WaSH Policy Research Digest

ISSUE #5, DECEMBER 2016: WATER TARIFFS AND SUBSIDIES

Detailed Review of a Recent Publication: Increasing block tariffs perform poorly at targeting subsidies to the poor

Nauges, Céline and Whittington, Dale. 2017 (forthcoming). Evaluating the Performance of Alternative Municipal Water Tariff Designs: Quantifying the Trade-offs between Cost Recovery, Equity, and Economic Efficiency. World Development

Through detailed modelling, this paper tackles a problem that many utility managers, regulators and policy-makers face – that they know little about how water tariffs actually perform in practice, and whether they have the desired effects or bring about the intended benefits. The authors of this paper point out that "policy makers and water professionals often rely too heavily on their intuition" when designing tariffs, and "often make implicit assumptions" about factors that determine tariff performance.

The paper looks specifically at the design of increasing block tariffs (IBTs). IBTs are widely used around the world for the pricing of piped water services. In a traditional IBT, the volumetric price for water use increases from one usage block to the next and customers are charged for the water they use in each block. An IBT often includes a "lifeline" block: a minimum quantity of water provided at a low volumetric price or sometimes free, designed to ensure that poor users can access affordable water. Figure 1 provides an example of an IBT with three blocks.

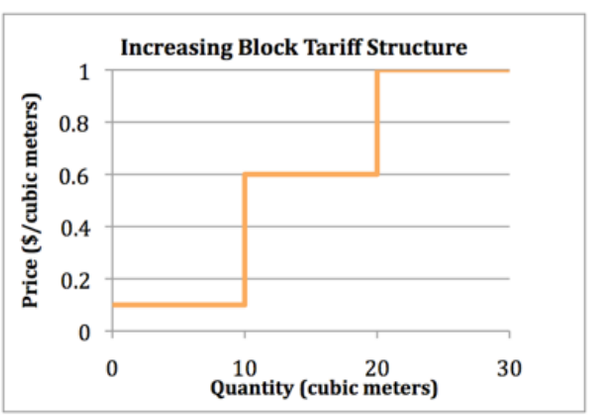

Figure 1: Example of an Increasing Block Tariff

Key Policy and Programmatic Takeaways

- Increasing block tariffs do not perform well in delivering subsidies to low-income households.
- Poor performance of increasing block tariffs in terms of equitable subsidy distribution is due to a number of factors, including a low correlation between water use and income, and less than full cost recovery through the tariff.
- Policy-makers need to explore alternatives to the lifeline block of an increasing block tariff in order to ensure all users have access to affordable water.

The authors examine the impact of tariff design on three criteria that utilities often try to balance: cost recovery, equity, and economic efficiency.

- *Cost recovery* determines the financial self-sufficiency of a utility. In the absence of transfers from government or donors, tariffs collected from users are the only source of revenue available to cover operations, maintenance and any capital costs the utility must meet. If one group of customers pays less than its full costs of service, another group of customers must pay more if cost recovery is to be achieved.
- *Equity* is defined in this paper in terms of distribution of subsidies, assuming that a tariff that targets more of the available subsidies to poor households performs better in contributing to an equitable outcome. The authors measure equity by reporting the distribution of subsidies among different income groups. (This definition is limited, as will be discussed below.)

The WaSH Policy Research Digest is issued quarterly by The Water Institute at UNC—problem solvers focused on the sustainable management of water for health and human development—and comprises a review of a recent article or report, and a short literature review on a WaSH topic. It provides objective, concise, and timely information to advise WaSH policy development. To subscribe, please go to http://waterinstitute.unc.edu/wash-policy-research-digest. Questions or comments about this publication? Please contact us at waterinstitute@unc.edu.

- *Economic efficiency* is defined as the change in consumer surplus (an economic measure of welfare) experienced by csustomers and what others (for instance, taxpayers) must pay to keep the utility running when cost recovery from tariffs is lower than 100%.

The authors develop a simulation model, using hypothetical data typical of conditions in industrialised countries, to compare the performance of several IBT design scenarios. They examine the results relative to a baseline in which the utility applies a uniform price tariff structure; that is, one in which all water use is priced at the same volumetric rate.

Description of the simulation model

The model used in the paper simulates the consequences of moving from a uniform price structure to nine different IBT designs for a hypothetical utility serving 5,000 private household connections. The authors assume monthly water bills were composed of a volumetric component and a fixed charge. All of the IBT designs have two usage blocks for the volumetric component. The size of the first block varied and was either 5 m^3, 10 m^3, or 15 m^3 per connection per month. For each of the three sizes of lower blocks, three levels of fixed charge were assumed: zero, US$10 per connection per month, and US$15 per connection per month.

The model worked with two levels of cost recovery: 100% recovery, meaning that the bills paid by the 5,000 households completely covered the utility's costs, and 50% cost recovery, meaning that the revenue from water bills covered only half the costs, and the utility would need additional funding from another source to cover operations, maintenance, and capital costs.

The paper presents several important findings related to subsidies. First, the authors show that *IBTs perform poorly in terms of targeting subsidies to low-income households*. This poor performance persists regardless of the level of cost recovery – i.e., the magnitude of the transfers that a utility receives from government or donors. This poor performance is regardless of the magnitude of any transfers that a utility receives from government or donors. Furthermore, the authors show that *changes to the size of the lifeline block and any fixed charges associated with the tariff do little to improve subsidy targeting*.

The authors suggest that there are several factors that are poorly understood by those who set tariffs. The paper helps to clarify two common misconceptions relevant to the performance of IBTs:

Customers do not necessarily respond to marginal price: An important assumption leading to the popularity of IBTs is that customers respond to marginal price. According to standard economic theory, customers would limit water use to avoid paying at the rate of the higher price blocks of the tariff. However, the authors point several reasons why this may not happen, including: 1) the complexity of tariff structures which make them difficult to decipher for customers; 2) water prices which are so low that households don't find it worth the trouble to adjust their water use; and 3) the difficulty of controlling water use if many household members are involved.

The correlation between household water use and income is, typically, not high: Water professionals typically assume that rich households use more water than poor households. The authors complement the modelling with an analysis of data from nine OECD countries and four developing countries; this shows that while the correlation between household water use and income is typically (but not always) positive, it is very low. This means that there are many rich households that use small amounts of water, and many poor households that use large quantities of water.

The "base case" scenario in the model assumes a low correlation between income and water use and cost recovery of 50%. Under this scenario, all of the IBT tariffs simulated were found to be ineffective at delivering subsidies to poor households because at 50% cost recovery, all water use is subsidized. Even the price of water in the highest block of the tariff is still below the average cost of providing it, so that the more water a household uses, the more subsidy it receives. When the authors ran the model with the assumption that income and water use are highly correlated (a common misconception), the performance of the tariff in delivering subsidies to the poor was even worse.

In the 100% cost-recovery scenarios, most of the subsidy still flowed to the non-poor if the correlation between household income and water use was assumed to be low. In fact, in this case, the authors report "there are many poor and middle-income households with high water use cross-subsidizing other middle income and rich households". Only in the case in which cost recovery is 100% and correlation between water use and income is high does an IBT target subsidies to low-income households. However, the authors point out that this combination of parameters (full cost recovery and a high correlation between income and water use) is unlikely, even if regulators and utility managers may assume otherwise. It should be noted that in the versions of the model with 100% cost recovery, the monthly water bills are very high (an average of USD254) which may surprise some readers. However, the authors explain that this reflects the fact that few water utilities actually achieve cost recovery, even in industrialised countries.

This paper provides data from a number of sources, and clear quantitative modelling to support its conclusions. It is useful to regulators and utility managers as it does something few of them have time or resources to do – it tests out the impact of various scenarios on the users who are destined to be winners, or, in many cases, losers.

It should be noted that the definition of "equity" used in the paper is limited, and does not include affordability, equality of access (for instance, exclusion based on ethnicity) or other parameters. The paper also does not look at inequalities created if some customers have private connections, but others use public standposts, share connections or buy water on-sold from the private connections of others; situations which are very common in low-income countries.

As the authors point out, a utility's customer billing records do not include information on households' income and other socioeconomic and demographic characteristics, so trying to design an equitable and efficient subsidy regime is very tricky. As this paper shows, it is easy to make apparently logical, but in fact incorrect, assumptions, and the results may be exactly the opposite of what was intended.

Review prepared by Clarissa Brocklehurst, Adjunct Professor, Department of Environmental Sciences and Engineering, Gillings School of Global Public Health, University of North Carolina at Chapel Hill

Literature review: Increasing Block Tariffs and Subsidy Targeting

Utilities can use a variety of tariff structures to charge for water and sanitation services, ranging from a simple fixed monthly fee that is independent of water use to complicated multipart tariffs based on metered water use. The increasing block tariff (IBT) is among the most widely applied tariffs, and is used extensively in low and middle income countries. According to GWI (2013), which conducts a global survey of tariffs globally, over 70% of utilities in low and middle-income countries used an IBT. The rate of IBT use is even higher in sub-Saharan Africa where 85% of 46 utilities surveyed by the World Bank used one (Banerjee et al. 2008).

In a typical IBT, the volumetric price for water use increases from one usage block to the next and customers are charged for the water they use in each block. The popularity of the IBT reflects two widely held beliefs about its potential merits. First, policy makers believe a low volumetric price in the lowest usage block of an IBT, often referred to as a "lifeline block", can ensure that low-income households have access to a certain quantity of water at a price deemed affordable. Second, they believe that higher prices in the upper block(s) of the IBT can both prevent wasteful or extravagant water use and provide an opportunity to increase cost recovery. These beliefs rest on the assumptions that: 1) all households have a private piped connection to the water network, and 2) low-income households use less water than high-income households.

Examples of common misconceptions about IBTs are reflected in the following quotes from the literature (summarized in Whittington et al 2015):

- ADB (2014) "[r]ising block tariffs are effective and fair. They are not perfect but they work well, are easy to implement, are easy to communicate to customers, and are a pragmatic solution to a complex issue."
- Hoque and Wichelns (2013) "Increasing block-rate tariffs are helpful in providing low-income consumers with essential water volumes at low prices while encouraging wealthier consumers to use water wisely ... Cross-subsidy involving low water prices for low-income consumers and higher prices for wealthier consumers can be achieved using an increasing block-rate tariff."
- Kahn (2014) "Such [scarcity] pricing can inflict real costs on the poor. An increasing block tariff rate with a low bottom rate for households that consume a low level of electricity or water would allow them to afford basic necessities."
- Groom et al (2008) "So, while a uniform tariff, despite its efficiency qualities, may have profoundly negative income effects on precisely those parts of the population least able to bear them, the IBT system is often thought to alleviate these problems by shifting the financial burden from low water consumers to high. In this way the equity efficiency argument appears to be circumvented."

Researchers have long questioned whether IBTs, and water tariffs more broadly, can effectively target subsidies to low-income households, and whether this is the best way to provide assistance to the poor (Whittington 1992; Boland and Whittington 2000; Komives et al. 2005). This has led to research that examines how well different types of tariffs for water and sanitation services target subsidies to the poor. Fuente at al. (2016) identify more than 20 studies that have been published on this topic since 2000.

Early studies used household budget and expenditure surveys to estimate subsidy incidence (e.g., Foster and Yepes 2006; Komives et al. 2006; Komives et al. 2007; Banerjee et al. 2008; Banerjee and Morella 2011; Barde and Lehman 2014). These studies find that, in general, subsidies delivered through water tariffs are poorly targeted and largely regressive. Indeed, many studies find that subsidies delivered through water tariffs perform worse than if the subsidies were equally distributed among households.

Several recent studies, including Nauges and Whittington (In press) reviewed in this digest, use alternative methods to examine the incidence of subsidies delivered through water tariffs. In another paper, Whittington et al. (2015) develop a simple diagnostic tool for estimating the incidence of subsidies delivered through the water tariff. They then simulate the performance of 23 different tariff structures using hypothetical data on water use and income reflective of conditions in low-income countries. As in the paper reviewed in this Digest, they find that water tariffs cannot be designed to effectively target subsidies to low income customers when water is sold below the average total cost of production. They also find that subsidy targeting is worse at low levels of cost recovery when the correlation between income and water use is high (i.e., when high income customers use more water than low income customers).

Another recent study, Fuente et al. (2016), combine household survey data and data on metered water use to examine subsidy incidence in Nairobi, Kenya. They find that, even among households with a private piped connection, the IBT implemented in Nairobi does not effectively target subsidies to low-income customers. They

attribute this to the facts that: 1) very few customers fall in the upper blocks of the IBT, 2) there is a low correlation between income and water use among households with a private piped connection in Nairobi; and 3) nearly all customers are subsidized at current prices.

Unlike other studies which focus on subsidy incidence among only residential customers, Fuente et al. (2016) also estimate the distribution of subsidies among all customer classes (e.g., residential, commercial, industrial, bulk, etc.). They find that residential customers in low income areas receive only 9% of the total subsidies delivered through the water tariff.

The literature on subsidy targeting indicates that water tariffs – and increasing block tariffs in particular – are an ineffective means of delivering subsidies to low-income households. This is particularly true when water prices are not sufficient to cover the cost of water and sanitation service delivery and when poor households lack a connection to the piped water and sewer network, conditions that are prevalent in many low and middle income countries. For example, Brocklehurst and Janssen (2004) found that private connections in Dakar, Senegal, were only available to customers who lived on land for which they had full tenure and on which they had constructed a house, two criteria that almost guaranteed that a household was not poor. Those without private connections were obliged to use public standposts, at which the effective tariff, when the costs of standpoint management were factored in, was more than three times that of the lifeline block of the IBT.

The literature suggests that policy makers should use the water tariff to pursue financial (cost recovery) and economic (efficiency) objectives and use other policy instruments to provide assistance to low income households and ensure they have access to high quality water and sanitation services. This could include subsidies for connections to the piped network and means-tested subsidies (e.g., vouchers, cash transfers) administered by the utility or as part of other social programs (Whittington et al. 2015; Fuente et al. 2016; and Young and Whittington 2016).

Review prepared by David Fuente, Program Coordinator, The Water Institute at UNC, Gillings School of Global Public Health, University of North Carolina at Chapel Hill

References

Asian Development Bank (ADB), 2014. Urban Water Supply and Sanitation inSoutheast Asia: a Guide to Good Practice. Asian Development Bank, Mandaluyong City.

Banerjee, S., V. Foster, Y. Ying, H. Skilling, and Q. Wodon. 2008. Cost Recovery, Equity and Efficiency in Water Tariffs: Evidence from African Utilities. World Bank Policy Research Working Paper No. 5384. Washington, DC: World Bank.

Banerjee, S.G., and E. Morella. 2011. *Africa's Water and Sanitation Infrastructure: Access, Affordability and Alternatives*. Washington, DC: World Bank.

Boland, J., and D. Whittington. 2000. "The Political Economy of Water Tariff Design in Developing Countries: IBTs versus Uniform Price with Rebate." In *The Political Economy of Water Pricing Reforms*, edited by Ariel Dinar. New York: Oxford University Press.

Foster, V., and T. Yepes. 2006. Is Cost Recovery a Feasible Objective for Water and Electricity? The Latin American Experience. World Bank Policy Research Working Paper No. 3943. Washington, DC: World Bank

Fuente, D., Gakii Gatua, J., Ikiara, M., Kabubo-Mariara, J., Mwaura, M., Whittington, D. 2016. Water and sanitation service delivery, pricing, and the poor: An empirical estimate of subsidy incidence in Nairobi, Kenya, *Water Resources Research*, 52, doi:10.1002/ 2015WR018375.

Groom, B., X. Liu, T. Swanson, and S. Zhang. 2008. "Resource Pricing and Poverty Alleviation: The Case of Block Tariffs for Water in Beijing." In *Coping with Water Deficiency* 48: 213-37. Dordrecht: Springer Netherlands. doi:10.1007/978-1-4020-6615-3_9.

GWI. 2013. Global Water Tariff Survey. Available at: http://www.globalwaterintel.com/global-water-intelligence-magazine/tariff-survey/.

Hoque, S.F., Wichelns, D., 2013. State-of-the-art review: designing urban water tariffs to recover costs and promote wise use. *Int. J. Water Resour. Dev.* 29 (3),472e491.

Khan, M., 2014. Smart and Sustainable Cities. World Bank Policy Research Paper No.6878. World Bank, Washington, DC.

Komives, K., J. Halpern, V. Foster, Q. Wodon, and R. Abdullah. 2005. Water, Electricity, and the Poor: Who Benefits From Utility Subsidies? Washington, DC: World Bank.

Komives, K., J. Halpern, V. Foster, Q. Wodon, and R. Abdullah. 2006. The Distributional Incidence of Residential Water and Electricity Subsidies. World Bank Policy Research Paper No. 3878. Washington, DC: World Bank.

Komives, K., J. Halpern, V. Foster, Q. Wodon, and R. Abdullah. 2007. Utility Subsidies as Social Transfers: An Empirical Evaluation of Targeting Performance. *Development Policy Review* 25(6): 659-679.

Nauges, C. and D. Whittington. 2017 (forthcoming). Evaluating the Performance of Alternative Municipal Water Tariff Designs: Quantifying the Trade-offs between Cost Recovery, Equity, and Economic Efficiency. World Development

Whittington, D. 1992. Possible Adverse Effects of Increasing Block Water Tariffs in Developing Countries. *Economic Development and Cultural Change* 41(1): 75-87.

Whittington, D., C. Nauges, D. Fuente, and X. Wu. 2015. A Diagnostic Tool for Estimating the Incidence of Subsidies Delivered by Water Utilities in Low - and Medium-income Countries, with Illustrative Simulations. *Utilities Policy* 34: 70-81.

Young, M., and D. Whittington. 2016. Beyond increasing block tariffs – decoupling water charges from the provision of financial assistance to poor households. GWP Perspectives Paper, July 2016. Global Water Partnership: Stockholm, Sweden. Available at: http://www.gwp.org/Global/ToolBox/Publications/Perspective%20Papers/08_perspectives_paper_Beyond%20increasing%20block%20tariffs.pdf