WATER

TARIFFS & SUBSIDIES IN SOUTH ASIA

Do current water subsidies reach the poor?

REFORM OF THE WATER AND SANITATION SECTOR is occurring in many countries, and offers the potential to improve services to all. Of particular concern, however, is the situation of the poor, and reform must be designed so that they receive increased access to affordable services. A key issue in this regard is water pricing, which is one of the main variables affecting the distribution of benefits between different stakeholders. However, experience shows that water pricing, and the subsidies which are often delivered through water tariffs, can be a source of major inefficiencies in the sector.

While affordability has been one of the prime concerns of those setting tariffs and designing subsidies, there may be significant flaws in many common pricing strategies and subsidy delivery mechanisms. Rather than providing affordable water to the poor, these may in fact be leading to financial unsustainability of utilities, lack of access to services, and inequity. The reform process provides the opportunity to rationalize and reconsider the design of tariff and subsidy structures, and seek new ones which may provide better results.

Picture by Indo-USAID FIRE-D Project

L arge scale subsidization of the water sector is typical in south Asian countries. For example, the federal and state governments of India together spend an estimated Rs. 5,470.8 crore (US$ 1.1 billion) per year on subsidizing the water sector; accounting for around 4% of all government subsidies in India and amounting to 0.5% of GDP. These subsidies are typically justified in terms of the need to ensure that essential water services remain affordable to the poorest in society.

However, there are a number of reasons for questioning whether these subsidies really benefit the poor. For example, the tariff structures typically used in the water sector in South Asia do not discriminate between rich and poor, so that everyone benefits from the general subsidy to water consumption. Furthermore, a high proportion of poor people in South Asia do not have private

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connections (the figure for India is 60%); as a result they are unable to benefit from the heavy subsidization of this service. Even though this group may benefit from subsidies to public taps and tanker deliveries, these services deliver such small amounts of water that the overall value of the subsidy is quite small compared with that going to users of private taps.

Nonetheless, until now, there has been no hard empirical evidence to confirm or reject the hypothesis that water subsidies may be failing to reach the poor. This paper summarizes the results of some new survey-based research that estimates the value of the water subsidy received by *individual* households in two South Asian cities, and also estimates the income

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levels of those households. Using both pieces of information together, it is possible to evaluate the extent to which subsidies are actually reaching the poor.

The analysis shows that about three quarters of the subsidies available to water utilities in the cities of Bangalore and Kathmandu are delivered in a way which completely fails to reach the poor. The vast majority of subsidy resources are spent on lowering tariffs for private connections through an Increasing Block Tariff, even though many poor people do not use water from these types of connections. While subsidized public taps were found to be a more

effective way to channel resources to the poor, these also suffer from serious disadvantages.

The Two City Studies

This paper is based on the results of two city-level household surveys conducted in Kathmandu (Nepal) in April 2001[1] and Bangalore (India) in August 2001.

Picture by UNICEF

Both surveys collected a wide range of information including household water expenditure, type of water supply, physical characteristics of the dwelling, and socioeconomic characteristics of the household (including overall income or expenditure). The surveys interviewed a representative sample of 1,500 households in Kathmandu and 2,905 households in Bangalore.

The two cities have a number of features in common. In both cities, service is provided by a large publicly-owned utility (Bangalore Water Supply and Sewerage Board, BWSSB, in the case of Bangalore and Nepal Water and Sewerage Corporation, NWSC, in the case of Kathmandu). In Bangalore, BWSSB reaches around 80% of the population, of which 73% have private taps. In Kathmandu, NWSC reaches 77% of the population,

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[1] Carried out by Research Triangle Institute, with support from WSP, as part of research into the impact of proposed water and sanitation sector reform on the poor

66% with private taps and a further 11% with public taps. As might be expected, the vast majority of non-poor customers are supplied through private taps (Figure 1). For poor customers, the picture differs by city. In Kathmandu, there are more poor customers with private taps than those relying on public taps, whereas in Bangalore the opposite is true.

Consumption by households with private taps in both cities is estimated to be of the order of 20 cubic meters per month. It is interesting to note that average

Figure 1: Distribution of existing water sources
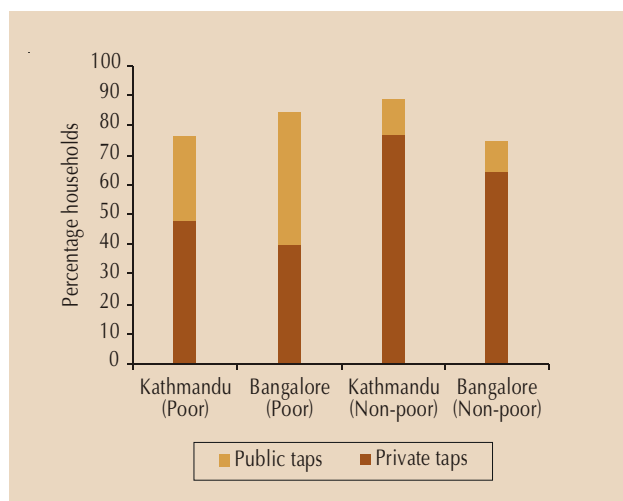
consumption by non-poor households is only about 20% more than that by poor households (Figure 2). On the other hand, those relying on public taps consume little more than one cubic meter per month in Kathmandu but almost five cubic meters per month in Bangalore.

Both utilities apply a relatively similar rising block tariff structure, although the lifeline block in Bangalore at 25 cubic meters per month is more than double that applied in Kathmandu; moreover the cost of part of this first block is levied as a minimum fixed charge for water consumption. (Figure 3).

Figure 2: Water consumption patterns of poor and non-poor
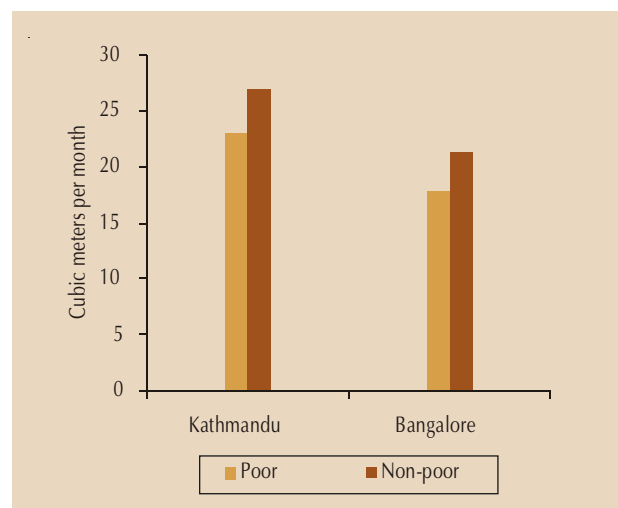
Given the similarities in the consumption patterns and tariff structures, average monthly household expenditure on water falls in the range US$ 1.50-2.50 per month for both cities. In both cases, water at public taps is provided free of charge.

Figure 3: Comparison of water tariffs
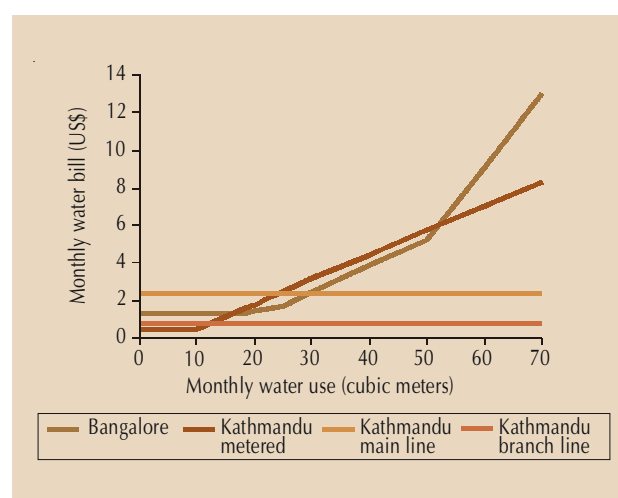
Due to the intermittent nature of water supply, as well as deficient water quality, households in both cities face significant 'coping costs'. These include

constructing storage tanks to insure against service cuts, queuing at public standposts for considerable periods waiting for the water to arrive, performing household treatment of drinking water. The survey indicates that households in both cities spend an overall average of US$ 1.00-1.50 on coping costs. This represents about two thirds of the average monthly water bill.

Finally, there are also important differences between the two cities. For example, in Kathmandu only 42% of households with private taps are metered, while the remainder pay a fixed monthly charge that varies according to whether they are connected to a distribution main line or branch line. In Bangalore, on the other hand, virtually all legal customers of the BWSSB are metered and only those supplied from alternative private networks lack meters. Another key difference is that in Kathmandu, most households tend to rely on a wide portfolio of water sources, so that for example even those with private taps continue to make regular use of public taps, and those who use public taps also collect water from other non-utility sources. In Bangalore, on the other hand, most households tend to rely exclusively on either public or private taps.

How were Water Subsidies Calculated?

The subsidy received by each household can be thought of as the difference between the full economic cost of producing the water that the household actually consumes and the monthly charge that the household actually pays to the utility (Box 1). The larger this gap, the larger the subsidy that the household implicitly receives from government.

Box 1: Subsidy formula

Household subsidy
=
Full economic cost of producing the household's monthly consumption
-
Household monthly utility charge

Three pieces of information were used from the survey to calculate the amount of subsidy that each household received: monthly household expenditure on water, monthly household consumption of water, and the average cost of producing water in the city where the household lives.

Households were asked directly about their monthly expenditure on water, which, in most cases, was reported from memory.

Monthly water consumption was estimated according to a variety of different techniques depending on the type of customer. Those relying on public taps were asked to report the number of containers that they filled on an average each day, together with the volume of those containers. For those with metered private taps, consumption can be inferred by applying the known tariff structure to the reported expenditure. For those with unmetered private taps, consumption was imputed based on other household characteristics, using a statistical water consumption model developed with data from metered households.

It is important to note that, due to the intermittent nature of water supply in South Asia, meters can often get damaged, either under-recording true consumption or breaking down altogether. This clearly makes it difficult to achieve reliable estimates of water consumption from water expenditure, particularly since there are no reliable estimates of the extent to which meters malfunction or under-record. The likely effect of this phenomenon is to dampen the variation in water consumption estimates between households. However, as long as there is no systematic relationship between meter malfunctioning and income level, the phenomenon should not necessarily affect measurements of the distribution of water consumption across income groups, which is the primary focus of this analysis.

The average cost of producing water was derived from engineering consultants' studies for each city that estimated the operating and maintenance cost of the service. These

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Picture by Indo-USAID FIRE-D Project

of inclusion (or proportion of total subsidy beneficiaries who are not poor), and the errors of exclusion (or proportion of the poor who are not subsidy beneficiaries). More precise definitions are provided in Box 2.

What are the Key Findings?

The results indicate that the average monthly subsidy per household with a private tap is US$ 8.88 in Kathmandu and US$ 15.74 in Bangalore. Moreover, the average non-poor household receives 44% more subsidy than the average poor household in Kathmandu, and 15% more in Bangalore. Given much lower levels of water consumption, the subsidies received by users of public standposts are correspondingly smaller, with an

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average value of US$ 0.71 in Kathmandu and US$ 3.74 in Bangalore. However, poor households receive a larger subsidy via public taps than do non-poor households, owing to the fact that the latter use this only as a backup source of water.

Looking at the overall distribution, the average subsidy received by the richest 10% (decile) of the population is 2-3 times as high as the average subsidy received by the bottom 10% of the population. (This can be seen in

yielded estimates of US$ 0.17/m³ in Kathmandu and US$ 0.34/m³ in Bangalore. Consultations with a number of water engineers suggested that, based on typical ratios of capital to operating expenditure, the full financial costs of water production (including all investment costs) could be three times higher than the operating and maintenance costs.

Finally, for the purposes of evaluating whether subsidies reach the poor, the people falling into the bottom 40% of the income distribution in each city are considered to be living in poverty. The use of official poverty lines was deliberately avoided, since applying a relative rather than absolute concept of poverty has the advantage of ensuring that the definition is consistent across the two city cases. Using this definition of poverty the equity characteristics of existing subsidies are evaluated based on a number of standard indicators. These include the leakage rate (or percentage of total subsidy resources captured by the non-poor), the errors

Table 1: Average monthly subsidies (US$)

	Private Tap		Public Tap	
	Kathmandu	**Bangalore**	**Kathmandu**	**Bangalore**
Poor	6.75	14.22	0.69	4.19
Non-poor	9.76	16.38	0.72	2.30
All	8.88	15.74	0.71	3.74

Note: Private and public tap subsidies are not mutually exclusive, since some households may be receiving subsidies from both sources.

Box 2: Understanding Errors of Exclusion and Inclusion

A key consideration in evaluating the efficacy of subsidies is measuring to what extent they succeed in reaching the poor. Two standard indicators are commonly used for this purpose; known as errors of exclusion and inclusion.

The following diagram helps to illustrate the meaning of these terms. The diagram divides the general population into two groups: poor (*P*) and non-poor (*NP*). A subset of this overall population are beneficiaries of a subsidy program (*B*). Since it is never possible to direct subsidies perfectly towards the target population, some of these beneficiaries are poor (B_p), while others are non-poor (B_{NP}).

Errors of exclusion (EE) arise when people who are genuinely poor fail to receive the subsidy. The error is defined as the percentage of the poor who do not receive any subsidy. In terms of the areas drawn in the diagram, this can be expressed as: $EE = 1-(B_p/P)$. Errors of exclusion could be regarded as an even more serious problem than errors of inclusion, since they indicate that the subsidy is failing to meet its primary objective of helping the poor.

Errors of inclusion (EI) arise when people who are not poor benefit from the subsidy. The error is defined as the percentage of subsidy beneficiaries who are not poor. In terms of the areas drawn in the diagram, this can be expressed as: $EI = B_{NP}/B$. Errors of inclusion are essentially a form of inefficiency, because they represent a leakage of subsidy funds towards a subset of the population that doesn't really need them.

Related to the error of inclusion, it is also interesting to calculate the *leakage rate*, which is the percentage of subsidy *resources* that are captured by the non-poor. The leakage rate tends to follow a similar pattern to the errors of inclusion; however if non-poor beneficiaries consume relatively large amounts of water compared to poor beneficiaries, then the leakage rate may be even higher than the error of inclusion.

Finally, it is interesting to note that errors of inclusion and exclusion tend to move in opposite directions. Thus, a subsidy with very high errors of inclusion will typically have relatively low errors of exclusion and vice versa. This happens because it is difficult to identify the poor, and to be sure of reaching most of them very broad eligibility criteria are required; which in turn brings in a large number of non-poor too. The implication is that to be sure of reaching the majority of the poor, it is often inevitable that there is a considerable amount of subsidy resources 'wasted' on the not so poor.

P. Poor   NP. Non-poor

B. Subsidy beneficiaries
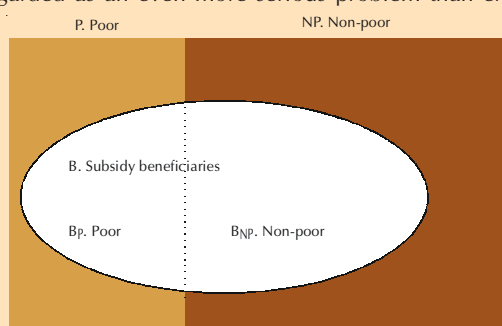
Bp. Poor   BNP. Non-poor

Figure 4, which shows that the subsidy received increases as the income deciles increase, from the poorest 10% at the left of the graph to the richest 10% at the right.)

The key factor underlying these distributional results is the targeting mechanism used to distribute the subsidy. In both Bangalore and Kathmandu, two different targeting mechanisms are at work. The targeting mechanisms can be evaluated in terms of leakage rates, and errors of inclusion and exclusion. A full definition of these technical terms can be found in Box 2.

The first targeting mechanism is the principle of self-selection, which suggests that poor households will be the predominant users of the more highly-subsidized public tap service, since richer households will be able

Figure 4: Average monthly subsidy received by income decile

■ Kathmandu   ■ Bangalore
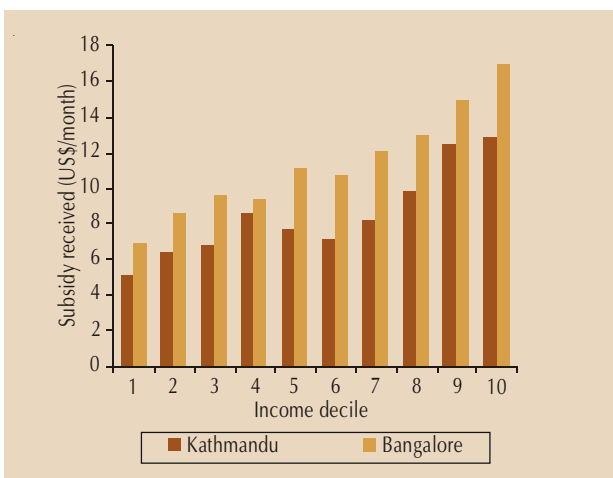
to afford private taps and hence will prefer to have that higher quality of service. Self-selection appears to work relatively well, since only 14 to 39% of the resources assigned to public taps fail to reach poor households (Table 2). The errors of inclusion are correspondingly low at 20 to 40%, reflecting the fact that public taps are unattractive to those who can afford a better service. The performance regarding errors of exclusion differs substantially across the two cities. In Bangalore, only 23% of the unconnected poor fail to benefit from the network of public taps, whereas in Kathmandu as many as 61% of the unconnected poor lack access to public taps (or don't use them because other non-utility sources, such as shallow tubewells, are more attractive).

The second targeting mechanism at work in these two cities is the Increasing Block Tariff (IBT). The IBT directs the distribution of subsidies towards smaller consumers, on the assumption that these are more likely to be poor. However, due to the relatively small differences in consumption patterns between poor and non-poor households (recall Figure 2), the IBT does not perform very well in targeting terms (Table 2). In particular, as much as 70 to 80% of subsidy resources fail to reach the poor. Errors of inclusion are correspondingly high at 71%, given that the IBT provides subsidies to *all* consumers with private taps, the majority of whom are not poor. In both cities, the errors of exclusion are just over 50% given that more than half

of the poor lack connections to the piped water network.

In other words, subsidies to public taps perform much better in distributional terms than subsidies to private taps. The reason is that the willingness to accept a low quality public tap service because it is free of charge is a more reliable indicator of poverty than the amount of water a family consumes.

However the absolute value of subsidies to public taps is very small compared with subsidies to private taps. This means that 90 to 95% of the total subsidies allocated to the water utilities of Kathmandu and Bangalore are spent on subsidizing private taps, and barely 5% on public taps (Table 2). Thus, the share of overall subsidies captured by the poor is still only 20 to

> **The absolute value of subsidies to public taps is very small compared with subsidies to private taps, absorbing only 5% to 10% of overall subsidy resources.**

30%, while the errors of inclusion are 60 to 65%. Looking at the overall picture, however, errors of exclusion are somewhat lower, at 12 to 33%, because most of the poor benefit from one or other of the two services provided by the utilities, whether it be a public or a private tap.

Table 2: Performance comparison of subsidy schemes

	Leakage Rate or percentage of subsidy resources captured by the non-poor		*Errors of Inclusion* or percentage of subsidy beneficiaries that are non-poor		*Errors of Exclusion* or percentage of poor who do not benefit from the subsidy	
	Kathmandu	**Bangalore**	**Kathmandu**	**Bangalore**	**Kathmandu**	**Bangalore**
Public taps	39%	14%	38%	23%	61%	23%
Private taps	78%	73%	71%	71%	53%	51%
Overall	77%	69%	64%	60%	33%	12%

Moreover, looking beyond distributional issues, public taps present various disadvantages to users. Collecting water from public taps is onerous both in terms of the time spent (users often spend hours queuing) and drudgery (water used at home has to be carried there). Water quality is jeopardized as the water is so often brought into contact with hands and implements – during collection, transfer to storage vessels in the house, and storage. Finally, the burden of water collection often predictably falls disproportionately onto women, but also in many cases children, who then have less time for school and recreation.

While the distributional performance of water subsidies in Kathmandu and Bangalore is not all that good in absolute terms, it is important to put the results

> **Barely a quarter of the subsidies provided by State governments and distributed by water utilities in the cities of Bangalore and Kathmandu end up benefiting the poor.**

into broader perspective. The problem of effectively targeting subsidies is neither unique to South Asia, nor unique to the water sector. A recent study of water subsidies in Chile and Colombia found errors of inclusion in the 60 to 80% range[2], while a number of studies of electricity subsidies around the world have found that barely 10 to 35% of these subsidy resources reach poor households. Moreover, a study by the Indian National Institute for Public Finance and Policy (NIPFP) concluded that food subsidies allocated via the Public Distribution System (PDS) suffered from errors of inclusion between 34 and 52%, and errors of exclusion between 25 and 98%.
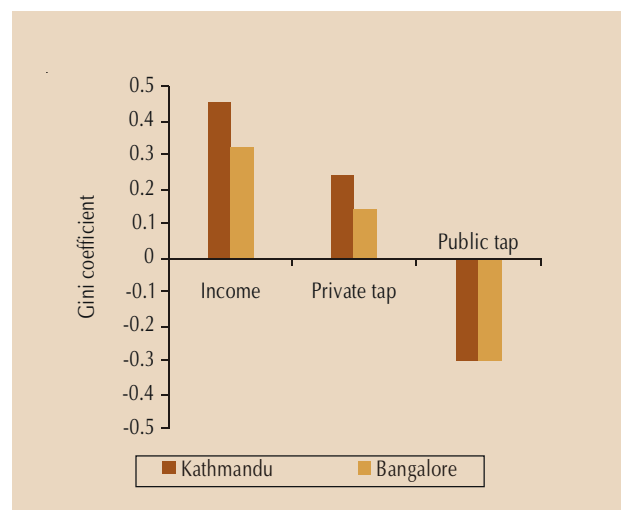
Finally, it is interesting to see whether water subsidies soften or accentuate existing inequalities in the distribution of income. This can be done by calculating quasi-Gini coefficients, which measure the extent to which the distribution of the subsidy is skewed towards the rich (positive Gini) or the poor (negative Gini). (A fuller explanation of this concept is provided in Box 3.) By comparing these indices with the income distribution Gini it is possible to say whether subsidies are more or less equitable than the economy as a whole. The results suggest that subsidies to private taps, although skewed towards the rich, are more equitably distributed than income (Figure 5). To that extent at least, they reduce the degree of inequality in society, though this in itself is not an argument for preserving them in their current form. Subsidies to public taps are heavily skewed towards the poor, and can thus be regarded as equitable both in a relative and an absolute sense.

Conclusions

To summarize, barely a quarter of the subsidies provided by State governments and distributed by water utilities

Figure 5: Comparison of Gini coefficients

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[2] Gomez-Lobo, Andres, Contreras, Dante, Subsidy Policy for the Utility Industries: A Comparison of the Chilean and Colombian Water Subsidy Schemes, University of Chile, August 2000.

Box 3: An introduction to Gini coefficients

In addition to looking at errors of inclusion and exclusion, it is important to understand the overall pattern of subsidy incidence across the full spectrum of rich and poor. A simple way of doing this is to rank the total population from richest to poorest, and then plot a *Lorenz curve* which shows the percentage of subsidy that is captured by the poorest X percent of the population.

Equal distribution. If the distribution of the subsidy was equal across the population, then the poorest 20% of the population would receive 20% of the subsidy, the poorest 50% would receive 50% of the subsidy, and so on, so that the Lorenz curve would essentially be equivalent to the 45^0 line shown in the diagram. Such a distribution is neither pro-poor nor pro-rich, since everyone essentially gets the same amount.

Regressive (or pro-rich) distribution. The first Lorenz curve plotted in the diagram (LC_1) represents a situation where the poorest 20% of the population receives only 5% of the total subsidy, while the poorest 50% receives only 15% of the total subsidy. As a result, the Lorenz curve bows down below the 45^0 line, indicating that the distribution is regressive, or pro-rich.

Progressive (or pro-poor) distribution. The second Lorenz curve plotted in the diagram (LC_2) represents a situation where the poorest 20% of the population receives 60% of the total subsidy, while the poorest 50% receives 90% of the total subsidy. As a result, the Lorenz curve moves up above the 45^0 line, indicating that the distribution is progressive, or pro-poor.

For convenience, it is typical to summarize the shape of the Lorenz curve in a single indicator known as a quasi-Gini coefficient (QGC). The quasi-Gini coefficient is defined as the area underneath the 45^0 line down as far as the Lorenz curve, divided by the whole area of the triangle under the 45^0 line. Thus, for the first Lorenz curve (LC_1) the quasi-

Gini coefficient is defined as: $QGC=A_1/T$. When the Lorenz curve bows up above the 45^0 line, the area between the Lorenz curve and the 45^0 line is deemed to be negative. Hence, for the second Lorenz curve (LC_2) the quasi-Gini coefficient is defined as: $QGC=-A_2/T$.

The quasi-Gini coefficient is bounded between –1 and +1, with an intermediate value of zero. A quasi-Gini of zero essentially indicates that the Lorenz curve lies right on top of the 45^0 line. A quasi-Gini close to +1 means that the distribution of the subsidy is very pro-rich, so that the Lorenz curve is bowing out almost to the edges of the triangle and almost 100% of the subsidy is going to the richest few people in the society. On the other hand, a quasi-Gini close to –1 means that the distribution of the subsidy is very pro-poor, so that the Lorenz curve is bowing out to make almost a triangle above the 45^0 line and almost 100% of the subsidy is going to the poorest few people in the society.

Gini coefficients are also commonly used to measure the distribution of income in a society, and in this case they can only take values between 0 and +1, since it is (by definition) impossible for the poorest 20% of the population to have more than 20% of the income.
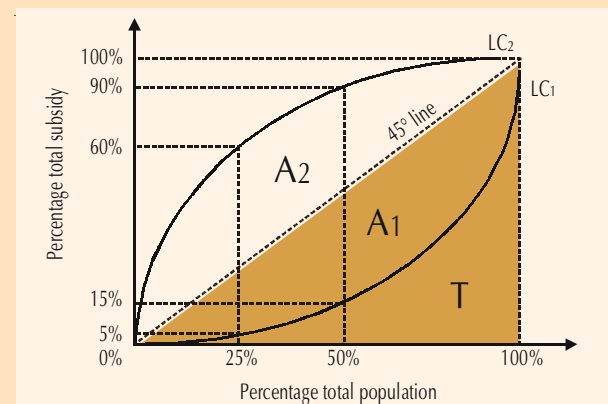
in the cities of Bangalore and Kathmandu end up benefiting the poor.

Around 90 to 95% of these resources are used to keep tariffs faced by households with private taps low, with each of these households receiving an implicit subsidy of US$ 10 to 15 per month. However, since 70% of those with private taps live above the poverty line, around 70 to 80% of these resources fail to reach the poor. There are two underlying reasons for this. First, barely half of the poor have private taps, hence most are excluded altogether from this type of subsidy. Second, the IBT structure used in both cities tends to skew subsidies towards small-volume consumers, on the assumption that they are

more likely to be poor. However, the evidence suggests that although poor customers consume less water on average than non-poor customers, the difference is not all that large.

The remaining 5 to 10% of subsidy resources are used to finance free public taps in poor neighborhoods. Due to the low volumes of water delivered by the public tap network, the implicit subsidy received by each household is no more than US$ 1 to 4 per month. Although modest in value, these subsidies are comparatively well targeted towards the poor. Since 60 to 80% of public tap users are poor, as much as 60 to 85% of subsidy resources channeled through this route reach the poor. The reason that public taps seem to be more successful than private taps in targeting subsidy resources to the poor is because they offer a level of service that proves unattractive to anyone who could afford anything better. In Bangalore, public taps manage to reach the vast majority of the unconnected poor, but this is not the case in Kathmandu, where most of the unconnected poor are still forced to rely on traditional sources of water. Notwithstanding the relatively favorable distributional performance of public taps, they carry a number of other disadvantages which may outweigh these benefits.

Although the distributional performance of water subsidies in the two cities is not good, they are nonetheless more equitably distributed than income and hence make some small contribution to reducing inequality. Notwithstanding this, the substantial leakage of resources away from the intended beneficiaries raises the question of whether a more sophisticated approach to targeting would prove any more effective. The next paper in this series will take-up this challenge.

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