International Studies Program

Working Paper 00-4
July 2000

User Charge Financing of Urban Public Services in Africa

William Fox and Kelly Edmiston

Georgia State University
ANDREW YOUNG SCHOOL OF POLICY STUDIES

User Charge Financing of Urban Public Services in Africa

William F. Fox
Professor of Economics
University of Tennessee, USA
and Director
Center for Business and Economic Research
University of Tennessee, USA
Telephone: +1-865-974-5441
Facsimile: +1-865-974-3100
E-mail: billfox@utk.edu

and

Kelly D. Edmiston
Assistant Professor of Economics
Andrew Young School of Policy Studies
Georgia State University, USA
Telephone: +1-404-651-3519
Facsimile: +1-404-651-2737
E-mail: edmiston@gsu.edu

USER CHARGE FINANCING OF URBAN PUBLIC SERVICES IN AFRICA

1. Introduction

Expansion and improvement of public services is essential to improving quality of life and productivity in developing countries. Some African countries have been diligent in expanding the infrastructure necessary to provide public services, but unfortunately, most have not done a very good job of paying for them. For example, public enterprises in Africa have consistently run deficits, due in large part to an inadequate financing mechanism. Imposition of user charges to fund public services would go far toward eliminating the financial problems faced by many African countries in providing services and would raise additional revenues that could be used to pay for other government expenditures.

Box 1. Benefits of User Charges: Evidence from Ghana

The Accra, Ghana city council was unable to maintain and empty two public pit toilets in Nima, a slum area of about 100,000 workers and self-employed people. The city council was also unable to provide refuse collection. Residents of Nima formed a local association in 1980 and successfully disposed of refuse and emptied the pit toilets. The local association continues to operate the pit toilets and charges fees to finance the operations (Lee-Smith and Syagga, 1990); extracted from Fox (1994):36.

In addition to the financial benefits, there are many other benefits from imposing user charges. User charges have the potential to greatly improve the public sector's efficiency, to impart a more equitable distribution of the financing burden of public services, to provide better

information regarding infrastructure needs, and to improve the quality of existing services.

The remainder of the paper is organized as follows. Section 2 discusses the general nature of user charges: what they are, the services upon which they should be imposed, and evidence of the willingness to pay them. Section 3 discusses the extent to which user charges have been imposed in Africa in the past. Section 4 articulates the theory behind the efficient pricing of public services, resulting in a guide for setting appropriate user charges -- in general as well as under special but common circumstances. Section 5 addresses the revenue implications of user charge financing, including the tendency of efficient prices to raise adequate revenues, ways to recover costs when efficient prices lead to deficits, and the attractiveness of user charges for taxation. Section 6 examines equity considerations of user charges. Finally, the analysis is brought together in section 7 by means of a case study of water supply services in Egypt. Throughout the paper, special attention is paid to the practical issues of levying user charges in Africa, issues which are too often overlooked in the literature. Concluding comments are provided in Section 8.

2. The Nature of User Charges

User charges can be imposed in several ways, but have traditionally been levied as a price per unit of services consumed.[1] In this respect, there is essentially no difference in paying a user charge for public services and a market price for services provided by the private sector. Not every public expenditure should be financed by user charges, however. In general, a public service can be efficiently financed by user charges only if the benefits derived from consumption of the service can be restricted to the individual who purchases it (exclusivity), and if

consumption by one person diminishes the amount of services available for consumption by others (rivalry). If public services are not excludable, consumers of the service are likely to forgo paying user charges because doing so will not affect their consumption. If nonrivalries exist, restricting consumption via charges is inefficient. Furthermore, there must be some means to measure individual usage, such as metering, so that consumers can be appropriately billed.

Given these requirements, a great many of the public services provided in African countries can be efficiently financed by user charges, as seen in table 1.

Table 1

Public Expenditures for which User Charges Should Be the Primary Source of Financing

Water supply	Markets and abattoirs
Sewerage	Housing
Electricity	Land development
Telecommunications	Public transit

Source: Bahl and Linn (1983)

Of course, in order for user charges to be imposed on public services, there must be a willingness-to-pay (WTP) on the part of consumers. Absence of willingness to pay can be interpreted as evidence that benefits are insufficient to justify provision of the services. One way to determine consumers' WTP for public services is to examine the costs they bear in acquiring services in the absence of public provision. There is much evidence suggesting that people in Africa pay a much higher price per unit of service when acquiring services from private vendors than they would pay in user charges if public provision was available. For example, in surveying

395 households in Nigeria, Whittington, et al. (1990) found that the amount households were paying for vended water was approximately equal to that paid in industrialized countries for much higher quantity and quality of water services. Reedy (1986) conducted a similar survey, finding that low-income households in Lagos, Nigeria pay private vendors four to eleven times the marginal costs of public water delivery in that city. Another survey of research in nine developing countries (Whittington and Choe, 1992) revealed that expenditures for water provided by private vendors represented more than 10 percent of income. The fees paid to private vendors represent a lower bound for WTP, suggesting ample evidence of a WTP user charges for water services in Africa.

Box 2. Public Services Defined

By public services, we do not necessarily mean services *produced* by the public sector, but services that are normally thought of as the responsibility of the government. Public services may be produced by the private sector, by public enterprises, or by the government, but in all cases the public sector is involved to some degree in providing the service. For example, public utilities in many countries are operated by the private sector but are regulated by the public sector. Examples of public service delivery mechanisms include (1) production of services by the public sector, (2) production of services by the private sector but financed by the government, and (3) privately produced and financed services that are regulated by the public sector.

Country by country comparisons confirm the research findings that the per unit usage fees paid by consumers for in-house water connections in developing African countries are lower than those paid to private water vendors (see table 2). Consumption levels may be higher with utility provided service, so the total cost can be greater with utility provided services. Also, public utilities provided in these countries may be subsidized from general fund revenue, and the charges may be higher if the user charge was set efficiently (see section IV).

Table 2

Price of Public versus Private Water Supply in Selected African Countries
Late 1970s - Early 1980s

Country	Public utility (in-house connection)	Private Vendor
Burkina Faso	0.30	1.0 - 1.5
Ghana	0.10	1.3 - 2.5
Kenya (Nairobi)	0.20	1.4 - 2.1
Senegal	Free	1.6 - 2.4
Uganda (Kampala)	0.33	1.3 - 3.0

Note: Figures are in US dollars.
Source: Bahl and Linn (1992): 296. See also Bahl and Linn (1983) and Vleiger et. al (1975)

Of course, for people to be willing to pay the same amount for public provision of water as for vended water, the quality of public services must be at least as great as that provided by private vendors. The quality of public services in African countries, as measured by reliability, output quality, and so forth, is generally regarded as very poor, and as a result, many Africans do not have faith that public services will be delivered once they are paid for (see Whittington et al., 1990).

Furthermore, there is likely to be a large protest by consumers if user charges are imposed on public services that were formerly free. Improving the quality of service concurrently with imposition of user fees is likely to diminish or eradicate this opposition. Given the empirical evidence, it seems there is a great potential to provide improved services while reducing the price per unit of consumption compared with services currently available.

Any enhancements in service quality that occur when pricing is instituted must be consistent with local consumer demands and willingness to pay. Linn (1983) examined the

phenomenon of a "demonstration effect," whereby administrators in developing countries raise standards beyond local demands because they are heavily influenced by industrialized countries. Using World Bank project data, he calculated that significant cost increases were incurred when public services were provided at higher than minimum standards of quality. Costs were between 22 and 31 percent higher for sewage disposal, between 53 and 81 percent higher for water supply, and between 271 percent and 321 percent higher for circulation and drainage. By themselves, these data do not say that costs were too high, because minimum quality may be insufficient for many purposes. Still, the data are suggestive that services levels in these projects were being set above appropriate levels.

3. User Charges in Africa: The Record

User charges are not heavily utilized in some African countries despite their many advantages, the large number of services upon which they can be readily imposed, and evidence of willingness to pay. With a few exceptions, local governments in Africa rely more heavily on taxes to fund local government expenditures than on user charges (see table 3). Francistown, Kitwe, and Lusaka are places that raise a substantial proportion of their public revenues by means of user charges. The experience of these cities indicates the potential for raising user charges in other African cities.

Table 3
Percentage Distribution of Financing of Local Public Expenditures in Selected African Cities by Type of Revenue

City, Country, Date	Locally Raised Revenues				External Sources /a/
	Total	Local Taxes	Self-financing Services	Other	
Francistown, Botswana, 1986	55.8	33.5	22.3	0.0	44.2
Mombasa, Kenya, 1981	75.6	75.6	N/A	0.0	24.4
Nairobi, Kenya, 1981	80.2	34.1	46.1	0.0	19.8
Lagos, Nigeria, 1980	51.2	42.8	0.2	8.2	48.8
Tunis, Tunisia, 1985	33.8	24.7	5.3	3.8	66.2
Bukaru, Zaire, 1971	69.9	67.4	N/A	2.5	30.1
Kinshasa, Zaire, 1971	26.9	25.4	N/A	1.5	73.1
Lumbumbashi, Zaire, 1972	90.5	72.8	N/A	17.7	9.5
Mbuji-May, Zaire, 1971	70.2	66.5	N/A	2.7	29.8
Kitwe, Zambia, 1975	92.7	35.0	53.1	4.6	7.3
Lusaka, Zambia, 1972	78.2	39.3	36.9	2.0	21.8

/a/ includes net borrowing, which may be negative, as well as grants and shared taxes
N/A information not available[2]
Source: Bahl and Linn (1992)

4. Efficient Pricing of Public Services [3]

4.1 Setting an Efficient Price

An important goal when setting user fees is to achieve economic efficiency. The basic rule for achieving this goal is for price to be set equal to marginal cost. Consumers are only willing to purchase services at a given price when their benefits from consumption of the service are at least as great as the price, so the rule says that consumers will purchase the service only when their benefits exceed the marginal cost of producing the service. The result is that marginal cost pricing maximizes social welfare. When the user charge is set equal to marginal cost, the benefit of consuming the last unit of service just equals its production cost. Production of an

additional unit of services results in positive net benefits to society if user charges are set greater than marginal cost. Conversely, production of public services beyond the point where the user charges equal marginal cost, which would occur if the user fee is set below marginal cost, would entail costs to society greater than the benefits derived from consumption.

User charge financing is more economically efficient than tax financing whenever it is possible to price services. Put another way, setting a zero price for services, as usually happens when services are tax financed, is less efficient than setting price equal to marginal cost. The reason is that consumers will overuse a service with a zero price, in the sense that they will access services when the benefits are lower than the marginal cost of producing the services.

The efficiency of marginal cost pricing presumes that production of utility services is technologically efficient, which means services are produced at the lowest cost. Production may be inefficient for a variety of reasons. One example is that there often is considerable loss in transmission of services from the site of production to the location of consumption. Insufficient operation and maintenance of transmission facilities for services, such as water supply and electricity, can result in excessive losses. Some loss is to be expected, but consumers should not be expected to pay for production inefficiencies. The appropriate user charge reflects the marginal costs of a technologically efficient (but not ideal) firm, and thus will lie below marginal historical costs for services that are produced inefficiently.

Box 3. The Subtractibility Criterion

Economic theory suggests that subtractibility, or the characteristic that an additional user of public services cannot access the service without diminishing the amount available to others, is necessary for user charges to be efficient. In the case where subtractibility is not present, economic theory asserts that the price should be zero because the marginal cost of an additional unit of consumption is zero. Despite the inefficiencies associated with imposing user charges in these situations, policy makers may want to consider levying some charge in an effort to provide a means for maintaining and expanding the service. Ostrum et al. (1990) provide an interesting example for which strict adherence to the subtractibility criterion seems absurd. Once a partially empty airplane is known to be flying from one point to another, the marginal cost of an additional passenger is near zero. As Ostrum et. al (1990) correctly point out, economic theory asserts that the airline should allow these potential customers to travel at no charge.

4.2 Efficient Prices With Capacity Constraints

Marginal cost pricing fails to achieve economic efficiency in at least two circumstances: when capacity constraints exist and in the presence of externalities. Prices other than marginal cost can be efficient in these cases.

If capacity is constrained at certain times of the day or during particular seasons of the year, marginal cost pricing is likely to create an excess demand for services. In the face of excess demand, the user charge must be raised above marginal cost to the level where excess demand is zero. The resulting price is efficient because it allocates the services to those who place the highest valuation on them (as evidenced by their willingness to pay).[4]

Figure 1 illustrates a situation where the demand for electricity is greater during business hours (given by D_{bh}) than at other times of the day (given by D_0). During off-hours when electricity-intensive businesses are not operating, electric capacity is unconstrained, and the appropriate charge is UF_0, which is equal to marginal cost. During business hours, however, demand for electricity at a price of UF_0 is Q_{bh}, which exceeds the capacity of the utility, $\underline{Q}$. In order to efficiently allocate electricity during these peak demand periods, the user charge must be

set at UF_{bh} to equate demand with supply.[5]

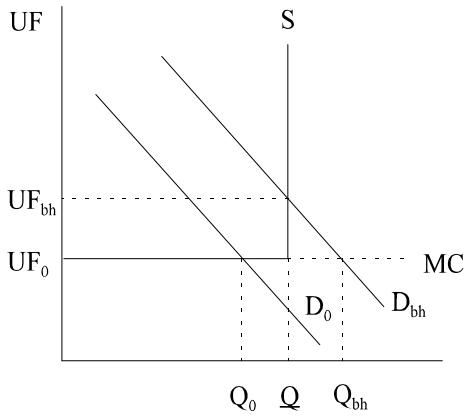

Figure 1
Efficient Pricing with Capacity Constraints

Infrastructure investments often require very large capital outlays. Good estimates of willingness to pay are important for infrastructure investments such as roads and public utilities because the large investments, once in place, generally cannot be transferred to "more profitable" locations. An appropriate peak-load charge not only allocates scarce resources efficiently, but has the added benefit of allowing public service consumers to reveal their preferences for additional output. The user charge communicates an approximate marginal benefit of capacity expansion. Information on marginal valuation of capacity expansion can be compared with estimates of the cost of capacity expansion to help guide the investment decision.

One way to incorporate the costs of capacity expansion into the user charge schedule is to price public services at average incremental cost (AIC), which sets the user charge equal to the marginal cost of operating the service plus the (discounted) average capital cost of expanding output. If the AIC is correctly calculated and all charges are collected, user charge revenues will

necessarily be sufficient to pay for future planned capacity expansions (OHUP, 1991).[6] Also, AIC pricing smooths the price fluctuations that often occur when short-run marginal costs are used to set prices for services where capacity is periodically constrained. Large price fluctuations can create a potentially onerous political problem.

IV.C. Efficient Charges in the Presence of Externalities

The presence of externalities is another reason why the efficient price may not be equal to marginal cost. Externalities occur when either the cost to society as a whole of producing a service to society as a whole is greater than the cost faced by the producer of the service (negative externalities), or when the social benefits of consumption are greater than those accruing to the individual who is the direct consumer of the service (positive externalities).

For example, a positive externality may occur in the case of public health. The individual who is immunized is protected from disease, a private benefit, but the risk of that individual spreading disease to others is also eliminated, a social benefit. Since the individual considers only private benefits in making purchasing decisions, he undervalues immunization, and the aggregate level of immunizations is likely to be below the optimal level. One solution is to subsidize immunizations (by setting price below marginal cost) in order to achieve the socially optimal level. Positive externalities are likely to exist with telecommunications because everyone already attached to a network can contact a new subscriber through the network. Positive externalities also exist for wastewater and refuse collection, since the entire community receives health and safety benefits from the proper disposal of waste by others.

Pollution is the most common source of negative externalities. The production of electricity, for example, is likely to release impurities into the air that are harmful to the

surrounding environment or to the health of local citizens. Both developing and developed countries generally have failed to properly account for negative externalities when setting price schedules for public services. Public service providers must be sure to take all costs, including pollution, into account when user charges are set. Charges will be too low if charges are only on the private costs associated with production. As a result, user charges will result in service provision in excess of the social optimum if the fee is based only on private costs when negative externalities exist.

5. User Charges as a Financing Source

In setting user charges, the goal of economic efficiency normally is balanced with other objectives, such as raising revenues and assuring equity. Pricing services is an important means of generating revenues to finance service delivery. Similarly, failure to price public services can have disastrous consequences for overall public revenues and for the ability to deliver adequate services. Reedy (1986) observed that many survey participants did not have access to public water supply in Lagos because the supply authority could not afford to expand service delivery. A major reason the water authority was unable to expand was because water was provided at no charge. Imposition of user charges could provide a revenue source to allow expansion of service delivery to additional consumers while substantially reducing the excess demand that results from underpricing services.

User charges have the potential to be the most reliable source for funding those services that can be priced. Tax revenues or intergovernmental revenues are much less likely to provide a consistent funding source as competing uses can diminish available resources. Local

governments in developing countries have found that intergovernmental revenues are a particularly erratic revenue source.

If user charges are to be the major funding source for service delivery, they must be high enough to finance service delivery. In most instances, user charges will raise adequate revenues if the price is set equal to marginal cost. However, many public services are priced below marginal cost in Africa, resulting in consistent and sizable deficits. Moreover, user charges tend not to keep up with changes in costs even if they are appropriately set to begin with. User charges in many developing countries have not changed, and have declined in real terms, for more than 15 years (Fox, 1994).

More aggressive imposition of user charges in Africa would provide a substantial boost to public coffers. Anderson (1989) calculated the potential contribution to public revenue of levying user charges on electricity, water, telecommunications, and roads in several African countries. He concluded that a 25 percent increase in public revenues was a "realistic possibility" (p.529).

User charges also have great potential for funding additional investment in public service infrastructure. Anderson (1987) demonstrated that if user charges increased the financial rate of return to public services infrastructure by 5 percent, enough revenue would be generated in sub-Saharan Africa to finance a 60 percent increase in annual investment.

5.1 Recovering Costs When Efficient Prices Lead to Deficits

Marginal cost pricing may not adequately cover production costs in several circumstances. One example is when the price is set to subsidize consumption because of positive externalities. A second example is when there are large economies of scale that are not

captured entirely by demand. Marginal cost will lie below average cost when demand is inadequate to take advantage of all economies of scale. The result is a revenue shortfall.[7]

Figure 2 illustrates a situation where provision of a public service requires a large initial investment, but the marginal cost of usage is low (Fox, 1995). Economically efficient consumption occurs at Q^*, where marginal cost equals demand. The efficient price is UF^*. At (UF^*,Q^*), total costs exceed total revenues by an amount equal to $ACabUF^*$.

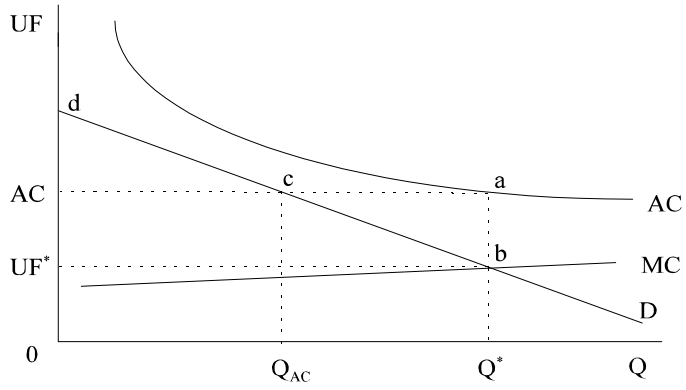

Figure 2
Deficits in Decreasing Cost Industries

The fact that the service is not self-financing does not mean that it should not be provided, however. A service should be provided as long as the total benefits received from consumption (the entire area under the demand curve to Q^*) exceed total cost ($ACaQ^*0$), or equivalently, as long as $dcAC$ is greater than abc.

In cases where revenue shortfalls occur but provision of the service results in positive net benefits to society, some means must be found for subsidizing service delivery. The government's general revenue fund is one means of financing the shortfall.

A second financing source is use of a two-part pricing structure, one part for marginal consumption and a second part for connection to the system. Since many public services have multiple dimensions (e.g. use and access), one way to make up a deficit would be to impose (or increase) an annual access fee so as to recover total cost. If there are N connections to the public

service illustrated in figure 2, the appropriate annual access fee would be $A^* = 1/N\{ACabUF^*\}$. The two-part tariff (UF^*, A^*) is then pareto efficient, given the financing constraint, unless A^* is high enough to drive consumers away from connection to the service (Feldstein, 1972).

Some economists argue that raising the user charge above marginal cost while lowering the annual access fee can lead to gains in efficiency. The pricing change would increase efficiency if the welfare loss from setting price too high is outweighed by gains via a reduction in the number of consumers driven away from connection by the annual access charge. Ng and Weisser (1974) derive the optimal balance between user charges and access charges by maximizing a social welfare function subject to a financing constraint, resulting in a pricing scheme based on price elasticities of demand.[8] The finding is that the more inelastic the demand for service, and the more elastic the access effect, the more likely that welfare will be enhanced by the change.

A third alternative is to set the user charges equal to average costs. However, average cost pricing would not solve the financing problem illustrated in figure 2, because the demand curve fails to cross the average cost curve. In cases where the demand curve crosses the average cost curve, a price set equal to average cost would provide sufficient financing. However, resources would be misallocated in the latter case because consumption would be below the efficient level since average cost is above marginal cost.

5.2 Taxation of Public Services

A natural extension of this discussion is whether prices for public services should ever be set above marginal cost, either by directly pricing above marginal cost or through taxation of service consumption. This paper has emphasized that setting user charges equal to marginal cost

is best for achieving economic efficiency. However, the government may need to raise additional revenues to finance delivery of services that cannot be priced. One option is to tax consumption of electric, water, or other services (in excess of the user fee), and to use the resulting revenues to fund services that cannot be priced.

Evidence suggests that user charges can be set to earn a surplus. For example, in a survey of 37 countries, Israel (1992) found that user charges for telecommunications services averaged 172 percent of delivery costs. Revenue potential is especially great for services in short supply because, as indicated in the previous section, efficiency requires that user charges on such services be high in order to ration the service to those with the greatest willingness to pay.

Any tax other than a lump sum tax or "head tax" will necessarily lead to efficiency losses, but lump sum taxes are not usually a viable option for raising significant public revenues. Policy-makers must consider the "second best" option, which is the tax that has the least distortionary effects on the economy. There is no *a priori* reason to expect taxes on public services to create greater distortions than taxes on other commodities. On the contrary, most public services have been shown to have relatively low price-elasticities of demand, which means that efficiency losses from taxing these services would be relatively low. Hubbell (1977), for example, estimated the price-elasticity of water use in Nairobi, Kenya to be - 0.5.

Figure 3 illustrates the efficiency and revenue gains from applying taxes to commodities with more inelastic demand. Good 2 is illustrated as having a more price-inelastic demand than is good 1. Imposition of an excise tax of P_T-P causes the price of either good to rise to P_T. For good 1, consumption falls from Q to Q_{T1}, and the government collects $P_T$cdP in revenues. The triangle given by acd is the welfare loss from the tax. For good 2, consumption only falls to Q_{T2},

government tax collections increase to $P_T$beP (a gain of bcde), and the efficiency loss is reduced to abe. Thus, by taxing commodities with relatively inelastic demand, tax revenues are greater and welfare losses can be reduced.[9]

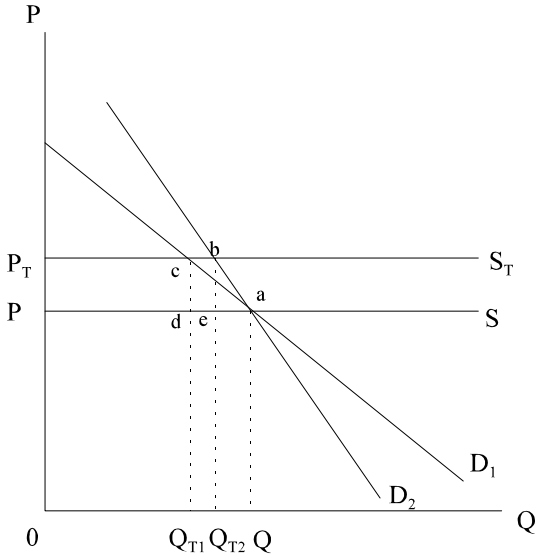

Figure 3
Optimal Taxation with Differential Price Elasticities

Taxing public services can offer advantages in addition to the potential for lower efficiency losses. Taxation of public services can be easy to administer if the collection mechanisms are already in place. Enterprises are already engaged in collecting consumption fees, and it becomes a simple matter to add taxes onto the existing bill.

The demand for public services has been shown to be income elastic (Linn, 1983). Taxes on income elastic goods and services have two salient benefits: tax progressivity and elastic revenue growth. Wealthier consumers pay a larger share of the taxes that are imposed on income elastic goods. Also, tax revenue growth will be proportionately greater as income grows over time.

5.3 Practical Issues of User Fee and Tax Collection

The first step in collecting fees is to develop some way of measuring individual usage. For services such as water and electricity, this means that whenever possible meters need to be placed in each household.[10] Next, up-to-date accounting systems must be established and employees must be trained in proper billing procedures. Finally, payment must be vigorously enforced once the billing procedures are in place. Developing countries often fail to collect substantial user charge revenues, primarily because of inadequate billing procedures, inadequate enforcement of payment, and outright theft.[11] Payment should be enforced through late fees or disconnection for noncompliance, though such mechanisms are frequently not used. Moreover, public enterprises in Africa are severely understaffed, so even if enforcement mechanisms are in place, consumers may not be compelled to actually pay.

Some people engage in theft or illegal tap-ins in places where collection is enforced. Illegal connections have been observed to account for losses of 20 percent of total water supply and electricity output in Africa (Anderson, 1989). Theft and illegal tap-ins can be reduced through combinations of different technologies and better enforcement.

Breaking of meters presents another collection problem. For example, meters are in place for most water delivery subscribers in some Egyptian cities, but a substantial percentage of these meters are inoperable (see table 5), due in large part to their being destroyed by subscribers (EHP, 1995).

Once user charges are collected, there can be problems in making the revenues available for delivering the service. Given the large deficits faced by most governments in Africa, there is political pressure to transfer user charge revenues to the general fund of the government. The service quality will suffer, leading to a diminution of willingness-to-pay, if there is no linkage

between service delivery and revenues. As mentioned in section II, a willingness to pay for public services is critical to the successful application of user charges. Earmarking of user charge revenues is necessary to ensure that the funds are available to finance the public services for which they were collected. For example, many municipalities in Bosnia used special enterprise accounts to earmark funds before the war.

Revenues collected above necessary service delivery costs should go to the government's general revenue fund, not to the earmarked pool. For most public services, marginal cost or average incremental cost pricing should provide adequate funding of O&M and planned investment, and any additional revenues should go to the general fund. An explicit tax on the service, rather than arbitrarily raising the price, is a preferred method for generating revenues because the amount to be transferred to the general fund is obvious.

World Bank data from road user charges (RUC) in sub-Saharan Africa provide evidence that user charge revenues are often not entirely earmarked for service maintenance and improvements. RUC revenues are being shifted to public purposes other than road service in all of the countries in Table 4. Possible results include erosion of infrastructure if services are not maintained or failure to expand the capital stock. Users may respond by decreasing their willingness to pay the RUC. An alternative explanation is that these countries are charging user fees above marginal cost. In this case, social welfare would be improved by lowering the user fee, unless the least distorting way to raise public revenues is through road user fees. Given Africa's record of undercharging for public services, however, the former scenario is much more likely than the latter.[12]

Finally, there are potentially severe political problems associated with taxing user

charges. As mentioned earlier, imposition of user charges is likely to be protested by consumers. Levying taxes in addition to the user charges will only exacerbate the situation.

Table 4

Road User Charges in Selected African Countries and Their Relation to Expenditures

Country	Year	RUC as a % of Road Expenditures
Kenya	1981	138
Mauritius	1981	1700
Somalia	1979	411
Sudan	1981	269
Uganda	1984	411
Zimbabwe	1983-84	345
Cameroon	1978	273
Sierra Leone	1979	200

Source: World Bank (1987); See also Anderson (1989)

6. Equity Considerations

Equity is a very important consideration of public administrators in Africa, as in all parts of the world. Many of the justifications that are given for financing public services with taxes rather than user fees result from perceptions by some that user charges are unfair. Equity is a very complex issue, and in many regards, the equity of differing revenue collection policies lies in "the eyes of the beholder." Equity is too often perceived as an issue of income distribution, and other equally important equity considerations are overlooked.

Equity implications of user charges can be evaluated both in terms of benefits received

and in relation to ability to pay. Equity of benefits received means that the people who receive the benefits of government expenditures are the ones who are responsible for paying for them. There is no better way to ensure equity on a benefits received basis than to finance public services with user charges. By their very nature, user charges are borne in relation to the proportion of total public benefits received, if the charges are properly enforced. Charging people who do not receive benefits is unfair on a benefits received basis.

A benefits received approach to equity is particularly appropriate for business consumption, where a linkage between ability to pay and user charge assessments is not meaningful. Industry is estimated to consume about 90 percent of water and electricity in Africa (Anderson, 1989).

Equity measured in terms of ability to pay refers to the relation of payments to household income. Some will feel that payments should be progressive, others proportional, and others believe that regressive payments are acceptable. Thus, a user fee system that is perceived as fair by some will be seen as unfair by others. The progressivity of user fee payments depends on the income elasticity of demand for services. Specifically, user charges are progressive for public services with income elasticities greater than one.

One potential method for raising the progressivity of user charges is to impose rising block tariffs. A rising block tariff is a user charge structure in which consumption up to a specified amount is priced at a very low rate, while additional "blocks" of usage are priced at increasing rates. Rising block tariffs have the potential to impart a substantial redistribution of the revenue burden to those with relatively higher incomes since low income people consume less public services than do high income people. Rising block tariff structures can shift much of

the burden to industry, which is a major consumer of services.[13]

Rising block tariffs may not offer the expected equity benefits in developing countries. Low income households in urban areas often live with several others in a single tenement, and in most cases the building has only one meter. Therefore, the potential exists for low income consumers to be charged substantially more for public services than more affluent consumers living in single-family dwellings -- a result exactly opposite from that intended by the imposition of rising block tariffs. Whittington (1990) investigated this problem in Kumasi, Ghana, where water supply is priced via a rising block tariff. His regression analysis demonstrated a statistically significant positive relationship between the number of households in a building and the average price per imperial gallon of water. For buildings with one to four households, the average price per imperial gallon was determined to be 0.25 cedis. The average price rose to 0.36 cedis for buildings containing more than 17 households. Moreover, there was an inverse relationship between the number of households occupying a residential building and household weekly expenditures for water supply.

An argument is sometimes made that low income consumers should have access to limited service levels at little or no cost, regardless of the progressivity of the overall user fee structure. The fee structure can be adjusted to satisfy such concerns while still obtaining the economic and financial benefits of user charges. One way is to establish a dichotomous fee structure where differential fees are charged for varying levels of service quality. Egypt uses a differential fee structure to offer highly subsidized prices for certain food commodities and health care of lessor quality. Better food and improved health care are made available at significantly higher prices. In the case of water delivery, public standposts or kiosks can be provided to low

income people for a minimal charge, while in-house connections can be made available to those willing to pay an increased price (see Whittington et al., 1990).

7. The Case of Water Supply in Egypt

Water service delivery in three Egyptian cities (Fayoum, Beni Suef, and Menya) provides an appropriate case study of public service finance. Water production and delivery is characterized by several apparent problems. First, public water providers in Egypt experience enormous deficits. In fact, the deficits are close to or in excess of revenues in all three cities. In the most extreme case, Menya, the deficit is 3.7 times than total collected revenues. If no financial improvements are made in Menya water service delivery, the deficit is projected to grow to L.E. 6.7 million by the year 2000 (EHP, 1995).

One obvious reason for Menya's deficit is a serious lack of enforcing payment. Only 33.5 percent of charges billed to consumers are actually paid. Fayoum and Beni Suef have done a better job of collecting revenues (86.3 percent and 77.4 percent, respectively), but still fail to collect significant billings.

Second, there is a significant discrepancy between water supply production and water supply billed. The largest amount billed relative to water produced is 59.0 percent (Fayoum). Some water loss occurs in all systems, but an effective system would only have about 15 percent losses. Water losses in these cities can be attributed to a variety of causes. One explanation for the loss is the technologically inefficient production and poor service delivery resulting from

Table 5

Water Delivery for Three Provincial Cities in Egypt
Selected Data

Category	Fayoum	Beni Suef	Menya
General Information:			
Population in Service Area	279,000	188,247	227,330
Household Coverage (%)	0.90	0.95	0.95
Number of Connections	43,000	29,100	37,357
Persons Served Per Connection	5.8	6.2	5.8
Number of Meters Installed	43,000	29,100	37,357
Percent of Meters Working	0.75	0.40	0.67
Water Supply Production	18,013,845	16,330,100	18,606,240
Water Supply Billed	10,633,698	7,802,711	8,323,790
Revenues (L.E.):			
Revenues Billed	2,341,045	1,775,502	2,236,000
Revenues Collected	2,020,602	1,373,509	748,651
Expenses (L.E.):			
Wages	2,506,353	793,651	1,681,076
Raw Materials	751,328	287,529	1,310,043
Electricity	1,176,000	1,442,939	516,600
Other Commodities	12,155	15,417	12,400
Service Inputs	0	14,916	0
Total Expenditures	4,445,836	2,554,452	3,520,119
Surplus (Deficit) [L.E.]	(2,425,234)	(1,180,943)	(2,771,468)
Ratios:			
m^3 billed / m^3 produced	59.0%	47.8%	44.7%
Revenues collected / revenues billed	86.3%	77.4%	33.5%
Average tariff per m^3 billed (P.T)	22.02	22.75	26.86
Average cost per m^3 produced (P.T)	24.68	15.64	18.92
Surplus (deficit) per m^3 produced (P.T)	(13.46)	(7.23)	(14.9)

Note: Figures are in Egyptian pounds (L.E.) or piasters (P.T)
Source: EHP (1995)

inadequate O&M expenditures. Another reason is theft, reputed to be a considerable problem in Egypt. Further, while all connections are said to be metered, which is a rare occurrence in developing countries, many of the meters are malfunctioning or are inoperable. Repair of broken meters is also likely to go far in assuring that more of the water supply production is accounted for and appropriately billed. In Beni Suef, for example, only 40 percent of meters are working, and less than 48 percent of production is billed.

Water supply financing deficits could be eliminated through a combination of better enforcement and improved production practices. In Beni Suef and Menya, the average tariff is greater than average cost, and thus would be sufficient to recover total costs if all of the water produced were to be billed and collected. Also, demand would fall with better collection practices, and production costs would fall with less water loss. Both factors would improve the fiscal position of water supply authorities in these cities. However, maintenance and collection costs need to rise or existing resources need to be used more efficiently.

Despite the many problems, there are positives for water delivery in Fayoum, Beni Suef, and Menya, Egypt. These cities have done a good job of providing near universal access to water and of establishing a basic infrastructure for proper billing. If these cities are able to keep their systems in good repair, enforce payment, and charge adequate fees, they should be able to make substantial progress in reducing the large deficits they have suffered in the past.

8. Conclusion

African countries have not been charging for public services to the extent that is consistent with enhancing economic efficiency and providing adequate revenues for appropriate

service delivery. Prices are charged in some circumstances, but often are below marginal cost. There are many practical problems in developing countries that make putting user charges into practice a considerable exercise in adjustment and patience. These problems include inadequate billing and collection procedures, insufficient attention to operations and maintenance, and political obstacles. Nonetheless, African countries would gain from significant increases in pricing of services whenever possible. The likely results of such a shift are significant improvements in the efficiency of public services, a more equitable distribution of the financing burden, and a substantial increase in government revenues (or a reduction in government subsidy costs).

NOTES

1. User charges may also be imposed as a lump sum charge for access to the service or as a proxy for consumption. Gasoline consumption, for example, is considered to be a reasonable proxy for road usage and can be taxed accordingly.

2. Although information was not available concerning self-financing services in some cities, it can be inferred that the proportion of local operating revenues collected from self-financing services is relatively small. The upper bound would be the amount in the category "other."

3. For a practical guide to estimating and implementing efficient user charges, the reader is referred to Linn (1983) and Turvey (1971).

4. Technically, raising the price in the face of capacity constraints is not really a divergence above marginal cost. For example, an absolute capacity constraint, such as might occur if supply factors were fixed in the very long run, would imply a marginal cost of near infinity.

5. Other means of handling the peak load problem also exist. For example, some users can be provided an interruptible power supply. This means that users' access to power can be limited during peak periods, such as can occur during unusually hot weather.

6. The appropriate formula for calculating the AIC can be found in Saunders, et al. (1977) or Bahl and Linn (1992).

7. This is a problem primarily of rural communities since most urban communities in Africa suffer from capacity shortages. An exception is delivery of a new service before sufficient time has elapsed for demand to develop.

8. Baumol and Bradford (1970) present a similar result assuming no access fee. For a recent application of this pricing formula to electricity utilities in the United States, the reader is referred to Hartman, et. al. (1994).

9. Sumptuary taxes, such as those on beer, liquor, and tobacco, also benefit from a low price-elasticity of demand. Sumptuary taxes are very popular in Africa and other developing countries, although they may be imposed for "moral" reasons in addition to the revenue potential. In 1986 for example, 41.9 percent of local taxes in Kinshasa, Zaire were collected from excise taxes on beer (Bahl and Linn, 1992).

10. In cases where administration costs outweigh the efficiency benefits of per unit charges, an alternative financing structure should be developed that still links charges with usage, even though the link may not be as direct as would be the case with per unit user charges. If the cost of installing, maintaining, and reading meters outweigh the benefits associated with reduced consumption, other charges should be used in lieu of per unit user fees. In Ramallah (West Bank), garbage collection fees are levied based on the number of rooms in the dwelling. Similarly, one-time connection fees and recurrent charges based on facility size are used to finance sewerage. With this fee structure, the equity and financing benefits of imposing user charges are still received, although economic efficiency is not attained.

11. The reader is referred to Achebe (1985) for some striking examples of these problems in Nigeria.

12. Cost information was not available and cannot be determined from the information contained in the table.

13. A rising block structure may not provide sufficient revenues to cover costs, particularly if the highest block price is set equal to marginal cost. Some means of subsidizing service delivery may be necessary.

REFERENCES

Achebe, Chinua (1985). *The Trouble with Nigeria*. Enugu, Nigeria: Fourth Dimension.

Anderson, Dennis (1987). *The Public Revenue and Economic Policy in African Countries: An Overview of Issues and Policy Options.* World Bank Discussion Paper 19. Washington, DC: World Bank.

Anderson, Dennis (1989). "Infrastructure Pricing Policies and the Public Revenue in African Countries," *World Development* vol. 17 no. 4: pp. 525-542.

Bahl, Roy W. and Johannes F. Linn (1983). "The Assignment of Local Government Revenues in Developing Countries," in Charles E. McClure, Jr. (ed) *Tax Assignment in Federal Countries*. Canberra: Australian National University Press, 1983.

Bahl, Roy W. and Johannes F. Linn (1992). *Urban Public Finance in Developing Countries*. New York: Oxford University Press for the World Bank.

Baumol, William J. and David F. Bradford (1970). "Optimal Departures from Marginal Cost Pricing," *American Economic Review* vol. 60 no. 3: pp. 265-283.

Environmental Health Project, U.S. Agency for International Development (1995). *Findings and Institutional Options for Future Management of Water Supply and Wastewater in the Governorates of Fayoum, Beni Suef, and Menya*. EHP Activity Report No. 10. Washington, DC: USAID.

Feldstein, Martin S. (1972). "Equity and Efficiency in Public Sector Pricing: The Optimal Two-Part Tariff," *Quarterly Journal of Economics* vol. 86 no. 2: pp. 175-187.

Fox, William F. (1995). "Designing Infrastructure Policy to Create Jobs in Rural Areas," in *Creating Employment for Rural Development*, Organisation for Economic Co-operation and Development (OECD), 1995, pp. 111-129.

Fox, William F. (1994). *Strategic Options for Urban Infrastructure Management.* Urban Management Programme Policy Paper No. 17. Washington, DC: World Bank.

Hartman, Raymond S., Kenneth A. Jensen, and Kenneth P. Seiden (1994). "Strategic Rate Making in the Context of Dynamic Ramsey Pricing," *Applied Economics* vol. 26:pp. 363-374.

Hubell, Kenneth L. (1977). *The Residential Demand for Water and Sewerage Service in Developing Countries: A Case Study of Nairobi*. Urban and Regional Report 77-14. Washington, DC: World Bank, Development Economics Department.

Israel, Arturo (1992). *Issues for Infrastructure Management in the 1990s*. World Bank Discussion Paper 171. Washington, DC: World Bank.

Lee-Smith, D. and P.M. Syagga (1990). *Access by the Urban Poor to Basic Infrastructure Services*. EDI African Region Paper, Mazingira Institute.

Linn, Johannes F. (1983). *Cities in the Developing World: Policies for Their Equitable and Efficient Growth*. New York: Oxford University Press.

Ng, Yew-Kwang and Mendel Weisser (1974). "Optimal Pricing with a Budget Constraint: The Case of the Two-part

Tariff," *Review of Economic Studies* vol. 41 no. 3:pp. 337-345.

Office of Housing and Urban Programs, U.S. Agency for International Development (1991). *Infrastructure Finance Volume I: Financing Urban Infrastructure in Less Developed Countries*. Arlington, VA: USAID.

Ostrum, Elinor, Larry Schroeder, and Susan Wynne (1990). *Institutional Incentives and Rural Infrastructure Sustainability*. Burlington, Vermont: Associates in Rural Development, Inc.

Reedy, Diane E. (1986). *Domestic Water Use and Sanitation in Lagos, Nigeria*. Background Paper. Washington, DC: World Bank, West Africa Projects Department.

Saunders, Robert J., Jeremy J. Warford, and Patrick Mann (1977). *Alternative Concepts of Marginal Cost for Public Utility Pricing: Problems of Application in the Water Supply Sector*. World Bank Staff Working Paper 259. Washington, DC: World Bank.

Turvey, Ralph (1971). *Economic Analysis and Public Enterprises*. London, UK: Allen and Unwin.

Vleiger, C.A. de, A.R. Manuel, G.A. Vuerstra, and M.C. Onlandvan Schendelen (1975). *Drinking Water Supply by Public Hydants in Developing Countries*. Draft Final Report. The Hague: International Reference Center for Community Water Supply.

Whittington, Dale (1990). *A Note on the Adverse Effects of Increasing Block Water Tariffs in Developing Countries*. Policy, Planning, and Research Working Paper. Draft Copy. Washington, DC: World Bank, Infrastructure and Urban Development Department.

Whittington, Dale, Apia Okorafor, Augustine Okore, and Alexander McPhail (1990). *Cost Recovery Strategy for Rural Water Delivery in Nigeria*. Policy, Research and External Affairs Working Paper WPS 369. Washington, DC: World Bank.

Whittington, Dale and Kyeongae Choe (1992). *The Economic Benefits Available from the Provision of Improved Potable Water Supplies: A Review and Assessment of the Existing Evidence*. Water and Sanitation for Health Project Technical Report. Arlington, VA: USAID.

World Bank (1987). *Interim Guidelines on Road Uses Taxation*. Washington, DC: World Bank, Transportation Department.