WPS 3878

The Distributional Incidence

of Residential Water and Electricity Subsidies

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Abstract

Subsidies to residential utility customers are popular among policy makers, utility managers, and utility customers alike, but they are nonetheless the subject of much controversy. Utility subsidies are seen as a way to help make utility service affordable for poor households and as an alternative mechanism for income redistribution. These arguments in favor of subsidies are countered by serious concerns about their adverse effects on consumer behavior, utility operations, and the financial health of utilities. Both the affordability and redistributive arguments for subsidies are based on the presumption that poor households benefit disproportionately from water and electricity subsidies, that they are well-targeted to the poor. This article tests this assumption by examining the extent to which the poor benefit from consumption and connection subsidies for water and electricity services. Our analysis of a wide range of subsidy models from around the developing world shows that the most common form of utility subsidy – quantity-based subsidies delivered through the tariff structure– are highly regressive. Geographically-targeted or means-tested subsidies do better, and in many cases have a progressive incidence, but large numbers of poor households remain excluded. Low levels of coverage and metering severely limit the effectiveness of consumption subsidy schemes to reach the poor. Simulations suggest that connection subsidies are an attractive alternative for low coverage areas, but only if utilities have the means and motivation to extend network access to poor households and only if those households choose to connect.

World Bank Policy Research Working Paper 3878, April 2006

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Introduction

Subsidies to residential utility customers are popular among policy makers, utility managers, and utility customers alike, but they are the subject of much controversy. Utility subsidies are seen as a way to help make utility service affordable for poor households, and to keep it affordable as governments seek to raise average prices to improve the financial viability of utilities and to scale back the hefty fiscal transfers many utilities currently receive. They are also a social policy instrument, a mechanism for income redistribution. In-kind transfers such as water and electricity subsidies have been promoted as an alternative mechanism of redistribution in places where administrative capacity to implement cash transfer programs is lacking.

The arguments in favor of subsidies are countered by two primary concerns. The first is the potential adverse consequences of these subsidies in terms of allocative and productive efficiency, financial sustainability and equity. Subsidies engender distortions in the use of water and electricity, which can indirectly raise the cost of service provision. Subsidies can also induce inefficiency in utility operations where utility managers face soft budget constraints. Moreover, subsidized prices for utility service have produced financially weak utilities with stagnant service areas and declining service quality. The endemic financial weaknesses of utilities that are not reimbursed for the subsidies offered to utility customers leaves many poor unconnected households facing the prospect of relying on alternative (and often expensive or poor quality) water and energy sources for years to come.

A second concern is that they are not in fact well-targeted to the poor. Whether water and electricity subsidies are a cost-effective way to reduce the cost of service for the poor (and thus raise their disposable incomes) depends on the degree and manner in which they are targeted. The better targeted the subsidy, the lower the subsidy budget needed to provide a given discount to the poor, or alternatively the greater the benefit to the poor for a given subsidy budget. Underlying both the affordability and redistributive arguments for subsidies described above is the presumption that poor households benefit disproportionately from water and electricity subsidies, that the distributional incidence of the subsidy is progressive. A number of recent case studies have questioned the validity of this assumption (Pattanayak and Yang 2002, Prokopy 2002, Foster 2004, Wodon, Ajwad, and Siaens 2003, Robles 2001, Walker et al 2000). Articles assessing the efficiency and equity of increasing block tariffs used in the water supply sector have also questioned whether this form of residential subsidy in practice actually results in lower prices for the poor (Whittington 1992, Boland and Whittington 2000). Unfortunately, the results and observations in these studies are not directly comparable, nor are their findings generalizable. As a result, policy makers currently have little systematic information about targeting performance on which to base their analysis of residential utility subsidies as a utility policy or social policy option.

This article seeks to contribute to closing this gap by systematically examining the targeting performance of residential utility subsidies using data from 13 water utilities and 27 electricity utilities around the world. A conceptual framework that decomposes the determinants of targeting performance is employed to identify those factors that most strongly influence the empirical results and predict targeting performance for various types of subsidies. We begin with an overview of the types of utility subsidies that exist and their prevalence among water and electricity utilities. The article then focuses on the analysis of the benefit and beneficiary targeting performance of consumption and connection subsidy schemes.

The results indicate that the most common forms of residential utility subsidies – quantity-based consumption subsidies such as increasing block tariffs -- are highly regressive. Most poor households are excluded from these subsidies, and the majority of benefits accrue to the non-poor. Prospects for achieving a progressive incidence of subsidies are better when other targeting mechanisms are used, such as means-testing. However, low levels of coverage and metering severely compromise the ability of any consumption subsidy scheme to reach the poor. Where coverage of standard in-house water and electricity service levels is low, subsidies targeted only to consumers of lower-levels of service or connection subsidies are better alternatives, but the performance of these subsidy models is highly dependent on how poor households respond to the subsidy offer. Even connection subsidies and service-level targeted subsidies may not reach many poor households if price is not the principal barrier to connection for poor households or if demand for alternative services (such as public taps or low voltage electricity service) is low.

Typology and prevalence of subsidies

We distinguish in this analysis between two broad categories of utility subsidies – consumption subsidies and connection subsidies. Consumption subsidies reduce the charge for consuming water or electricity service, while connection subsidies are a one-time reduction in connection charges. Consumption subsidies are available only to existing utility customers. Connection subsidies are by definition for unconnected households only.

Consumption and connection subsidies may be targeted or untargeted. Untargeted subsidies occur when there is general underpricing of utility services, such as when certain costs are not passed on to customers.

Targeted subsidies reduce prices for only a subgroup of customers. In practice, targeted and untargeted subsidies are often combined: there may be an across-the-board price subsidy for all customers, but some customers are targeted to receive greater discounts than others.

A recent survey by Global Water Intelligence, covering water utilities in 132 major cities worldwide, revealed that underpricing of water services is widespread (GWI 2004). The survey compared estimates of the average tariff that would be needed to achieve varying degrees of cost recovery to average tariffs actually charged for a large number of utilities. The conclusion was that all surveyed water utilities in South Asia and Eastern Europe and Central Asia, and more than half in East Asia, the Middle East, and North Africa, charged average tariffs below what would normally be required to even cover ongoing operation and maintenance costs. A similar study of electricity tariffs (Foster and Yepes 2005) found that the average tariffs in nearly a third of electricity utilities in Eastern Europe, Central Asia, East Asia, South Asia, and Sub-Saharan Africa were likewise probably too low to fully cover probable O&M costs. Cost recovery was higher among both water and electricity utilities in Latin America, with half of the water and electricity utilities appearing to charge enough to recover all O&M and a portion of capital costs from consumers. The two studies together suggest that any targeted water and electricity subsidies that may exist are combined with untargeted general price subsidies in virtually all water utilities and many electricity utilities in the developing world.

The targeting of subsidies can occur in two ways. The first is through implicit subsidy structures – elements of utility pricing or practice that have distributional consequences, but that do not represent an explicit conscious attempt to reduce the cost of service or of connection for particular customers. Common implicit subsidies include the practice of charging a flat fee for service rather than using volumetric charges. Flat fees do not distinguish between consumption levels and thus subsidize large-volume customers. Illegal connections and inaction in the face of non-payment of bills are two other forms of implicit subsidies, which benefit those with illicit connections and those who do not pay their bills respectively.

The second form of targeted subsidy, which we focus on in this article, is targeting through an explicit subsidy mechanism. The most common type of explicit targeted subsidy in water and electricity utilities is the quantity-based consumption subsidy. Increasing block tariffs (IBT) – stepped tariffs that charge an increasingly higher price per unit to all consumers as their consumption increases into subsequent blocks – are a common example. Some (primarily electricity) utilities apply another form of quantity-based subsidy, termed here a volume-differentiated tariff (VDT). VDTs are composed of two or more different tariffs (e.g. the first highly subsidized and the second less or not at all) to which consumers are assigned based on their total volume of consumption. Our recent survey of water and electricity tariff structures in Latin America, Africa, and Asia found that roughly three-quarters of utilities in both sectors include some form of quantity-based subsidy in their residential tariff structures (Komives et al 2005).

Quantity-targeting can be thought of as a form of self-selection, in the sense that individual customers determine how much of a subsidy they receive based on how much water or electricity they choose to consume. Another form of self-selection is service-level targeting in which only those households who opt to use a particular lower-cost service level (e.g. public water taps) receive a subsidized connection or a subsidy for on-going service. The use of service-level targeting is quite rare in the electricity sector. In the water sector, it is not uncommon for utilities to provide free or reduced price water from public standposts.

Another form of explicit targeting involves the use of administrative decisions to determine subsidy eligibility. The decision could be to subsidize all customers in a particular demographic or employment group (e.g. categorical targeting of pensioners or war veterans) or those living in particular neighborhoods or regions (i.e. geographical targeting). For geographic targeting to effectively identify the poor, the location of the household must be a reliable proxy for poverty status. This may work well, for example, where poor households live together and isolated from non-poor households. Geographic targeting is often found combined with an IBT or VDT. The water tariffs in Panama City; in Merida, Venezuela; and in Managua, Nicaragua, for example, combine a special tariff for slum areas with a general IBT for residential customers (Walker et al 2000).

Means-testing is a more time consuming and data-intensive approach to administrative decision-making about targeting. It involves using a multi-criteria instrument to evaluate the income or poverty level of individual households in order to find those who are most in need of a subsidy. One example is the Georgian Winter Heating Assistance Program (GWHAP), put in place in 1998 as electricity prices were set to increase in Georgia. This scheme provides subsidy recipients with free electricity for a fixed volume of kilowatt-hours per year (Lampietti et al 2003) The Chilean water subsidy is another—and perhaps the most widely cited example — of a means-tested consumer utility subsidy. The program subsidizes between 40 and 70 percent of up to 15 cubic meters of water for poor households.

Our survey of utility tariffs and subsidies revealed little systematic information on the use of administrative targeting in water and electricity utilities (Komives et al 2005). It is clear, however, that many utilities in Latin America at least offer separate social tariffs or special discounts for disadvantaged customers. Use of categorical targeting to reach pensioners in particular is very common on Eastern Europe and Central Asia.

Quantity-targeting, categorical targeting, geographical targeting, and means-tested can all be used to allocate either consumption subsidies or connection subsidies. In the remainder of this article we evaluate the targeting performance of consumption and connection subsidies that use all of these targeting methods to determine subsidy eligibility and to distribute subsidy benefits.

Data, measurement, and conceptual framework

Data

The data on which this study is based come from a variety of published and unpublished studies of subsidy performance in individual cases. All of these studies evaluate subsidy performance using a combination of household survey and utility data. In a small number of cases, we have done our own analysis of household survey data in order to generate a new subsidy case or expand the analysis done in a previous study.

The final sample includes 45 cases of existing subsidy programs in water and electricity, respectively. The majority are quantity-based subsidies, reflecting the prevalence of this subsidy mechanism. A number of simulated subsidies were also included to illustrate the differential performance of alternative subsidy mechanisms. The final sample includes 45 electricity subsidies from 27 utilities, plus 32 water subsidy programs from 13 utilities. Most cases are delimited by utility service area. Water utilities tend to serve one urban area; thus, the water cases are primarily city cases. For electricity cases, the sample includes a mix of national, state, and municipal cases. Though by no means a representative sample, this group of subsidy cases is representative of a broad cross-section of subsidy types and utilities located in different geographical areas, which permits drawing more systematic conclusions than could have been drawn from individual case studies. A list of the cases and the original sources for the case material can be found in appendices 1 and 2.

Measurement of targeting performance

The analysis of the distributional incidence of subsidies considers two dimensions of targeting performance: the beneficiary incidence of the subsidy and the benefit incidence. Beneficiary incidence is meant to address this question, “To what extent does the subsidy reach poor households?” The indicator used to measure how well utility subsidies target beneficiaries is the error of exclusion, defined as the percentage of poor households that do not receive the subsidy.

Benefit incidence addresses the question:, “How well does the subsidy instrument target benefits to the poor versus other households?” To measure the benefit incidence of the subsidy, a targeting performance indicator, termed Ω, measures the share of the subsidy benefits received by the poor divided by the proportion of the population in poverty.[1] A value of 1.00 for Ω implies that the distribution of the subsidy across income classes is neutral, with the share of benefits going to poor households equal to their share of the population. For example, if 40 percent of the population is poor, then a neutral targeting mechanism would deliver 40 percent of the subsidy to the poor. Neutral targeting means that the subsidy performs no better than random assignment of subsidies across the entire population or than a universal subsidy that delivers equal benefits to all. A value greater than 1.0 implies that the subsidy distribution is progressive, because the poor receive a larger share of the total benefits than their share of the population. A regressive subsidy would have a Ω value below 1.00.

In our analysis, subsidy recipients are defined as those customers who receive a *financial* subsidy – those customers for whom the cost of providing the service or connection they receive exceeds what they pay for the service. For consumption subsidies, this means $CQ_j - E_j$, where C is the average unit operating and capital cost of producing and distributing water or electricity, Q_j is the quantity consumed by household j, and E_j is that household's expenditure on utility service (that is, the utility bill).[2]

This calculation is complicated for connection subsidies, as there is no universally accepted definition of exactly which costs are associated with the installation of a connection and should, therefore, be recovered through the connection charge. In practice, therefore, our analysis of connection subsidies simply assumes that the existing connection charge is an accurate reflection of the cost of connection (however the utility chooses to define that cost).

The "poor" in this study are defined as the poorest 40 percent of households. In some of the poorest countries and cities studied here, this underestimates poverty as compared to an absolute poverty line. In Rwanda, for example, 60 percent of households have per capita incomes below the national poverty line.

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[1] Note that in some of the cases presented in this book, the analysis is population-weighted, so that the size of households is taken into account when analyzing the distributional properties of utility subsidies. In other cases, information on household size was unavailable or not considered in the original subsidy analysis.

[2] This approach to estimating the financial value of a consumption subsidy incorporates two important assumptions. The first assumption is that the unit cost of serving a customer is constant across customers. Although logic tells us that these cost differentials exist, the cost differences are rarely known. In practice, therefore, average cost is used to estimate the cost of serving any particular household. The second assumption is that the cost of serving a customer is solely a function of the quantity of water or electricity consumed, and the cost increases linearly with consumption. This assumption is a reasonable for large volumes of consumption but may not be accurate for low consumption levels, as part of the cost of serving a customer is billing, metering, and providing customer service to that client. This may lead to underestimation of the cost of serving low-volume customers and therefore may underestimate the value of the subsidy those customers receive.

In other cases, 40% overestimates absolute poverty. To test whether this definition of poverty affects the results, we conducted a sensitivity analysis of the poverty definition and determined that the assumed poverty line did not alter the findings (Komives et al 2005).

Conceptual framework

To assess key factors that influence observed targeting performance of residential subsidies, we employ a simple conceptual model that decomposes the benefit and beneficiary targeting performance of the subsidies into the factors that affect this performance.[3] The benefit targeting performance indicator, termed Ω, is defined as the share of subsidy benefits received by the poor (S_P / S_H) divided by the proportion of poor households in the total population (P / H) in poverty, where S_P is the value of subsidies accruing to the poor, S_H is the total value of the subsidy received by the population as a whole, P is the number of poor households, and H is the total number of households in the population. The Ω ratio can also be expressed as the average subsidy benefit per poor household, divided by the average benefit per household in the population as a whole:

$$\Omega = \frac{\frac{S_P}{P}}{\frac{S_H}{H}}, \qquad (1)$$

The numerator and denominator, S_P/P and S_H/H, can each be represented as a product of six factors: network access rates (A), uptake rates among those with access to the network (U), targeting rates among those with connections (T), the rate of subsidization enjoyed by those targeted to receive the subsidy (R), the quantity consumed by subsidy recipients (Q) and average cost per unit (C):

$$\frac{S_P}{P} = A_P \times U_{P|A} \times T_{P|U}\, x\; R_{P|T} \times Q_{P|T} \times C \qquad (2)$$

$$\frac{S_H}{H} = A_H \times U_{H|A} \times T_{H|U}\, x\; R_{H|T} \times Q_{H|T} \times C \qquad (3)$$

Recalling equation 1, the benefit targeting performance indicator is then defined as the product of five ratios, which compare the situation among the poor to the situation among the population as a whole.

$$\Omega = \frac{A_P}{A_H} \times \frac{U_{P|A}}{U_{H|A}} \times \frac{T_{P|U}}{T_{H|U}} \times \frac{R_{P|T}}{R_{H|T}} \times \frac{Q_{P|T}}{Q_{H|T}}. \qquad (4)$$

[3] This framework is based on Angel-Urdinola and Wodon 2005 and is presented in more detail in Komives et al 2005.

To understand conceptually why this is true, first consider A_H and A_P, which are the share of households and poor households respectively that have access to the water distribution network or the electricity grid in their neighborhoods. These households have potential access to the utility services, in the sense that they have the option of connecting. Households without access to the network or grid do not have the option of using utility services, and they cannot benefit from standard utility consumption subsidies.

Next consider $U_{H|A}$ and $U_{P|A,}$ the share of all households and poor households with potential access (A_H and A_P) that actually connect to the network or grid. $A_H \times U_{H|A}$ is equal to the actual connection rate, or the percentage of households that are connected and use water or electricity service. Likewise, $A_P \times U_{P|A}$ is equal to the actual connection rate among the poor. Unconnected households are excluded from consumption subsidies.

$T_{H|U}$ and $T_{P|U}$ are the share of utility service users (that is, households or poor households respectively with access and a connection) who are targeted (i.e. fulfill the eligibility criteria for receiving a subsidy) and, therefore, receive a subsidy. Where a general subsidy is provided to all residential customers, $T_{H|U}$ and $T_{P|U}$ would equal 1, indicating that all connection households in fact do receive the subsidy. Alternatively, connected households that do not fulfill the targeting criteria would be excluded from the subsidy.

The first three factors --access to the network, uptake rates, and the targeting mechanism – thus combine to explain who receives and who does not receive a subsidy. The share of all households receiving the subsidy is equal to $A_H \times U_{H|A} \times T_{H|U}$. The share of poor households receiving a subsidy is $A_P \times U_{P|A} \times T_{P|U}$. The error of exclusion (defined as the share of poor households not receiving the subsidy) can be represented as $1 - (A_P \times U_{P|A} \times T_{P|U}.)$.

Two additional factors help determine the benefit incidence of the subsidy – the ratio of subsidy rates ($R_{H|T} / R_{P|T}$) and the ratio of the quantity of water or electricity consumed ($Q_{H|T} / Q_{P|T}$). The rate at which each unit of water or electricity is subsidized for a particular customer can be calculated by dividing the household's expenditure or bill (E) by the cost of providing the service the household received (Q * C). The average rate of subsidization across all subsidy recipients is $R_{H|T} = 1 - E_{H|T} / (Q_{H|T} \times C)$, where C is assumed to be constant across customers. The average total value of the subsidy received by subsidy recipients is $R_{H|T} \times Q_{H|T} \times C$. Parallel calculations can be done for the subsidy rate and value of subsidy received by the poor.[4]

The above framework addresses the distributional incidence of consumption subsidies. A similar framework was employed to assess the targeting performance of connection subsidies. When all unconnected households are assumed to be potential beneficiaries of connection subsidies,[5] the benefit targeting performance indicator Ω^C takes the following form:

$$\Omega^C = \frac{X_P}{X_H} \times \frac{T^C_{P|x}}{T^C_{H|x}} \times \frac{U^C_{P|T}}{U^C_{H|T}} \times \frac{R^C_{P|u}}{R^C_{H|u}} \qquad (5)$$

The first term in equation 5 (X) is the ratio of the share of poor households without connections to the share of nonpoor households without connections[6]. The final three terms are the targeting rate ratio of the connection subsidy (T^C), the ratio of connection uptake rates (U^C), and finally the subsidy rate ratio (R^C). The U^C ratio compares the share of poor households to the share of all households who are eligible for connection subsidies (those who do not initially have connections and are targeted for a connection subsidy) and decide to take up the offer and connect to the network.

Results and findings

Performance of quantity-based subsidies

Table 1 presents a snapshot of subsidy performance for subsidy cases in the sample that rely exclusively on quantity-targeting. The empirical results suggest that quantity-targeted subsidies do not effectively target the poor – many poor households are excluded, and the non-poor benefit disproportionately from the subsidies.

The four water IBTs presented in Table 1 all exclude more than half of the poor households. The electricity IBTs in the Africa case studies fail to reach more than 70 percent of the poor. Errors of exclusion are somewhat lower for electricity subsidies in India, but one-third of poor households are still excluded in most cases.

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[4] Note that unless all households are subsidy recipients (in other words, all (a) have access to the network, (b) have connections to that network, and (c) qualify to be subsidy recipients on the basis of the targeting procedure used), the average value of the subsidy received by subsidy recipients is less than the average value of the subsidy across all households. The same is true for the average value of the subsidy provided to the poor.

[5] In practice, this assumption might not hold. For example, households in neighborhoods without access to the water network or electricity grid would not be able to connect unless the utility decided to extend services into their area. The implication of a violation of this assumption for subsidy performance is discussed in more detail below.

[6] Using the notation from the consumption subsidy example, X_P is equal to $1 – (A_P \times U_{P|A})$ and X_H is equal to $1 – (A_H \times U_{H|A})$.

Table 1. Performance Indicators for Quantity-Based Subsidies

Country, city	(1) Type of subsidy	(2) Benefit targeting performance indicator (Ω)	(3) Error of exclusion (%)	(4) Connection rate	(5) Product of access ratio & uptake ratio	(6) Targeting ratio	(7) Product of subsidy rate ratio & quantity ratio
Electricity cases							
Guatemala	VDT	0.20	55.4%	73.0%	0.71	1.00	0.28
Rwanda (S)	IBT	0.35	87.2%	32.0%	0.40	1.00	0.87
São Tomé and Principe	IBT	0.41	76.8%	42.3%	0.56	1.00	0.74
India, Bihar	State IBTs	0.43	47.7%	67.1%	0.63	1.00	0.69
Cape Verde	IBT	0.48	75.6%	44.1%	0.55	1.00	0.87
Honduras	VDT	0.49	56.0%	68.8%	0.65	1.12	0.68
India, Tamil Nadu	State IBTs	0.53	15.3%	92.4%	0.91	1.01	0.58
India, Delhi	State IBTs	0.57	9.1%	92.0%	0.98	1.01	0.58
India, West Bengal	State IBTs	0.62	30.5%	84.4%	0.84	1.01	0.73
India, Kerala	State IBTs	0.65	14.5%	90.8%	0.93	1.00	0.69
India, Uttar Pradesh	State IBTs	0.66	25.8%	84.2%	0.87	1.00	0.76
India, Maharastra	State IBTs	0.66	13.8%	89.8%	0.98	1.01	0.67
India, Haryana	State IBTs	0.66	15.4%	92.7%	0.94	1.02	0.69
India, Madhya Pradesh	State IBTs	0.70	12.4%	93.3%	0.94	1.00	0.74
India, Orissa	State IBTs	0.71	40.1%	81.6%	0.80	1.01	0.87
India, Karnataka	State IBTs	0.74	18.6%	91.2%	0.88	1.01	0.83
India, Andra Pradesh	State IBTs	0.78	16.4%	91.3%	0.89	1.01	0.87
Peru	IBT	0.82	59.9%	78.3%	0.79	1.24	0.84
India, Rajastan	State IBTs	0.84	20.7%	91.0%	0.91	1.02	0.90
India, Punjab	State IBTs	0.91	13.4%	95.7%	0.97	1.07	0.88
Hungary (S)	IBT	0.98	1.7%	100.0%	1.00	1.00	0.99
India, Gujarat	State IBTs	1.00	21.6%	92.3%	0.93	1.08	1.00
Water cases							
Cape Verde	IBT	0.24	89.7%	26.5%	0.39	1.00	0.63
Nepal, Kathmandu	IBT	0.56	53.0%	65.5%	0.74	0.99	0.77
India, Bangalore	IBT	0.66	60.5%	53.8%	0.74	1.00	0.90
Sri Lanka	IBT	0.83	69.5%	37.4%	0.83	1.00	1.00

Notes: S = simulated subsidy

Benefit targeting results are even less impressive. Only two of the 26 quantity-based subsidy cases come close to achieving a neutral subsidy distribution; the rest are all regressive or highly regressive. The poorest performers are the water IBT in Cape Verde, where the poorest 40 percent of the population receives only 10 percent of the benefits, and the VDT for electricity in Guatemala (with a discount for all households consuming less than 300 kilowatt-hours per month), which manages to allocate only 8 percent of the benefits to the poorest 40 percent.

Why do these quantity-based subsidies perform so poorly? First, the cases with the highest errors of exclusion are all cases that have low coverage rates (Column 4 in Table 1). The majority of the populace, including many poor households, do not benefit from the subsidy because they do not have connections.

Second, in almost all cases the poor are less likely than others to be connected and thus less likely to be eligible for subsidies. This occurs either because the poor are more likely to live where no water network or electricity grid is present or because they are less likely than the non-poor to connect even when they live in proximity to a network. Common problems that non-poor households face in connecting to the service are not only the cost of the connection itself, but also the cost of intra-household fixtures, restrictions due to tenure status, and incompatibility between the household income stream and the timing and format of utility payments. This situation produces an access factor ratio <1.0 (Column 5 in Table 1), and thus tends to skew the distribution of consumption subsidies in most developing country settings in favor of the non-poor. This "access handicap" is less pronounced in countries with near universal service coverage, such as the Hungarian case in our sample and many other transitional and OECD economies that enjoy nearly full coverage of water and electricity service.

A third factor that could explain the poor performance of quantity-based subsidies is the limited extent of household metering. The effective application of increasing block tariffs and VDTs requires households to have functioning meters to measure water and electricity use. Thus, to benefit from the subsidies delivered though these types of tariffs, households must have not only a connection but also a meter.[7] Even in cities with similar coverage rates, differences in metering patterns can create huge differences in the pool of potential subsidy beneficiaries. Because utilities often charge households for the installation and maintenance of a meter, one might expect to find that poor households with connections are less likely to have meters than richer households with connections. Metering coverage patterns may thus accentuate coverage trends and would tend to heighten the regressive beneficiary incidence. In Guatemala, for example, roughly one-quarter of all households in the poorest income quintile that have electricity connections do not have meters. By contrast, only 10 percent of the connected households in the richest quintile do not (Foster and Araujo 2004). Unfortunately, information about the coverage of meters by income class is scarce, making it difficult to assess whether this finding from the Guatemala electricity sector extends to the water sector and to other cities and countries.[8]

Targeting has little effect on distributional incidence (Column 6 in Table 1): the targeting ratio (T) is close to 1.0 in all case but one, indicating that poor households are not more likely to be targeted to receive the subsidies than other households. These findings are not surprising given that IBTs and VDTs

[7] Quantity-based subsidies might indirectly reduce bills for unmetered households if the fixed charges for unmetered households are calculated on the basis of the IBT or VDT and of an assumption that unmetered households are low-volume consumers. In this case, however, any subsidy received by unmetered households would be an implicit subsidy, not an explicit quantity-targeted subsidy.

[8] As a result, in our analysis, the effect of metering on subsidy performance is subsumed in the analysis of targeting (T).

are generally combined with general price subsidies for residential customers, as we saw above. In many instances, the price of most blocks in an IBT and the prices applied to most customer groups in a VDT are less than average cost. Hence most if not all residential customers receive some subsidy regardless of how much water they consume. Even when the top block of an IBT exceeds average cost, the structure of an IBT is such that all residential customers receive a subsidy over some units of consumption. A household ceases to be a net subsidy recipient only when the surcharge applied to the last units consumed is large enough to exceed the subsidy received on the first units consumed. Because the consumption volume at which cost recovery prices are charged tend to be quite high (well beyond subsistence levels), this situation rarely occurs. In La Paz, Bolivia, in the late 1990s, for example, only 1 percent of households consumed enough water each month to reach the block in the IBT where the price was set at average cost (Komives 1999).

The problem is less pronounced with a VDT because this tariff structure can be designed so that households consuming more than a set threshold do not receive a subsidy on any units of consumption. For example, in a two-block VDT structure, all units of electricity or water can be subsidized for households that consume less than a particular monthly threshold, with no unit subsidized for households that consume more than that. How high the threshold is set, however, determines how many households are excluded from receiving a subsidy. In the cases of VDT subsidies studied here, the threshold is set so high that few households are charged the unsubsidized tariff.

Given the general ineffectiveness of the targeting mechanism in differentiating among poor and non-poor households, it is the patterns of network access, connection coverage, and metering coverage that are the primary determinants of the high levels of exclusion of poor households from the quantity-based subsidies. The poor beneficiary targeting performance of quantity-targeted subsidies contributes to a regressive distribution of subsidy benefits in these cases. To fully understand the benefit targeting performance of these subsidies, however, we also need to examine how the rate of subsidization received by poor households and the quantity of water or electricity they consume compares to the population as a whole (see equation 4). Although we are not able to individually examine each factor in all cases due to data limitations, these two factors combined have a regressive effect on subsidy performance in most cases (Column 7 in Table 1).

There are two reasons why IBTs and VDTs might not necessarily result in a higher rate of subsidization of the poor than the non-poor. One explanation is the inclusion of fixed charges in the tariff structures. In the presence of fixed charges, small-volume consumers pay a higher price per cubic meter or kwh than high-volume consumers. Two forms of fixed charges are commonly used. One is a minimum consumption rule which charges households for a preset minimum volume of consumption even if they use less. Alternatively, utilities require households to pay a fixed monthly charge on top of the volumetric charge. At least half of the water and electricity utilities surveyed for this study apply a minimum consumption rule, a fixed charge, or both (Komives et al 2005).

A second reason the rates of subsidization for the poor and non-poor is similar is that the volume of consumption does not vary significantly among poor and non-poor households (esp. for water service). Figures 1 and 2 examine water and electricity consumption patterns by quintile in a variety of cases. The average consumption levels in the poorest quintiles are not as different from the middle quintiles as one would perhaps expect. In the electricity sector, the richer households tend to have significantly higher average consumption levels, while water consumption does not follow this pattern to the same degree.

Where consumption patterns of the poor and the non-poor do not differ substantially, the fifth and final determinant of benefit targeting performance – the ratio of the average quantity consumed by poor subsidy recipients to the average quantity consumed by all recipients --would have no effect on benefit incidence. When the poor do in fact consume less than the population as a whole (and when nearly all residential customers are subsidy recipients), this factor tends to *decrease* the size of the total subsidy received by poor recipients relative to the total subsidy received by the population as a whole. Ironically, this means that the less the poor consume relative to the non-poor the *less likely* the subsidy is to deliver the bulk of the benefits to the poor.

Figure 1. Electricity consumption by quintile

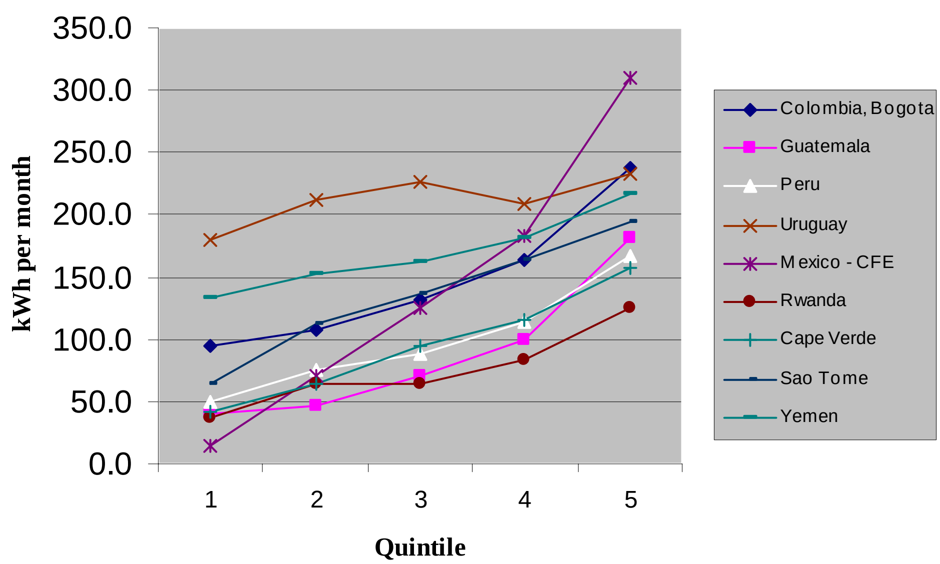
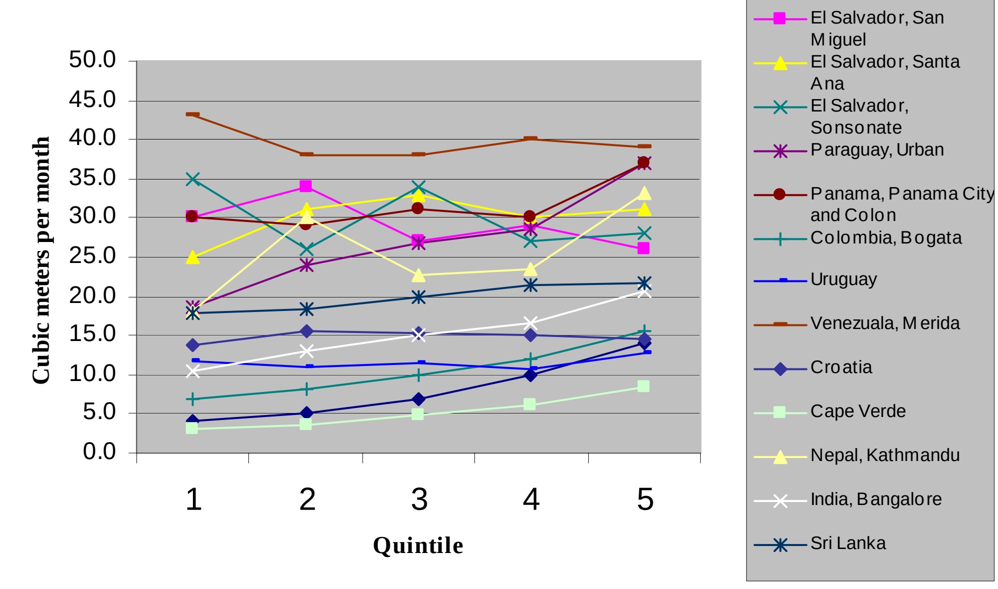


Figure 2. Water consumption by quintile



An intuitively appealing solution to this problem is to modify the tariff structure in such a way that many non-poor households are transformed from being subsidy recipients into net cross-subsidizers. This could be done by reducing the size of the subsidized first block of an IBT or reducing the subsidy threshold of a VDT, while raising the rate charged in the unsubsidized portions of the tariff to more than average cost. However, the prospects for significantly improving the distribution of benefits from quantity-targeted subsidies are slim, even with these modifications. Revising the block sizes of the tariff structure will only subsidize the poor at a greater rate than the rich if there are significant differences in the consumption patterns of the rich and the poor. We have seen that this is not always the case, especially in the water sector. Moreover, tariff modifications do not change the base coverage conditions that tend to accentuate the regressivity of consumption subsidies; they have no direct effect on access, uptake rates, or metering rates. Households that are ineligible for the subsidies because they do not have metered connections will remain excluded from the subsidy. The scope for improving targeting performance via changes in block size or thresholds is therefore very limited in low-coverage areas in particular and more limited for water than electricity.

Empirical studies that simulate the distributional effect of changes in tariff structures support this conclusion (see Komives et al 2005 for detailed empirical results). In the simulations of “improvements” to quantity-targeted subsidies evaluated for this study, beneficiary incidence remained virtually unchanged after the modifications. Benefit targeting performance improved in most cases but only produced a progressive subsidy distribution in two cases: the move from an IBT to a VDT for electricity in Cape Verde, and the reduction of the first block of the water IBT in Paraguay to 5 cubic meters per month. Increasing the size of the first block in Paraguay—even to just 10 cubic meters—produces a regressive distribution of benefits. These findings suggest that altering tariff structures is unlikely to dramatically improve the targeting performance of quantity-targeted subsidies. More fundamental changes – such as the elimination of general subsidies for all residential customers and the expansion of coverage and metering – would be needed in most cases for quantity-based subsidies to begin to achieve a neutral or slightly progressive distribution of subsidy benefits.

Performance of other consumption subsidies

As the potential for improving targeting performance through changes in tariff structure is quite limited, one alternative is to allocate the subsidy based on alternative targeting methods. Such approaches are found in practice in a number of utilities. In some cases, the quantity-based subsidies offered through IBTs and VDTs are combined with various forms of subsidies distributed through administrative selection. In other cases, administrative selection alone is used to target consumption subsidies. Two types of administrative targeting are considered here: geographic targeting and means testing.

Table 2 presents the benefit and beneficiary targeting performance of existing and simulated subsidies using administrative targeting. More than half of these cases achieve a slightly progressive distribution of subsidies (ie $\Omega > 1$).

The ratio of targeting rates presented in column 4 of this table is the principal explanation for improved targeting performance. With these targeting mechanisms (and unlike quantity-based subsidies), connected poor households are more likely than the population of connected households as a whole to receive the subsidy. The targeting efficacy of means testing is greater than geographical targeting in most cases, as evidence by the larger T ratio. This superior targeting power is sufficient in a number of cases to offset the ‘access handicap”, the fact that poor households are less likely than others to have connections (column 3 of Table 2). The cases that still have regressive distributions are those where the targeting mechanism is not able to direct benefits to the poorer potential subsidy recipients and where the combined effect of subsidy rates and quantity of water and electricity consumed by the poor and non-poor (column 5 of Table 2) also tends to work against a progressive incidence of subsidies.

The error of exclusion in many of these well-targeted subsidies tends to be rather high. The existing means-tested water subsidy in Paraguay, for example, excludes 93% of the poor, and three-quarters of the poor do not receive the means-tested electricity subsidy in place in Georgia. The coverage levels that were so important in explaining the poor targeting performance of quantity-based subsidies are only part of the story here. In an attempt to exclude non-poor households through administrative targeting, many poor households are also excluded. This can be seen, for example, by comparing the error of exclusion for the existing water and electricity IBTs in Cape Verde (90% and 76% respectively) to the errors of exclusion in the simulated means tested subsidy in the same case (98% and 93%).

Table 2. Subsidy Targeting Performance - Administrative Selection

Country, city	(1) Benefit targeting performanc e (Ω)	(2) Error of exclusion (%)	(3) Product of access ratio & uptake ratio	(4) Targeting ratio (including metering where relevant)	(5) Product of subsidy rate ratio & quantity ratio
Geographic targeting					
Electricity cases					
Colombia, Bogota	1.10	3.7%	1.00	1.17	0.95
Mexico	0.60	n/r	0.96	0.92	0.67
Water cases					
Nicaragua, Managua	1.18	5.0%	0.98	1.00	1.21
Venezuela, Merida	1.09	0.0%	1.00	1.00	1.09
Colombia, Bogota	1.09	1.9%	0.99	1.08	1.02
Paraguay, urban	1.42	98.8%	0.87	1.71	0.95
India, Bangalore (S)	0.67	60.0%	0.74	1.00	0.92
Nepal, Kathmandu (S)	0.60	53.0%	0.74	0.99	0.82
Means testing					
Electricity cases					
Argentina *	1.50	94.0%	0.98	n/r	n/r
Georgia, Tiblisi	1.20	75.0%	n/r	n/r	n/r
Colombia, Bogotá (S): means test and geographic	1.35	16.8%	1.00	1.47	0.92
Cape Verde (S)	1.46	93.3%	0.55	3.56	0.74
Water cases					
Argentina *	1.23	76.0%	0.95	n/r	n/r
Chile	1.63	78.0%	0.91	1.74	1.02
Paraguay, urban: means test, housing characteristics	1.64	93.1%	0.87	1.89	1.00
Paraguay, urban (S): means test, hh characteristics	2.14	96.0%	0.87	2.22	1.11
Colombia, Bogota (S): means test and geographic	1.31	19.0%	0.99	1.48	0.90
Cape Verde (S)	1.39	98.0%	0.39	4.69	0.76
Kathmandu (S)	0.65	52.1%	0.74	1.00	0.89
Bangalore (S)	0.66	60.0%	0.74	1.00	0.90

Notes: S equals simulation
* Average results for provincial means-tested subsidies: analysis assumes all the eligible households are receiving the subsidy

Another alternative to quantity based targeting is service-level targeting. The sample of subsidy cases includes two examples of service-level targeting in the water sector -- public tap subsidies in Bangalore and in Katmandu. In Bangalore, 24 percent of the population obtains water from public taps: 44 percent of the poor households and only 10 percent of the non-poor. Poor households are four times more likely than non-poor households to use public taps. Likewise, in Katmandu, half of poor households and only one-quarter of non-poor households use public taps. That is good news for public tap subsidies, because a greater share of poor households than of non-poor households has opted to take advantage of this subsidy. The resulting benefit targeting performance indicators reflect this choice. Public tap subsidies in

Katmandu achieve a progressive distribution of subsidy benefits (Ω is 1.54), as do the subsidies in Bangalore (Ω is 2.14). Nonetheless, errors of exclusion of the subsidies are high: 72 percent of poor households do not receive this subsidy in Katmandu, and 61 percent do not receive it in Bangalore. The error of exclusion for the public tap subsidies is thus higher than that of the IBT in place in these cities (see Table 1), reflecting the fact that more poor households in the city have private taps than use public taps.

Performance of connection subsidies

One overriding weakness of subsidies for consumption is that they exclude households that are not currently using the subsidized service. With the exception of the service-level targeted subsidies, this means that unconnected households are left out of the pool of subsidy beneficiaries. This "access handicap" severely compromises the targeting performance of consumption subsidies offered on standard connections. As only *unconnected* households are the potential beneficiaries of connection subsidies, the problem that plagues consumption subsidies can work in favor of the targeting performance of connection subsidies.

Few cases of existing connection subsidies have been studied in sufficient detail to apply the conceptual framework used in this study. We therefore simulated connection subsidies using data on coverage levels among the poor and non-poor in all cases for which sufficient information was available. The first simulations were of universal connection subsidies and assumed that all unconnected households were both offered and accepted subsidized connections. The error of exclusion for these universal connection subsidies is solely a function of the connection rate in each country: more poor households are excluded in high coverage cases than in low-coverage cases. The distribution of benefits from these universal connection subsidies is nearly always progressive (Komives et al 2005). The only exceptions are Azerbaijan and Belarus, where non-poor households are as likely as poor households to be unconnected.

This assessment of connection subsidies presumes that all potential or targeted beneficiaries could and would eventually be connected (or at least that households in all income deciles could and would connect at the same rate). There are two scenarios under which this would not be the case: (a) when not all eligible households choose to connect (even when offered the subsidy) and (b) when the utility does not offer a connection to all (i.e. network or grid is not present in proximity to the eligible households**).** In either scenario, the future uptake rate among the poor would probably be lower than for the population as a whole and network or grid extension would likely favor areas where the non poor reside. In practice, errors of exclusion would most likely increase and the progressivity in the distribution of benefits would diminish, relative to the result of the first simulations. A simulation of the targeting performance of a connection subsidy when only 50 percent of the unconnected poor households choose to or are able to connect predictably shows that errors of exclusion increase, and benefit targeting performance declines and often becomes regressive. In sum, one cannot conclude a priori that connection subsidies will necessarily produce a progressive distribution of subsidy benefits. The performance of these subsidies will depend on the behavior of both utilities and of households. Nonetheless, even when only 50 percent of the poor choose to take up the connection subsidies, the targeting performance of the simulated connection subsidies is better than that of many of the consumption subsidies assessed above.

Conclusions

Consumer utility subsidies are a common feature of water and electricity services in the developing world. General subsidies for residential customers are present in most water utilities and in half of electricity utilities. These subsidies are in some cases combined with or replaced by an explicit targeted subsidy, which may be a quantity-targeted subsidy (such as those provided through IBTs and VDTs), a consumption subsidy targeted using administrative selection (geographic targeting or means testing) or self-selection (service-level targeting), or a connection subsidy.

The most widespread form of these subsidies -- quantity-targeted subsidies -- are invariably regressive. Quantity-targeted subsidies perform better in situations where a higher percentage of poor households are connected to the utility network. Nevertheless, even with universal service coverage, subsidies delivered through IBTs or VDTs rarely achieve much more than distributional neutrality.

The benefit targeting performance of quantity-targeted subsidies is equally poor for water and electricity, although for different reasons. Electricity service has a number of characteristics that favor the benefit targeting performance of quantity-based subsidies, including higher metering rates and better tariff designs (involving smaller subsistence blocks and price gradients that rise more rapidly toward cost recovery levels). On the other hand, consumption differentials between poor and non-poor are larger for electricity than for water service, allowing the non-poor to capture a larger absolute value of subsidy. Those two factors offset each other so that ultimate benefit targeting performance is quite similar for water and electricity.

Although it is sometimes argued that the poor performance of quantity-based targeting could be reversed by improving the design of tariff structures, our study suggests that tinkering with the tariff structure does little to improve targeting performance. The deficiencies of quantity-based targeting have as much to do with large access differentials and the consumption patterns of the poor and non-poor as they do with tariff structures. Reducing the first block of an IBT or switching from an IBT to a VDT will have the greatest effect in high coverage, extensively metered areas and where the tariff modifications ensure that many households are excluded from the subsidies or become net cross-subsidizers. In other words, prospects for "improved" quantity-targeted subsidies are least favorable in the poorest countries, where coverage is low and where even middle and upper income households would likely resist raising charges to average cost.

Alternative forms of targeting can contribute to an improvement in targeting performance, whether they are used as the sole targeting mechanism or used in combination with quantity targeting. Use of geographical targeting mechanisms raises the benefit targeting performance indicator Ω on average to 0.99, which is roughly equivalent to a random distribution of subsidies. Means testing is more powerful, with Ω taking a strongly progressive average value of 1.31 in means-tested subsidies. However, this greater targeting accuracy comes at the cost of a substantial increase in the errors of exclusion. The two available cases of service-level targeting through public standposts for water service suggest that this approach to targeting subsidies could perform well in distributional terms in some situations.

These alternatives to quantity-based consumption subsidies improve targeting, but they do nothing to address the underlying access differential between the poor and non-poor. Hence, there is a limit on the extent to which targeting performance of consumption subsidies can be improved through such approaches, particularly in countries where a sizeable portion of the population does not have access to the service.

In low coverage areas, connection subsidies are a promising option. Simulations of a universal connection subsidy produced estimates of progressive benefit targeting performance in all cases considered. Those simulations are based on the bold assumption that unconnected households in each income decile would connect at the same rate. In practice, this assumption is unlikely to hold because utilities may face constraints in expanding their networks and poor households may face non-financial obstacles to connecting (such as the absence of legal tenure). Both of those considerations may substantially reduce the targeting performance of connection subsidies in practice. More study of existing connection subsidy programs is needed to better understand connection dynamics.

Given the generally poor performance of water and electricity consumption subsidies and the many questions about the potential of connection subsidies, it is important to ask to what extent the observed targeting performance undermines the objectives behind utility subsidies. If utility subsidies are seen primarily as an alternative social transfer mechanism, the targeting performance of utility subsidies should be evaluated in comparison with other social transfer programs. A recent study by Coady et al (2003) examined the targeting performance of a wide range (cash transfers, food subsidies, public works programs, and social funds among others) of social transfer programs using the same benefit targeting performance indicator adopted in this study. Table 3 compares the average targeting performance of the water and electricity subsidies in our sample to the average targeting performance of other social transfer programs that use the same targeting method.[9] This comparison reveals that utility subsidies targeted with means-testing or self-selection such as service-level targeting perform at least as well on average as other social programs that use the same targeting method. These two targeting methods are, however, much more prevalent in other social sectors than in the realm of utility subsidies. Targeted utility connection subsidies could also perform on par with alternative transfer mechanisms if potential up-take problems could be overcome.

Table 3. Benefit Targeting Performance: Consumer Utility Subsidies Vs Other Social Policy Instruments

	Consumption (quantity targeting)	Geographic targeting	Means testing (individual assessment)	Self-selection (service level, workfare)
Water subsidies				
Existing consumption	0.60	1.05	1.36	1.84
Simulated consumption	0.78	0.86	1.19	-
Simulated connection	-	1.30	1.71	-
Electricity subsidies				
Existing consumption	0.63	0.90	1.23	-
Simulated consumption	0.64	-	1.39	-
Other social policy instruments*	1.00	1.33	1.4	1.78

* From Coady, Grosh, and Hoddinott (2003)

Quantity-targeted utility subsidies and subsidies using geographic targeting, on the other hand, perform slightly worse on average than other social transfer programs that adopt the same targeting approach. The results for geographic targeting could simply be a function of differences in the composition of cases compared in the two studies.

A second objective of water or electricity subsidies is to make or keep service affordable to the poor, especially as prices increase to cost recovery levels. It is important for policy makers to recognize that consumption subsidies have serious drawbacks in this regard:: the leakage cost of the subsidies is high and many poor households do not receive any subsidy. At best, connection and consumption subsidies have the potential to address only one of the many factors – price – that explain why so many poor

[9] The Coady study looked at the targeting performance of a range of social programs including cash transfers, near cash transfers, food subsidies, public works programs, and social funds, but contained almost no cases of utility subsdies..

households currently do not use utility services. Utility subsidies cannot eliminate barriers such as tenure insecurity and may even exacerbate other problems if the utilities are not reimbursed through government transfers or cross-subsidies for the discounts they provide to residential customers. Financially weak utilities will lack the resources to expand network service and improve service quality.

Policy makers also need to recognize that subsidies are not the only instrument available for reducing the cost of utility service to consumers. Reducing operating and particularly capital costs and improving collection rates are all important ways to bring revenues and costs closer together and thus reduce the tariff increases needed to achieve cost recovery. These measures may not do away with the demand for utility subsidies altogether, since the gap between current tariffs and cost recovery tariffs is very large in many countries: tariffs could need to increase several fold in some water and electricity utilities to reach notional cost recovery levels. Nonetheless, they help contain the magnitude of utility subsidies and address bottlenecks that could otherwise undermine the targeting performance of subsidies.

Appendix 1: Electricity Subsidy Cases Included in Database

Location	Existing subsidy cases	Simulated subsidy cases	Year	Base study for subsidy analysis
Argentina	Avg. of provincial means-tested subsidy*	Discount for means-tested households	2002	Foster 2004
Cape Verde	IBT with 40 kWh first block	VDT with 40 kWh threshold; means-tested discount	2001-02	Angel-Urdinola and Wodon 2005a
Colombia (Bogota & urban areas)	Geographically defined tariffs with IBTs	Geographically defined tariffs with IBTs and means testing	2003	Melendez et al 2004; Melendez 2005
Croatia	Uniform volumetric tariff		1998	Shkaratan 2005
Georgia (Tbilisi)	Means-tested free allowance; means-tested discount		2001	Lampietti et al., 2003; World Bank 2004.
Guatemala	VDT with 300 kWh threshold	VDT with 100 kWh threshold	2000	Foster and Araujo 2004
Honduras	VDT with 300 kWh threshold		1999	Wodon et al 2003
Hungary		IBT	1997	Shkaratan 2005
India (urban areas in each state)	IBTs, with variations by each state		2001-02	Santhakumar 2004.
Mexico	Geographically defined tariffs with IBTs		2002	World Bank 2004
Peru	IBT		2003	OSINERG 2005
Rwanda (national & urban areas)	Uniform volumetric tariff	VDT with 50, 40, and 20 kWh threshold; IBT with 50, 40, and 20 kWh first block	2000-01	Angel-Urdinola et al 2005
Sao Tome and Principe	IBT with 300 kWh first block	VDT with 300 kWh thresehold; IBT with 200 kWh first block	2000-01	Angel-Urdinola and Wodon 2005b

Appendix 2: Water Subsidy Cases Included in Database

Location	Existing subsidy cases	Simulated subsidy cases	Year	Base study for subsidy analysis
Argentina (national & Buenos Aires)	Average of provincial means-tested subsidy*	Discount for means-tested households	2002	Foster 2004
Cape Verde	IBT with $7m^3$ first block	VDT with $7m^3$ threshold; Means-tested discount on 10 m3	2001-02	Angel-Urdinola and Wodon 2005a
Chile	Means-tested discount		1998	Gomez-Lobo and Contreras 2000; Gomez-Lobo and Contreras 2003
Colombia (Bogota and urban areas)	Geographically defined tariffs with IBTs	Geographically defined tariffs with IBTs and means testing	2003	Melendez et al 2004; Melendez 2005
Croatia	Uniform volumetric tariff		1998	Shkaratan 2005
India (Bangalore)	Subsidy on public taps; IBT with 25m3 first block	Uniform volumetric tariff; IBT with 18m3 and 6m3 first block; Geographically-targeted discount; means-tested discount	2001	Prokopy 2002
Nepal (Kathmandu)	Subsidy on public taps; IBT with 10m3 first block	Uniform volumetric tariff; IBT with 7m3 first block; Slum discount; Means-tested discount	2001	Pattanayak and Yang 2002; Pattanayak et al., 2001
Nicaragua (Managua)	IBT with slum discount		1995	Walker et al. 2000.
Panama (Panama City & Colon)	IBT with slum and pensioner discount		1998	Walker et al. 2000.
Paraguay (Urban areas)	Discount for means tested households (housing characteristics)	IBT with 15 and 5 m^3 first block; geographically targeted discount; means tested discount	2001	Robles 2001
Sri Lanka	IBT		2003	Pattanayak and Yang 2005; Pattanayak et al., 2004; Brocklehurst 2004
Uruguay		Means-tested exemption of fixed charge		Ruggeri-Laderchi 2003
Venezuela (Merida)	IBT with slum discount		1996	Walker et al. 2000.

Notes:
Data from the sources was reanalyzed in many cases in order to create comparable analysis across cases. Thus, the results reported in the base study will not necessarily mirror the results reported in this book.
*= Analysis assumes all the eligible households are receiving the subsidy
IBT = Increasing block tariffs; VDT = Volume differentiated tariffs

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