption levels were relatively high, with households consuming, on average, 22 m^3 (cubic meters) per month from a variety of sources. The consumption for those with private wells was very similar to those with house connections . The widespread use of wells, and the fact that people were accessing substantial amounts of water from them, suggested that self-provisioning through private wells was a substantive and realistic alternative to piped water in the project areas. Water consumption was relatively similar across socioeconomic groups, with the poor using only slightly less water, at an average of 19 m^3 per month from all sources, and 16 m^3 per month from house connections. This consumption was almost double the first, heavily subsidized, block of the tariff. Poor households were consuming into the third block of the tariff structure, suggesting that current water prices were no obstacle to consumption. The average reported monthly bill of the poor represented about 0.7 percent of their median consumption expenditure. As average water consumption from house connections for the fifth income quintile (the richest portion of the sample) was 20 m^3, it appeared that few households consumed above 25 m^3 per month. Although household water consumption is not very different between the poor and the rich, per capita water consumption is much lower for the poor than for the rich. Water consumption per capita for poor households is about 4 cubic meters per month, whereas the non-poor households consume about 60 percent more water per capita.

2. About 97 percent of households with access to piped water had functioning water meters. In the case of households with access to private wells, the survey tried to estimate their water consumption training the enumerators extensively to ensure that this estimate was reasonably accurate.

3 FEATURES OF THE PSP TRANSACTIONS

At the time of the study, the then government of Sri Lanka was proposing two separate PSP arrangements: one for the town of Negombo, north of Colombo, and one for the area stretching along a coastal strip south of Colombo, from the town of Kalutara to the town of Galle. The population in these two PSP areas in 2001 was about 1.6 million, representing a little less than 10 percent of the total population in Sri Lanka. These service areas included not only the areas in and around the towns, but also part of the hinterland that was more rural in nature. Some pockets of habitation – for instance, beach-dwelling fishermen – were very distant from the piped network. The southern most area of the coastal strip (around the town of Galle) is moreover characterized by a service area that is mostly discontinuous, with higher density areas included in the area to be serviced under the PSP contract.

The intention of the government was to attract local private investors, preferably in a consortium with international water companies. The contract proposed for the two service areas would be for 15 years. The operator would be remunerated by being paid a fixed operator tariff, specified in contract, for every cubic meter of water delivered and sold to customers. The operator collects revenue from consumers on behalf of the government, according to the tariff structure set by the government. The operator retains the amount of his fee, and remits the difference to the government, which uses its share to pay for the investments in the system.

The contract had a number of features that will be explained hereunder, which refer to coverage targets, tariff structures and levels, and technical standard setting.

Universal Service Obligation

The vision of the government was that, within the service area defined in the two project areas, 95 percent of residents would eventually have access to piped water through house connections at the end of the project. The use of private wells and public taps would be gradually phased out. Although the 95 percent coverage target was not specially designed to target the poor, most of the poor would gain access to piped water supply as it almost approaches universal coverage. This coverage target was a very ambitious objective given the dispersed (almost rural) nature of part of the service areas and the limited reach of the existing network .

Service Performance Specifications

Customers of the piped water supply system would be connected through household connections. The levels of service were to meet certain standards, as specified in the proposed contracts including 24 hours supply with a water quality that would conform with the Sri Lanka National Water Quality Standards.

3. Only 69 percent of the population mentioned they could access house connections or public taps. However, for the poor, this number was lower at 61 percent.

Table 2: Increasing Block Rate for Residential Customers (2003)

Consumption	Price	Price in US$ equivalent
1 to 10 m^3 per month	SLR 1.25 per m^3	US $0.013 per m^3
11 to 15 m^3 per month	SLR 2.50 per m^3	US $0.026 per m^3
16 to 20 m^3 per month	SLR 6.50 per m^3	US $0.068 per m^3
21 to 25 m^3 per month	SLR 20.00 per m^3	US $0.211 per m^3
Above 25 m^3 per month	SLR 45.00 per m^3	US $ 0.476 per m^3

Tariff and Subsidy Policy

The investment needs were considerable if coverage targets of 95 percent were to be met. It was clear that significant increases in tariffs would be required over the planned 15-year period of the contracts if the operators were to realise returns on the investments they financed. These increases were estimated to be up to 100 percent of the existing average tariff, depending on the area and the assumptions regarding the extent of government and private sector funding of the total investments.

Tariff levels for piped water residential consumers were very low, with a household using 20 cubic meters of water per month billed only at a fraction of the cost of supply. The government did not want to initiate large tariff increases in the short run, and decided to subsidize the difference between the operator tariff and the tariff revenue that the government would receive from consumers in the first years of the contract. The size of this subsidy would be determined by the amount of investment required, and the rate at which the consumer tariff was expected to increase over time.

Tariff Structure

The government wanted to maintain the existing tariff structure for domestic consumers, which comprised an increasing block tariff with five blocks (as can be seen in Table 2), assuming that the current tariff structure benefits poor customers and is well targeted.

Connection Charges

The cost for a household to connect was about Sri Lankan Rupee (SLR) 9,000 (equivalent to US $95) to bring the water from the main network to their house by cutting the road, laying the branch pipes, and installing a water meter. The financing of the connection cost and charges were treated slightly different in the two proposed transactions. In the transaction covering the coastal strip between Kalutara and Galle, the connection charge to be paid by consumers (including residential consumers) approximated the cost of

4. Investment needs were estimated at about US $20 million in Negombo, and $50 million in the Kalutara to Galle coastal strip.

5. The cost of supply was estimated to be approximately Rs 23 per cubic meter, so the first four tariff blocks provide residential customers with a heavily subsidized water supply service, because only the final block exceeds the cost of supply.

connections with an assumed cost of a residential connection of SLR 10,000 in 2002 prices. In Greater Negombo, the connection charge to consumers was projected to be partially subsidized.

Table 3: How Household Characteristics Impact Demand for Improved Water Supply Services — Probit Regression

Variable	Mean	Coefficient	p-value
Regression Constant	1.00	1.357	0.000
Monthly consumption charge (Rs.)	487	-0.002	0.000
One time connection fee (Rs.)	5534	-0.00003	0.007
Household is poor (1 = yes, 0 = no)	0.20	-0.309	0.002
Household receives remittance (1 = yes, 0 = no)	0.10	0.288	0.009
Household is a Samurdhi recipient (1 = yes, 0 = no)	0.19	-0.224	0.023
Household head is employed in the private sector (1 = yes, 0 = no)	0.41	0.200	0.004
Distance to main road (kilometres)	0.32	0.113	0.131
Household resides in Greater Negombo (1 = yes, 0 = Kalutara or Galle)	0.45	-0.479	0.000
Household resides in Kalutara (1 = yes, 0 = Galle or Greater Negombo)	0.23	-0.318	0.001
Household has access to private well in GN	0.79	-0.316	0.019
Household thinks water quality of their alternative source is excellent or good in GN	0.59	-0.325	0.010
Household believes that there is a water contamination problem (1 = yes, 0 = no)	0.10	0.243	0.026
Household thinks government should provide connection subsidy to low-income households for improved water supply services (1 = yes, 0 = no)	0.30	0.024	0.743
Household is particularly conscious of institutional issues (1 = yes, 0 = no)	0.01	0.609	0.028
Private sector will provide improved service (1 = yes, 0 = public sector will provide)	0.55	-0.121	0.074
Household is particularly conscious of health issues (1 = yes, 0 = no)	0.02	0.649	0.003
Household has experienced a case of morbidity event (1 = yes, 0 = no)	0.02	0.653	0.006
Household is Tamil (1 = yes, 0 = no)	0.03	-0.475	0.047
Household owns the house (1 = yes, 0 = no)	0.94	-0.352	0.015
Education of household head (years)	8.94	0.022	0.065
Number of observations		1735	
Likelihood Ratio Statistics		390	0.000
Pseudo R2		0.17	
% Responses that are correctly predicted		73	
Log Likelihood		-942	

4 RESULTS FROM THE HOUSEHOLD SURVEY

The results of the household survey suggested that some rethinking of the main features behind the PSP transactions was very necessary.

4.1 Universal Service Obligation

The results from the willingness-to-pay analysis as summarized in Table 3 shows that several factors determine the willingness to connect and pay for piped water. While poverty and costs are key determinants, location, access to alternative water supply sources, and perceptions matter too. Subsets of these factors matter differently for subsamples of the population. Poverty dampens the demand for private piped water connections and income-earning opportunities provide a mechanism to enhance demand for improved service. Turning to location factors, we find that households farther away from the road network have a significantly higher demand for piped water. We also see that households in Greater Negombo and Kalutara are less willing to connect in comparison to those in Galle, after we control for socioeconomic status, substitutes, and perceptions.

Looking at the substitutes to piped network connections, we find as expected that households in neighborhoods with greater self-provision (primarily through private wells) have lower demand. This effect is amplified for households who like their non-network source. Those who rated their non-network source as providing excellent or good quality water (measured in terms of taste, color, smell, safety, and regularity) have a significantly lower demand for water from network connections. The probability that households which are satisfied with their current source will less likely connect to the piped water network makes the government's goal of almost universal piped water coverage more difficult to achieve. When we consider attitudes, households who believed water contamination to be the most important environmental problem have a higher demand for services.

The results of the willingness-to-pay analysis showed that with the significant tariff increases that were needed to fund the investment program, the uptake rate would be less than 50 percent assuming connection fees remained at about SLR 9,000. This uptake rate was significantly lower than the originally anticipated 95 percent coverage rate. When looking at these rates at a more disaggregated level, the uptake rate for poor and unconnected households was significantly lower – ranging from 27 percent in Negombo to 32 percent in the Kalutara – Galle Coastal Strip (Table 4). A series of uptake simulations as discussed in Pattanayak et al (2006) were undertaken to examine the impact of the different variables. The simulations showed that removal of the connection fee was shown to be a significant "lever" for increasing uptake rates. In one of the simulations, it was assumed that poor households would pay neither a connection fee nor a monthly consumption charge. Yet even in this scenario – assuming perfect targeting – about 30 percent of the poor unconnected households did not want to be connected, which may assume that a transfer to another source of water involves some sort of additional (transaction) costs.

The low uptake rates raised important questions about the financial viability of the PSP transactions, particularly in the case of Negombo, which had been assumed to be the more attractive service area from a private operator's point of view. The government asked the consultants to recalculate the financial viability of these contracts using lower

Table 4: Summary of Uptake Rates by Subgroup with Private Sector Provision: Regression Model Predictions

District	Poor	Non-Poor
Greater Negombo		
Connected	49%	64%
Unconnected	32%	47%
Kalutara–Galle		
Connected	44%	59%
Unconnected	27%	42%

demand assumptions for water supply services. This resulted in a slight increase of operator tariffs and consumer tariffs needed to ensure the financial viability of the transactions because of the trade-off between lower coverage rates and investment requirements.

Obviously, the lack of demand for piped water services is a major issue that is difficult to address in the short run. The probit regression model showed that income and education have a positive impact on the demand for improved piped water, but these effects will only materialize in the long term. In the short term, marketing campaigns may have a positive impact on households' perceptions regarding water supply. Yet as the current sources are not posing any serious health problems as measured in the incidence of water-borne diseases, the impact of such campaigns cannot be focused on promoting the health merits of piped water services.

4.2 Service Levels and Standards

Required Service Levels

The initial PSP transaction design featured the provision of piped water through house connections. The assumption about whether households favored these types of service levels was tested using conjoint surveys. Such surveys can be used to unpackage households' demand for the different attributes of water services including price, quantity, safety and reliability – assuming that households care about more than only the price of the water supply service.

The study confirmed the viability of using service level alternatives, as respondents were not demonstrating a strong preference for house connections (Table 5, and for more details, see Yang et al. 2006). Interestingly, the preference of non-poor households for house connections is much stronger than that for poor households. Poor households seem to prefer lower service levels that are cheaper than piped water that will require high up front connection costs.

Table 5: Attributes of Service Alternatives — Conditional and Mixed Logit Models for Conjoint Analysis

Variable	Mean	Conditional Logit		Mixed Logit	
		Coefficient	p-value	Coefficient	p-value
Proposed monthly water bill (Rs.)	216	-0.003	0.000	-0.007	0.000
Volume of water per day (liters)	450	0.0004	0.000	0.001	0.000
Standard deviation				0.003	0.000
Hours of water supply per day	10	0.039	0.024	0.144	0.000
Standard deviation				0.027	0.148
Squared hours of water supply per day	161	-0.001	0.053	-0.004	0.000
Standard deviation				0.002	0.000
Water is safe for drinking straight from the tap (1 = yes, 0 = no)	0.18	0.840	0.000	2.006	0.000
Standard deviation				2.189	0.000
Water is safe for drinking only after filtering (1 = yes, 0 = no)	0.08	0.468	0.000	1.234	0.000
Standard deviation				0.179	0.783
Water is safe for drinking only after boiling (1 = yes, 0 = no)	0.23	0.396	0.000	0.921	0.000
Standard deviation				0.177	0.637
Water is safe for drinking only after filtering and boiling (1 = yes, 0 = no)	0.08	0.246	0.037	0.385	0.066
Standard deviation				0.273	0.471
House connections dummy (1= yes, 0 = mini-grid or standpost)	0.25	1.223	0.000	0.686	0.011
Standard deviation				4.142	0.000
Mini-grid dummy (1 = yes, 0 = house connections or standpost)	0.25	1.058	0.000	1.218	0.000
Standard deviation				3.210	0.000
Household chooses to opt out (1 = yes, 0 = no)	0.25	2.005	0.000	3.484	0.000
Standard deviation				7.666	0.000
POOR * Proposed monthly water bill	43	-0.001	0.030		
POOR * Volume of water per day	90	0.00005	0.834		
POOR * Hours of water supply per day	2	-0.0002	0.997		
POOR * Squared hours of water supply per day	32	-0.0001	0.924		

(continued)

Table 5: Attributes of Service Alternatives — Conditional and Mixed Logit Models for Conjoint Analysis (continued)

Variable	Mean	Conditional Logit		Mixed Logit	
		Coefficient	p-value	Coefficient	p-value
POOR * Water is safe for drinking straight from the tap	0.04	-0.019	0.915		
POOR * Water is safe for drinking only after filtering	0.02	0.272	0.322		
POOR * Water is safe for drinking only after boiling	0.04	0.128	0.408		
POOR *Water is safe for drinking only after filtering and boiling	0.02	-0.107	0.636		
POOR * House connections dummy	0.05	-1.081	0.000		
POOR * Mini-grid dummy	0.05	-0.581	0.000		
POOR * Household chooses to opt out	0.05	-0.492	0.080		
Number of observations		21,616*		21,616*	
Likelihood Ratio Statistic		2,464	0.000		
Log Likelihood		-6260		-0.83 ^	

* Approximately 1,800 households responded to 3 scenarios and 4 service levels, making the total sample equal to 21,616.
^ Indicates mean Log Likelihood.

Further analysis of the data showed that the use of so-called "mini-grids" could be a good alternative for households, with poor households preferring mini-grids over house connections. Hence, allowing the utility to provide water through small networks or "mini-grids" using household storage tanks to ensure adequate quantity and pressure could help to reduce the investment costs, especially in areas farther away from the current piped water network. This finding would allow for more flexibility in the delivery of water supply services, which – in combination with the finding that demand for piped water was greater farther away from the current network – could reduce the cost of service delivery.

Service Standards

The conjoint analysis was used to determine how consumers valued particular service standards, especially the reliability of services – as measured in the numbers of hours households are supplied with piped water – and drinking water quality.

Reliability of Service

As expected, supply hours generate positive utility for households. The positive sign on the linear term and the negative sign on the squared term for supply hours indicate a diminishing marginal utility for increases in this attribute. This is further confirmed by

6. "Mini-grids" are small-diameter piped water systems with a storage overhead tank.

re-estimating this model with a dummy variable for scenarios that proposed hours of supply greater than 12 (i.e., beyond 12 hours, households do not care if the hours of supply are increased). As most households use private wells, 24-hour supply is not necessarily an attribute that is considered a must for consumers once households receive a basic number of hours of supply, estimated in the model at 20 hours per day. For households that use house connections, almost half of the respondents mention the less than 24-hours service as the main problem of their piped water service. Yet most of these households receive on average15 hours of daily supply in the dry season and 17 hours in the wet season.

Drinking Water Quality Standards

Progressively safer and better quality water generates greater utility. Better quality and safer water yields the highest utility, while unsafe water generates the lowest utility. The mixed logit model seems to suggest that "except for the safest quality water (i.e., water that you could drink "straight from the tap"), households do not seem to have diverse preferences for other levels of safety." As such, incremental improvements of drinking water quality are not highly valued. The preferences of the poor are essentially not different in terms of hours of supply and water quality. This does not mean that they do not care about these features of the service, only that they are not different from the non-poor in this respect.

Implications of these results show that the demand for water supply will not only be influenced by the price of the service, but also by the ability to provide the expected levels of consumption volumes, safety, and hours of supply. Therefore, piped water service is not a homogeneous service, but a service with different service attributes which different consumers can value differently. The analysis shows that house connections and mini-grids are preferred to public taps, but that the current alternative is preferred to all other service level alternatives – in line with the previous results on uptake rates for piped water. Moreover, the results show that the poor are not different from the non-poor in terms of preferences for consumption volumes, water quality, safety, and hours of supply. If preferences for these particular service attributes are similar for poor and non-poor households, similar service options can be offered.

4.3 Tariffs, Subsidies and Connection Fees

Tariff Levels

The 2003/2004 tariffs were very affordable, even for the poor. This was evidenced by the fact that the average water consumption among those with house connections was not much lower than for the overall sample. Poor people were clearly not limiting their consumption to the heavily subsidized first block of the tariff, or even to the second block. The average reported monthly water bill of the poor represented less than 1 percent of their median consumption expenditure. This is much lower than the rule of thumb of affordability used, assuming that water and sanitation services are affordable when the combined cost of these services does not exceed 5 percent of monthly household income.

Because the results of the willingness-to-pay studies are not always well understood, we decided to test households' revealed preference for piped water by looking into the price elasticity of demand for such services (Nauges and van den Berg, 2006). The (marginal) price elasticity of households exclusively relying on piped water is -0.74, a value which is

Table 6: Price Elasticity of Demand for Water Supply Services

Source of Water	Price or Time Cost Elasticity	Income Elasticity
Households that exclusively use piped water	-0.7430	0.1014
Households that use piped water but not exclusively	-0.6940	0.1119
Households depending on non-piped water	-0.0636	0.0713

significantly higher than what is usually found in price elasticity studies . Interestingly, for households that use piped water, price elasticity is not statistically different between different income groups due to similarities in consumption patterns and the low cost of the service as reflected in the proportion of these costs in the total household budget. Households will reduce their consumption when tariff increases are implemented but there is no difference in how poor and non-poor households react to these tariff increases.

As can be seen in Table 6, the price elasticity in the demand for piped water of households that rely (but not exclusively) on piped water is equally high. The relatively high price elasticity can be explained by the availability of easily accessible and cheap water sources that provide good quality drinking water . The price elasticity values for piped water are in line with the willingness-to-pay survey results for connected households, whose decisions to stay connected are being affected by price increases.

Yet even though the price elasticities found are relatively high, the demand for piped water is still price inelastic, and hence tariff increases will result in an increase in the utility's revenues. When the transaction advisors (Cameron McKenna et al, and Halcrow Group Ltd., 2004) prepared their financial models they assumed a zero price elasticity value. As such, it was assumed that the tariff increases needed to fund the proposed investment programs would not affect the consumption of piped water. To ensure the viability of the transaction, and the investment program proposed with it, higher tariff increases would be required – with the price elasticity values that were found – to ensure that the utility revenues could cover the cost of the investment program.

The high values of the short-term price elasticity – and the low value of the price elasticity for non-piped water – suggest that the water supply market in this part of Sri Lanka is more complex than originally assumed by the transaction designers and the government. The widespread availability of alternative water sources will put downward pressure on the price of piped water, reducing the possibilities to increase tariffs without significant consequences on the demand for piped water.

7. A recent meta-analysis of the price elasticity for the demand of piped water found an average price elasticity of -0.43, and a median of -0.35 (with most data referring to studies that were conducted in developed countries), with price elasticity values higher for increasing block rates than for other types of tariff structures.

8. Even households that tend to only use piped water tend to have easy access to more sources.

Table 7: Access to Public Taps and Public Wells by Income Category and Location

Access to water	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile	Total
Greater Negombo						
• access to public taps	10.5%	15.6%	13.7%	8.6%	5.9%	10.5%
• access to public wells	7.3%	2.1%	4.2%	4.6%	2.0%	3.8%
Kalutara–Galle Coastal Strip						
• access to public taps	5.0%	1.4%	1.0%	1.1%	0.6%	2.0%
• access to public wells	18.3%	10.8%	3.1%	4.2%	1.3%	8.3%

Tariff Structure

An increasing block rate is often introduced with the aim to provide services to the poor against subsidized rates. Yet a general weakness of the existing tariff was that it provided subsidies to almost all domestic users. The design of the block tariff — with very significant subsidies for users of less than 20 m^3 per month — plus the fact that average consumption at house connections was only 19 m^3 per month and that only 28 percent of the poor households are connected to house connections (compared to 43 percent of non-poor households) — meant that significant subsidy resources were being captured by the non-poor.

The benefit targeting performance indicator — a tool to measure the effectiveness of targeting (Komives et al., 2005) — of the subsidies on consumption charges is estimated at 0.75 which implies that the subsidy distribution is regressive since the poor benefit from a smaller share of the total benefits than their proportion in the population. The errors of exclusion show that 72 percent of the poor households do not receive the subsidy as they are not connected to the piped water supply network. Yet when households receive subsidies — due to the very low tariffs in the lower blocks — they receive a subsidy that is equal to 2.2 percent of their monthly income which is a significant benefit relative to their household income. But although the total amount of subsidy is relatively large, few poor households actually benefit from these subsidies as they tend to be not connected to the piped network.

Some residents used free public taps and some used metered public taps shared by a group of families. Customers who used metered public taps were billed at a rate which was higher than the costs of household connections. Some cases of sharing of connections were also observed (Brocklehurst, 2003). In these cases, the increasing block rate structure led to high prices. Public taps were gradually phased out, but in the interim a more equitable tariff needs to be established for them because currently the cost of public tap water and water provided through shared connections is more expensive than the water delivered through house connections. The data in Table 7 show that public taps are not exclusively used by poor households. In Greater Negombo, the use of public taps

9. The benefit targeting performance indicator measures the share of subsidy benefits received by the poor divided by the proportion of poor in the total population.

among the first three quintiles is rather similar and significantly higher than in the Kalutara — Galle coastal strip where public taps are much less commonly used.

Summarizing: it is quite likely that improving the tariff structure is not necessarily going to improve targeting performance because piped water consumption patterns between the poor and non-poor are rather similar and the access differentials are very large.

Connection Fees

Because the consumption subsidies currently in place are not good in targeting the poor, it is often suggested that assistance to pay connection fees would be better targeted and represent a more effective use of government subsidy resources than consumption subsidies.

The benefit targeting performance indicator of the subsidies on connection charges is estimated at 1.20 which implies that the subsidy distribution would be progressive. Assuming all households will connect, the poor benefit from a larger share of the total benefits than their proportion in the population. Unfortunately, with a total house connections rate of 38 percent, being unconnected is not a good proxy for poverty, as almost 60 percent of the non-poor are not connected to house connections. In the case of Greater Negombo, the difference is even starker because access rates essentially do not differ between quintiles. Therefore, using a connection subsidy whose only criteria is current access status will result at best in a neutral subsidy distribution. Yet as poor households tend to be less willing to connect to piped water (Pattanayak et al., 2006), it is likely that the subsidy distribution will be more "anti-poor" in the sense that the non-poor households will benefit disproportionally from the available subsidies. As such, connection subsidies are not likely to be a very relevant tool to target the poor in this particular environment.

Other Targeting Mechanisms

Because targeting the poor using consumption subsidies and, to a lesser extent, connection subsidies are not very effective, the possibilities of using other targeting mechanisms were investigated. Detailed color-coded maps showing the distribution of the poor in the project areas were prepared. These so-called poverty maps confirmed that poor people were somewhat more likely to be farther from urban centers (and therefore from piped water networks). The maps also revealed some pockets of poverty, but overall little explicit clustering. Many areas showed a mix of poor and non-poor. The impact of the lack of distinctive clustering means that the use of spatial or geographical factors to distinguish between groups of customers can only partially work. Analysis showed that geographical factors (such as location, distance to coast, access to other water supply sources, distance to roads, etc) could only explain 35 percent of the variation in a model of the probability of a piped water connection (Pattanayak et al. 2005).

Successful targeting is likely to require a combination of geographical and household characteristics, which means relatively high costs to administer such a subsidy targeting program. Yet setting up such programs is not easy as the experience of the Samurdhi program shows. This government welfare program has a component that subsidizes

10. The benefit targeting performance indicator measures the share of subsidy benefits received by the poor divided by the proportion of poor in the total population.

connections from the water utility while households are allowed to pay the connection costs over time. Yet the effectiveness of this program is limited because it is not a very well targeted program. Although overall data on the Samurdhi program are not available, the survey results seem to suggest that the errors of exclusion may be high — 53 percent of the households sampled that were classified as poor did not receive Samurdhi payments.

Targeting turns out to be complicated, regardless of what targeting method is used. In such an environment, characterized by access to cheap alternative water sources that pose few public health problems, it may make eminent sense for the poor to depend on these good quality non-piped drinking water sources.

4.4 Household Perceptions

Perceptions color consumer behaviour as was shown in the willingness to pay analysis. We will look into one particular type of perceptions, related to households' attitude towards the provision of water supply services.

Perceptions Regarding Private Sector Participation

The regression models in Pattanayak et al. (2006) introduced a randomized splitting of the sample, such that one-half of our sample considered service provided by a private operator whereas the other half considered service provision through a public operator. This design allowed us to investigate how households perceive the water utility being managed by a private operator, as this often turns out to be a political issue. The assignment of a household to the private sector participation scenario is represented by a dummy variable. The negative coefficient on the private sector participation dummy shows that, all else equal, fewer households in the overall sample will connect to the network if this service improvement is provided by the private sector, in contrast to a reformed public sector. Households seem to be willing to pay a premium towards provision of water supply services through a public operator. Yet the intensity of this bias varies across subsamples of the population, with an actual reversal in Greater Negombo, where uptake rates under private sector provision were higher than under a scenario where the services were provided by a reformed public operator. The intensity of the bias seem to influenced by cultural and economic factors that differ between the two service areas, meaning that addressing this bias in consumer preferences will need attention in the Kalutara — Galle Coastal Strip.

Marketing campaigns can have an impact on improving the demand for piped water supply. By addressing the perceptions that households have — and that drive consumer preferences — consumer behaviour can be influenced. This idea has gained importance in recent years (Brocklehurst ed. 2002) assuming that consultation, stakeholder engagement, and more recently public relations campaigns are needed to influence households' perceptions to gain support for water sector reform in general and private sector participation in particular. The final decision to access and consume piped water supply services rests with the household, and should be taken into account when determining the most appropriate (direct or indirect) channels to communicate with households.

5 CONCLUSIONS

Many of the assumptions underlying the government's policy regarding the PSP transactions did not bear out. The study results threw into question the practicality of universal coverage, the value that households attach to certain attributes of piped water supply (24-hour supply, quality of drinking water and the preference for service provided through house connections), and the poverty impact of a project that would likely benefit largely the non-poor with the current tariff and subsidy policies in place. It also showed that the water supply market was much more competitive than anticipated with households having access to different water sources that can act as substitutes for piped water. As a result, it would have been very difficult to ensure the financial viability of the two contracts. The distributional impact of the transaction could have hampered its political acceptability, as the benefits of the transactions are rather inequitably distributed among the different stakeholders. In the months that followed after the study team submitted its conclusions and recommendations to the government, the concept of private sector participation faced political opposition within the central government and the PSP transactions were eventually abandoned.

Making these proposed transactions pro-poor turned out to be difficult in the absence of a strong demand for piped water in the particular service area because it threatened the financial viability of the transactions, and the likelihood of making the transactions pro-poor. Increasing demand for house connections water services is likely to be a long and arduous process in the presence of alternative water sources that are cheap, easy to access, and considered of high quality in an environment where expansion of the house connections network will require large investments. Such an environment would result in upward pressure on piped water tariffs to be paid by households and, hence, increase the price differential between piped water and alternative sources of supply.

The studies showed that although the three districts are close to each other geographically, they also showed sufficient diversity in terms of consumption patterns, preferences as reflected in willingness to pay for piped water connections, and perceptions. A case in point was the policy regarding connection subsidies and the differences between Negombo and Galle which are less than 100 miles apart. It is a common mantra used by water supply professionals that water and sanitation services are local services. The results of the study show that consumer behavior is also determined by local factors. Hence, one-size-fits-all solutions are not going to be necessarily very successful if these local differences are not sufficiently captured in transaction design. This obviously makes designing a PSP transaction — or a public sector investment program — more complex because "rules of thumbs", or extrapolations from one local area to another (and even more so from one country to another), cannot be applied without running the risk of a large margin of error in determining the viability of a PSP transaction or a public investment program.

Understanding consumers' behavior can help improve PSP transaction design and help to understand how such transactions affect especially the poor. More broadly, it can help improve utility performance whether the service provider is a private or a public operator. The survey findings show that conducting ex ante baseline surveys to investigate the demand for services is a useful tool to improve the design of PSP transactions (design of subsidies, provision of service levels and other attributes of service, application of techni-

cal standards, etc.) in order to strengthen their pro-poor impact and enhance their political acceptability and sustainability. Such a baseline will make it possible to set targets in PSP contracts and monitor progress towards these targets. Often the costs of such surveys are being mentioned as an impediment to undertaking the analysis. While it is true that the costs of such baseline surveys are not negligible, they tend to be very small in comparison to the proposed investment programs — and are also relatively small in comparison with the costs of the financial and technical advisors who design the transaction and prepare the bidding documents.

The information generated from such research can also improve the focus of public investment programs. When the demand for piped water is lacking as was the case in Sri Lanka, the question arises — especially in this particular environment where the public health benefits of piped water are relatively small and government resources are used to fund or subsidize investment programs — whether the return on these public resources is enough to ensure that the benefits of such investments cover their costs. If not, it may make more sense from a public finance point of view to use these resources for investments that are able to generate higher rates of return.

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ANNEX 1
THE SRI LANKA TRANSACTION DESIGN

Assumptions Versus Reality

Assumptions	Reality
Water resource legislation The Water Sector Law proposed that no exclusivity would be granted to the operators.	Although provision through other service providers than the water utility is rare in the service areas, self-provisioning is very common. Private wells are the most prevalent water source used by households. Easy and cheap access to private wells results in a "competitive" environment for the private sector operators, which dampens the demand for piped water supply services.
Service area The service area consists of two areas: Greater Negombo, and the Kalutara to Galle Coastal Strip. The current piped network mainly lies next to the road that follows the coast line.	Many people in the service area live in quasi-rural areas on the perimeter of the service area, far from the existing network adding to the cost of providing water supply service.
Coverage targets The coverage targets within the two defined project areas was estimated with 95 percent of the population having access to piped water services at the end of the contract.	• The demand for piped water services is not very high. Assuming a 100 percent tariff increase, less than 50 percent of the households would want to connect to the piped water network • Given the limited extent of the network and the dispersed nature of the population, extending the network will be expensive
Service levels It was assumed that 95 percent of the households connected would have access to a house or yard connections ("house connections").	Poor households — making up 20 percent of the population in the two service areas — have a very low preference for house connections given the prices they would need to pay for obtaining such connections.
Standards of service: • The operators would provide water 24 hours per day • The operators would deliver water that conforms to the water quality standards as defined in the Sri Lanka Drinking Water Standards	• Although households value regular supplies of water, the willingness to pay for this feature of supply shows that households only value a regular supply up to 20 hours per day; every hour supplied above 20 hours is valued less • Households value good drinking water quality but intermediate levels of drinking water quality are little valued by either poor or non-poor households.

(*continued*)

Assumptions Versus Reality

Assumptions	**Reality**
Tariff Levels Tariffs could be gradually increased to cover both the costs of managing the system and the cost of the major investments involved and residents would be willing to pay these higher tariffs.	The price elasticity for piped water demand is inelastic, but the value of the price elasticity is much higher than what is normally found in most developed countries. Although utility revenues will increase after a tariff increase, the revenue impact is lower than what was assumed by the transaction advisors. Price elasticity between income groups is not statistically different.
Tariff Structure The existing tariff structure is essentially beneficial to poor consumers and well targeted	The high level of cross subsidies in the tariff structure means that essentially all residential consumers (whether poor or not) are subsidized. The existing tariff structure with its increasing block rates turns out not to benefit the poor: • The poor are underrepresented in the customer base with a lower probability to be connected to house connections • The poor tend to rely more, if connected to the piped network, on public taps • Poor and non-poor households consume more or less similar amounts of water, meaning that subsidies based on volume consumed are not well targeted Public tap water is more costly for consumers than water from house connections due to the higher tariffs being charged to consumers, while the cost of public service delivery is lower (due to the lower distribution cost), creating its own inequities.
Connection charges It was assumed that current connection policies would be maintained.	The current connection charges are relatively high, with a median value of SLR 9000, which amounts to about 80 percent of monthly income of poor households. The study found that connection fees can hamper the willingness to connect, yet how it impacts the poor also depends on other factors.
Targeting of subsidies It was assumed that the cross subsidies implicit in the water supply tariff structure . Targeting direct subsidies through programs such as Samurdhi were well targeted and reaching the poor.	The water supply tariff structure is not benefiting the poor. Direct subsidy programs like the Samurdhi welfare program are not well targeted with only 47 percent of the poor gaining access to that program.

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