Do Cross-Subsidies Help the Poor to Benefit from Water and Wastewater Services? 
*Lessons from Guayaquil*

by Guillermo Yepes

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Introduction

Do Cross-Subsidies Help the Poor to Benefit from Water and Wastewater Services?: Lessons from Guayaquil

The importance of demand responsive approaches to assuring sustainable water and sanitation services has long been a tenet of the UNDP-World Bank Water and Sanitation Program. Earlier papers in this series have presented arguments in favor of gauging consumer demand and using this information in investment choices ("Lessons from Large-Scale Rural Water and Sanitation Projects" by Harvey A. Garn), have explored willingness to pay studies ("The Neighborhood Deal" by Dale Whittington et. al) and have described cases where appropriate technology and community participation have been applied to identify solutions which utilize effective demand ("Considerations for Regulating Water Services While Reinforcing Social Interests" by Vivien Foster and "PROSANEAR – People, Poverty and Pipes", by Yoko Katakura and Alexander E. Bakalian.) Each of these, and indeed most analysis on the subject of demand responsiveness in water supply, focuses on the customers willingness to pay and ways to find an appropriately affordable delivery system. But as Guillermo Yepes’ paper implies, sustainability depends not just on customer willingness to pay, but also on the company’s willingness to charge.

As Guillermo Yepes points out, many systems in developing countries have failed because they presume that customers cannot pay and base their tariff structure on that presumption. The understandable desire to assure that the poor have access to reliable water and sewerage services has often led to a system of cross-subsidies. The water utility charges low income groups and most residences at below-average rates, but charges industrial and commercial users at above-average rates to make up the difference. Despite the good intentions the cross subsidies often leave companies less willing and able to serve the low income population in the long run, and too weak to provide sustained services to higher income groups. They also tend to send the wrong message to consumers, and to companies themselves about water use and conservation.

Guillermo Yepes has been with the World Bank for over twenty years, moving from sanitary engineer to deputy division chief for Latin American water supply to unit chief for urban and water projects in Latin America, to the position he now holds as Water Supply Advisor for the World Bank. During his tenure Yepes has overseen the refocusing of Bank projects from large-scale engineering investments to support for institutional strengthening and the development of a “business outlook” in water supply companies. Yepes points to his work with the water company of Santiago, Chile in the late 1970’s and early 1980’s as key in setting the stage for the new thinking about effective water supply practices. For the past five years he has been developing performance indicators from water companies on a worldwide basis, as part of the Bank’s benchmarking project.

In this paper Guillermo Yepes examines a single case, that of Guayaquil, Ecuador and shows the multiple effects of the subsidies applied in the tariffs. He concludes with concrete recommendations concerning tariff policies and ways to apply subsidies without creating negative impacts.

Harvey Garn
The World Bank
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Tariff policy in many countries is often driven by the understandable desire to assure that the poor have access to reliable water and sewerage services which leads, in turn to a system of cross-subsidies. The water utility charges low income groups and residences at below-average rates, but charges industrial and commercial users at above-average rates to make up the difference. While this cross subsidy is planned with good intentions, it may be the case that it leaves companies less able to serve the low income population in the long run, and too weak to provide sustained services to higher income groups.

This paper looks at the particular case of Guayaquil, Ecuador. Water and wastewater public utilities in Ecuador have been unable to extend service to the poor. Tariffs paid by the poor and residential consumers do not cover the costs of providing services and, besides causing an effective “welfare loss” by distributing water resources inefficiently, they leave the utilities unable to generate the financial resources to extend services. In addition, national and municipal governments lack the financial resources to provide grants to extend and improve service on a sustainable basis. The shortage of funds frequently leads the utilities to charge high connection costs for water and sewer hook-ups. The end result is that residents in poor areas have been excluded, de facto, from these services and have no other alternative but to depend on unreliable sources of water that are either costly, of poor quality, or both.

**Background**

The Water and Sanitation company of Guayaquil (ECAPAG), responsible for providing water and sewerage services and storm drainage, faces the challenge of improving quality and coverage of services. Service coverage is low. Some 500,000 people of a total population of 2 million have no house connection and about 1 million lack adequate sanitation services. In addition, deficient maintenance has water service intermittent, flowing only for a few hours a day in some areas of the city. Poor care of drains and waste water systems has accentuated flooding in some zones. A similar situation prevails in other urban areas of the country.

It is estimated that the expansion and improvement of the water and sewerage systems in Guayaquil will require an annual investment of about $90 million for the next four years. World Bank missions calculate that about half or $45 million/year are urgently needed to cover the cost of rehabilitating the existing infrastructure alone. Given present consumption levels, an average tariff of $0.94/m3 would provide funds to meet these objectives, based on preliminary Bank calculations of a long-run marginal cost of about $1.00/m3. But in 1995 the average water and sewerage tariff was $0.47/m3. Will Guayaquil be able to fill the gap created by its tariff system? And can it operate and maintain an expanded system without changing that system?

**The Existing Tariff System**

Guayaquil’s water utility charges different rates depending on the type of user (domestic, industrial, commercial and official) and on the amount consumed. Tariffs range from $0.02 to $1.76/m3.

The utility charges nothing at all to the military, to sport centers, and to municipal parks, all of which receive water free of charge. The charges for wastewater collection service - or use of the sanitary sewer system - represent a percentage of the monthly water bill. Domestic users pay 60% of their water consumption, commercial users 80%, and industry pays between 100 and 150% (The latter charge applies to industries where water is part of the final product, e.g. soda water).

Total annual revenue is estimated at US$55 million. US$45 million are derived from operations and US$10 million come from municipal subsidies, including transfers from taxes to other municipal services. Revenue from wastewater collection represents approximately 84 percent of the water billing. At 45 percent of billings, collection efficiency is low. Guayaquil’s situation reflects that of many Latin American cities. And, as we shall see, it is compounded by its tariff policy.

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1 In contrast, families without house connection frequently buy their water from private vendors at substantially higher rates ($3.45/m3).
Problems Created by Cross-Subsidies

Economic Welfare Losses

Cross-subsidies have adverse economic, financial and other effects which often are not quantified or appreciated, because regulators and utilities believe that they are not substantial. However, in many instances, these side effects can be substantial. To begin with, a cross-subsidy policy sends the wrong signals to both the utility and consumers. These signals translate into inefficient choices by users at both ends of the tariff scale. In Guayaquil the fact that water is supplied free of charge to military bases and sports stadiums can lead to wasteful uses of a good that represents zero cost, regardless of the amount consumed. The same principle applies to residential and other customers who are charged less than the marginal cost of water production and delivery. Customers who pay higher tariffs for water may reduce their consumption, or find other water sources, even though they would very likely have bought more water if they were charged at the marginal cost and not above it.

At the same time, cross subsidies can discourage utilities from collecting payments. Problems with low collection rates are rooted in ill conceived policies which subsidize utilities, regardless of performance; unrealistically low rates which discourage collection, and lax regulatory practices.

In the past, the effects of price on water consumption tended to be neglected. It was often assumed that people would be indifferent to price increases because water forms such a basic human need. Most tariff policies were based on this notion, or on a corollary, that people’s consumption patterns relative to price changes would be the same regardless of cost increases. If this were the case it would be easy to justify subsidizing one group’s water consumption because another group could be expected to purchase enough water at a higher price to make up the difference. Recent studies have shown this assumption to be erroneous. High income residential, industrial and commercial consumers are more price-sensitive than residential low-income consumers. When the price of water goes up even high income consumers will buy less. Therefore, there is a real possibility then that the revenue loss from the subsidy given to a group can not be fully recovered from the overtaxed group in which case the average revenue per m3 will drop.

Economists refer to both the overconsumption by subsidized customers and the loss of sales to the subsidizing customers as inefficiencies. In the case of water, both of these inefficiencies also constitute losses to society, or “welfare losses” because it can be argued that society as a whole would be better off if the water were valued and used at its true cost, avoiding both waste and underuse. In the case of Guayaquil, knowing the marginal cost of water to be around $1.00/m3 and knowing the changes in consumption patterns which result in both the subsidized and subsidizing groups, we can calculate the welfare loss to be approximately US$ 4.4 million/year.

This amount corresponds to the welfare loss based only on water consumption. If we were to consider the waste water collection and treatment in the equation the losses would more than double. Many utilities add a surcharge to the water bill to cover the cost of providing wastewater collection and treatment services. While the experience in industrialized countries is that the cost of sewerage services is almost always higher that the cost of water supply and therefore the surcharge fraction should be higher than 1, in most Latin American countries waste water collection and treatment is charged at a fraction of the water bill - generally 50%. (In Guayaquil it is calculated to be 85% of the water bill.) Moreover, many utilities separate the charges for wastewater collection and wastewater treatment. It is especially important to calculate waste water treatment in settings with large industrial bases as these can impose significant additional treatment.

Price elasticity of industry was found to range from about -0.5 to 1.2 while poor consumers exhibit a price elasticity in the range of -0.1 to -0.3. See Cestti, Rita, Guillermo Yepes, and Augusta Dianderas. “Managing Water Demand by Urban Water Utilities.” Transportation Water and Urban Development Department, World Bank, Washington D.C. February 1997.
costs. Waste water treatment charges should be factored in the reduction of organic load (based on BOD or COD), of suspended solids, and, of course, overall volume treated. (This implies a waste water stream free of deleterious substances and a system of serious sanctions for violators.)

**Financial Losses**

Besides welfare losses, cross subsidization frequently causes serious financial losses to utility companies. Taking a case in point, for Guayaquil, we can calculate the revenues which would be lost annually were ECAPAG to increase its connections by 500,000 among the currently unserved marginal population. Given the current subsidized tariff rate ($0.02/m3), ECAPAG would find itself running an annual loss of some US$ 4.7 million to cover the unrecovered costs of serving the new consumers. This has serious implications for the utility. The first is an implicit increase of rates to the higher income customers to cover the unrecovered costs of the subsidized group. But we cannot rely on a straight calculation, because each time the cost per cubic meter increases at the upper end, the amount of consumption drops and ECAPAG will have to calculate a still higher tariff to cover its costs. In summary, the average tariff for the “subsidizing” group would need to be increased by $.87/m3 - and increase of almost 50% from the current rate of $1.35/m3 to a new rate of $2.42/m3.

Up to now we have discussed mainly the effect of subsidies on the consumers, and how their behavior will affect the utility, ECAPAG. But as we said at the outset, the cross subsidy system also sends signals to the utility, depending on which group it considers.

**At the Lower End of the Tariff Spectrum**

In Guayaquil variable costs run about 0.11/m3 while billing and collection costs represent about US$ 1.00 per connection/month to ECAPAG. This means that over and above the loss in revenue from production costs, the utility also incurs in a net operating loss (marginal operational revenues less marginal operating costs). If ECAPAG were to connect 500,000 currently unserved households it would run an additional net operational loss of approximately $2 million per year from the costs of registering charging and collecting customer payments. In this situation, it literally will cost ECAPAG more to calculate and to send out the bills than it would bring in if the bills were paid. The utility loses incentives to charge, or to reduce the part of unaccounted for water (UFW) related to commercial losses. In effect, under these circumstances it is not cost effective either to meter or to collect from this highly subsidized group of users. The situation in Guayaquil confirms this: UFW is in the order of 75% and only 26% of the water connections are metered. In addition, some 60,000 water and 38,000 sewerage connections are not even registered. The utility finds it cheaper to give free service than to incur the costs of connection and collection.

**At the High End of the Tariff Spectrum**

In Guayaquil, where all residences benefit from subsidies, the industrial and commercial groups pay higher tariffs which, as we’ve seen, can prompt them to reduce consumption on the one hand or to search for alternative water supplies. If they can find cheaper sources of water they will simply disconnect from the public water system. In this case the utility company stands to lose its biggest and highest paying consumers and a substantial revenue loss. In fact, led by its own policy, the utility will lose its competitive edge. Although not fully documented, industrial consumers with their own private supply are on the increase. But many buy water from the same private vendors who also sell to the poor. Even though vendors are notorious for buying from the utility at subsidized rates (or obtaining water free of charge) and selling at extremely high prices, they still can represent a bargain to consumers at the high end of the tariff scale. The utility will then find itself caught in a vicious circle, needing to increase tariffs for an ever smaller group of industrial and commercial users and a growing number of subsidized consumers. The result is to exacerbate the cross-subsidy problem and the financial viability of the utility. As this examples also suggests, highly differentiated tariffs may also encourage corruption as users seek to be classified in a lower tariff bracket. ECAPAG’s endemic and protracted problems with the commercial system provide circumstantial evidence to this effect.
Since the signals to the utility suggest that consumption at the high end could and should increase, there is always pressure to increase the number of subsidized users (already 90.8 percent) and the tariff on the subsidizing users (2.9 times the average). In the case of ECAPAG, non-subsidized rates have been increasing at an annual rate of 12 percentage points higher than subsidized ones. The experience in many cities including Guayaquil is that the ratio of subsidized consumers and consumption to non-subsidized users and consumption tends to increase over time. Furthermore, consumers who face higher charges may be induced to use more of other inputs in order to offset the disproportionately high cost of water. An industry, for example might opt to recycle water - even though it means using more energy and equipment to offset high water tariffs and optimize production. Clearly, such reactions can lead to losses for both the utility and for its customers.

Other Problems with Cross-Subsidies, and Some Misconceptions

Conflicting Objectives

Cross-subsidies are often predicated on grounds that “progressive tariffs” favor water conservation and are, therefore, intrinsically good. However, if the base tariff reflects the economic costs of providing the service, higher or lower tariffs will result in welfare losses. Furthermore, when, as in the case of Guayaquil, a high percentage of users are not charged at all, either by explicit subsidies (military, sports users) or by the de facto UFW (the utility’s decision not to bill) there is no incentive to conserve water. Indeed, water running unstopped into the streets or into channels is not an uncommon sight in Guayaquil. When there is no meter, no bill and no valve, there is little incentive to conserve water.

Cross-subsidies also present the utility and the regulator with two conflicting objectives: to recover the costs of providing the service (economic or financial objective) and, at the same time, to charge less than cost to some consumers (social objective). Countries which have attempted to meet these two conflicting objectives have often failed to do either, as evidenced by financially weak utilities which provide poor quality service and low coverage.

The Information Gap

As we have seen, tariff policies tend to be based on inadequate knowledge of consumer patterns and effective demand. To begin with, the relative growth of subsidized consumers and their corresponding consumption patterns over time are poorly known. Households which are assigned a subsidized tariff rate tend to keep on paying that rate - and getting intermittent service - even though their economic status may improve over time.

More important, tariffs are designed without taking into account the impacts of price increases (and decreases) on consumption. In economic terms people’s tendency to buy more or less water depending on how much it costs is called the elasticity of demand for water with respect to price. Working without any basis in fact, utilities and policy makers wrongly assume that industrial and commercial clients will continue to buy the same quantity of water regardless of how much it costs. By the same token, they presume that poor families will use only a minimum “presumed” amount of water and no more, even if it gets much cheaper.

While elasticity with respect to price has not been sufficiently studied, its corollary, elasticity of water with respect to income (or how people’s purchasing habits will change if their earnings increase) has been the subject of considerable research. A recent World Bank review documents households’ tendencies to use as family income rises. (The average income elasticity reported in these studies is + 0.30; e.g. if incomes double then water consumption will go up by 30 percent). This has serious implications as far as who benefits from cross subsidies. When all residential consumers receive a subsidy the high income families will stand to benefit more - even if the amount of subsidy is less at higher income levels. In Guayaquil, a residential customer using 10 m3/month receives a subsidy of $ 120 per year while a residential customer consuming 100 m3/month receives a subsidy of $ 830 per year though the higher paying user is charged at a rate fifteen times higher than the lower paying customer.

Finally, even though the magnitude of the cross-subsidy transfer is often substantial, few policymakers or utility managers ever know exactly how much the cross subsidy costs them. Even if they attempted to find out, most utilities lack complete data and rely on murky definitions of which consumers and which uses get subsidized. A calculation based on the average tariff ($0.47/m³) gives about $16 million/year as the full amount transferred from industrial and commercial users to residential and official ones in Guayaquil. This sum is equivalent to 35 percent of operating revenues, but it is less than the US$22 million/year, calculated by breaking down costs and payments per subsidized group.

**Sound Tariff Policy - Lessons From Guayaquil**

**Tariff Objectives**

An adequate tariff system should promote both economic efficiency in the use of natural resources and financial soundness in the utility company. There are cases, however, when the application of full cost recovery would exclude the poor from receiving service. In this case, a subsidy is needed to ensure access to these services. To achieve these objectives, several principles must be satisfied:

1. **Tariffs should cover all costs.** This objective can be defined in economic (marginal cost) or financial terms (utility financial needs). Both alternatives should be based on the premise that the utility will be operating efficiently. Tariffs set under these two approaches will differ in most situations. Although an economically-based tariff is the desirable alternative, trustworthy information is often not available to perform a meaningful calculation. The tariff based on financial terms can often be calculated more readily by making use of the financial information available. Nonetheless, it is often necessary to make adjustments to this information to determine an adequate tariff level. Such adjustments pertain to the value of the fixed assets and related depreciation, adequate level of maintenance, and contribution to investments and debt service obligations.

2. **The tariff should not be discriminatory.** That is, the price per unit of consumption should be the same for all users. Price differentials are acceptable, under both economic and financial objectives, when the corresponding costs to serve different consumers vary.

3. **The tariff should send a clear signal to the consumer.** Users will adjust their consumption to price variations if they are metered and the tariff is a function of the volume consumed. To this end fixed charges should be minimal. For the same reason, tariffs should be readjusted periodically to maintain their real value.

4. **Collection efficiency is an integral part of the tariff policy.** This implies applying penalties that reflect the real cost of money and rapid disconnection of services for late payment. If this policy is not applied, not only will subsidies be extended (and increased) to those who do not pay but it would also set a dangerous precedent that can seriously undermine the financial soundness of the utility.

5. **Subsidies should be explicit and clearly targeted at the poor.** The application of the first principle needs to be compromised if the resulting price causes the poor to withdraw from or not connect to the service. However, it is not imperative, nor desirable, to provide subsidies through the tariff structure. Some countries, notably Chile, provide a subsidy to the poor through the national and municipal budgets. In this case, the utility receives the same revenue for the same volume consumed regardless if consumers are poor or wealthy. Therefore, the utility has the same incentive to serve both.

6. **Sound information about consumption patterns should form the basis for tariff policy.** Cross-subsidies are all too often designed without any prior knowledge of what the poor — or the rich — are willing and able to pay. The maxim, “if you can’t measure it, you can’t manage it” should be key to setting tariff structures insofar as a clear quantification of effective demand is needed to design a policy — and to evaluate it later.
Conclusions

A sound tariff system is to promote the rational use of resources is necessary to provide a good service to all its customers. Cross-subsidies can create significant distortions that interfere with these objectives and create welfare and financial losses to the detriment of society and/or the utility.

High connection fees effectively discriminate against the poor. One alternative is to abolish these fees and include the related costs in the volumetric price of water; another is to provide long term financing to facilitate their payment. Payment of these fees should be an integral component of the tariff policy.

In many countries, including Ecuador, a subsidy mechanism independent of the utility, like the one in Chile, is not a feasible option. Such a subsidy system requires an elaborate administrative mechanism to maintain the registry of users entitled to a subsidy and to transfer these government subsidies to the utility. In such cases, cross-subsidies might have to be accepted as a second best solution provided the following principles are followed:

- the subsidy should be limited to the poor to promote basic consumption and facilitate access to the service;
- the level of the subsidized tariff should be ascertained on the basis of willingness-to-pay surveys. The amount paid by the poor to water vendors is a good starting point to measure willingness to pay;
- the subsidized tariff should cover, at least, all variable costs, including the costs of metering, billing and collection. However, if willingness-to-pay surveys indicate the need for a subsidized price below variable and billing and collection costs, a subsidy mechanism other than a cross-subsidy should be considered;
- the subsidy system, including eligibility criteria, should be set up in close cooperation between the municipal authorities and the utility; it should be easy to manage and monitor;
- care should be exercised to determine the cross-over price above which some subsidizing users will opt to build their own supplies and stop buying from the utility. If this situation occurs, the financial situation of the utility will worsen.