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A diagnostic tool for estimating the incidence of subsidies delivered by water utilities in low- and medium-income countries, with illustrative simulations

Dale Whittington [a, b, c], Céline Nauges [d, *], David Fuente [b], Xun Wu [e]

[a] Department of Environmental Sciences & Engineering, University of North Carolina at Chapel Hill, USA
[b] Department of City & Regional Planning, University of North Carolina at Chapel Hill, USA
[c] Manchester Business School, UK
[d] School of Economics, University of Queensland, Australia
[e] Institute of Water Policy, Lee Kuan Yew School of Public Policy, National University of Singapore, Singapore

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ABSTRACT

It is conventional wisdom that poor households use less water than rich households, and intuition suggests that an increasing block tariff with a lifeline block will target subsidies to poor households. In this paper we provide a simple diagnostic tool that a water utility can use to estimate the distribution of subsidies to households in different income quintiles and to check whether this intuition about the incidence of subsidies is correct in a specific local service area. The results of our illustrative simulations calibrated using data from low- and medium-income countries, show that subsidies delivered through the most common tariff structures are very poorly targeted to poor households. This finding holds regardless of the specific characteristics of the tariff structure used to calculate households' water bills. We also find that the higher the correlation between household income and water use, the lower the proportion of total subsidies received by poor households.

1. Introduction

Most water utilities in developing countries charge all their customers—households, industries, and government agencies—-less for water than the average total cost of service. Every unit of water delivered by the water utility is thus sold below cost and must be subsidized, typically by a combination of donor funds, fiscal transfers from central governments (taxpayers), and deferred maintenance and capital expansion (future customers). It is widely believed that poor households would not be able to afford piped water services if water were priced to recover costs. In addition, the majority of water utilities in developing countries now use an increasing block tariff structure (IBT) to calculate their customers' water bills. These two decisions–to utilize an IBT structure and to sell water to all customers below average total cost–determine the magnitude and distribution of subsidies to different income groups and customer classes.

However, water utilities rarely know the incidence of the financial subsidies they deliver because they do not have data on the income (or wealth) of their customers. Equally important, it is conventional wisdom that poor households use less water than rich households, and intuition suggests that an IBT with a lifeline block will target subsidies to poor households effectively. In this paper we provide a simple diagnostic tool that a water utility can use to estimate the distribution of subsidies to households in different income quintiles and to check whether this intuition about the incidence of subsidies is correct in a specific local service area. This diagnostic protocol is designed to calculate the incidence of financial subsidies to households with metered private connections, not to households using public taps or unmetered connections, or to industries or other users.[1] But the protocol could be

* Corresponding author.
E-mail addresses: Dale_Whittington@unc.edu (D. Whittington), c.nauges@uq.edu.au (C. Nauges), fuente@unc.edu (D. Fuente), sppwuxun@nus.edu.sg (X. Wu).

[1] Note that our focus is on the distribution of financial subsidies across income quintiles, not the economic efficiency of different tariff structures. We do not claim to measure the excess burden (or the welfare-theoretic consequences) of different tariff designs.

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adapted to cover such situations.

We use our diagnostic protocol to simulate baseline (status quo) conditions and typical tariff structures common in many water utilities and their associated service areas in cities in developing countries. The results show that only a small percentage of the total subsidies reach low-income households. This finding holds regardless of the specific characteristics of the tariff structure used to calculate households' water bills. We also find that the higher the correlation between household income and water use, the lower the proportion of total subsidies received by poor households. This contrasts sharply with common intuition that IBTs will effectively target subsidies to poor households if the poor use less water than the rich. We conclude that making small adjustments to water tariff structures in hopes of assisting poor households is misguided. If water utilities really want to assist poor households, they need to focus on alternative subsidy targeting mechanisms, and in particular means testing (i.e., an assessment of households' income, wealth, or socioeconomic status in order to determine their eligibility for financial assistance). Municipal water tariff structures should be designed to meet financial and economic objectives—and not attempt to achieve objectives related to poverty alleviation and income redistribution.[2] If means testing is impractical or politically infeasible, then other policy instruments are required to achieve poverty alleviation.

The second section of the paper summarizes the types of water tariff structures currently used in developing countries, the rationales underpinning the widespread use of IBTs, and the findings from the existing literature on the incidence of subsidies in the water and sanitation sector. The third section presents the modeling strategy used to calculate the incidence of subsidies and the key assumptions needed. The fourth section of the paper discusses in more detail the data requirements for the use of the diagnostic protocol. The fifth section presents the results of the application of the diagnostic tool using simulated data that reflect conditions typical of water utilities in low-income countries. The final section discusses the implications of our findings for water tariff design.

2. Background

IBTs are now the tariff structure of choice in low- and middle-income countries. In 2013 Global Water Intelligence (GWI) surveyed 165 water utilities in 71 low- and middle-income countries[3] and found that 74 percent were using IBTs (Table 1).

Table 1
Water tariffs in use in low- and middle-income countries.

Tariff structure	No. utilities	Percent
Decreasing block	1	1%
Fixed	6	4%
Increasing block	122	74%
Uniform volumetric	36	22%
Total	165	100%

Source: GWI (2013).

IBTs appear to have three appealing features. First, poor households can obtain water in the first ("lifeline") block cheaply, or even for free. Thus, piped water services should be affordable to poor households if they do not use "excessive" quantities of water. Second, assuming rich households use more water than poor households, there is a potential for rich households to cross-subsidize poor households. Third, the price signals in the higher blocks provide an incentive to households to conserve water.

However, in order to increase their revenues, utilities have often made three modifications to the standard IBT, all of which diminish its simplicity and intuitive appeal. The first is to impose a minimum charge on a household's monthly water bill. For example, this minimum charge is often set equal to the price in the first block times the size of the first block – i.e., households are charged for the entire first block regardless of how much water they use. The consequence of such a minimum charge is that the household has no incentive to use less water than the maximum quantity in the first block. Second, a positive fixed charge is often added to the volumetric component of households' water bills. For households falling in the lifeline block, this can greatly increase the average cost per unit of water purchased.

The third modification is termed a "Volume Differentiated Tariff" (VDT), sometimes called a "ratchet" IBT. When a VDT is used to calculate a household's water bill, households that use more water than the lifeline block are charged the volumetric price in the highest block in which their water use falls for their entire water use. The VDT provides households a strong incentive to keep their water use just under the amount of the next highest priced block so that the higher prices do not kick in for all previously used units. It also provides a strong incentive for utilities to bill for water use just over the threshold of the next highest priced block and for households to bribe a meter reader to record the household's water use as just under the threshold of the higher price block. VDTs thus induce a variety of socially inefficient and undesirable behaviors.

IBTs in their various forms are popular throughout the world, but the specific features of the IBT (i.e., the number of blocks, the average prices charged in each block, the size of the first block or "lifeline" block, and the size of the positive fixed charge) vary widely from utility to utility. The majority of utilities with IBT structures in the GWI database used three or four blocks, but five, six, seven, or even eight blocks were not uncommon (Fig. 1).

The median size of the first block was 10 cubic meters, surprisingly large (Table 2). Seventy percent of water utilities using IBTs added a positive fixed charge to the volumetric component of the tariff; the median size was US$4–5 per month in East Asia and Latin America and US$1 per month in South Asia and Sub-Saharan Africa.

Looking at the subsample of 34 utilities in the GWI database that use a three-block IBT, the median price of water was US$0.35 per cubic meter in the first block, US$0.57 per cubic meter in the second block, and US$0.75 in the third block. In most utilities in developing countries, the average total cost of water services is in the US$1–2 per cubic meter range (not including wastewater collection and treatment), so even water sold in the highest block is subsidized. Average household water use varies across households and by water utility, but in low-income and middle-income countries with such low average water prices, mean and median household water use typically falls in the range of 10–20 cubic meters per month. With the average lifeline block equal to 10 cubic meters, it is

[2] Of course, it is a reasonable expectation that the water tariff does not worsen the poverty and income inequality. But charging prices to recover costs may not make many poor households worse off, especially if coupled with a means-tested subsidy program. In many municipalities poor households simply do not have a connection to the piped system. Of those that do, existing water bills are typically a small fraction of the total monthly expenditure (less than 3%).

[3] In this paper, we define low and middle income countries as countries in the following regions: East Asia and Pacific, Latin America and Caribbean, the Middle East and North Africa, South Asia and Sub Saharan Africa.