Chapter 1

Cities Awash: A Synthesis of the Country Cases

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Introduction

The objective of this study is to compare the net gains from different reform experiences, and to draw lessons for other reforming countries. We analyze each reform in terms of its "regulatory contract", i.e. the explicit and implicit agreements that define the relationship between a government and a regulated monopoly, and the institutions that govern this relationship. Following World Bank 1995 and Shirley and Xu 1998, our premise is that, holding institutions constant, a regulatory contract will be more likely to achieve its goals when three necessary conditions are met: (i) information asymmetries between regulator and manager are reduced; (ii) sufficiently high powered incentives are provided to motivate the manager to comply with the contract's goals; and (iii) both parties provide credible signals of their commitment to abide by the contract and credible enforcement provisions are established. We further assume that, holding contractual design constant, the stronger the regulatory, judicial and other institutions, the more likely the prospects for the contract to achieve its goals.

A contract can be designed to achieve its objectives and still not improve efficiency or economic and social welfare if these are not part of its goals. Hence, we further assume that a contract will improve efficiency and economic and social welfare

when the above conditions are met and, in addition, the contract (i) provides incentives to raise efficiency; (ii) motivates an expansion of access to water and sewerage; (iii) prices consumption of water and sewerage services at levels most people are willing to pay; and (iv) provides incentives to reduce waste and pollution.

Our study must necessarily rely on case studies since the current experimentation with private operation of water systems in developing countries is so recent.[1] Our sample was chosen to represent cases where reform was longer -- seven years on average – and to include the dominant contractual forms. The six cases we examine are Abidjan, Cote d'Ivoire; Conakry, Guinea; Buenos Aires, Argentina; Lima, Peru; Mexico City, Mexico; and Santiago, Chile.[2] The sample is small and includes only capital cities, but covers a variety of reforms in very different economic settings and in water systems of widely varying size and coverage. (**Error! Reference source not found.** describes sample characteristics). Findings that hold across such a varied sample would be powerfully suggestive, but confirmation would require more data on a larger number of cases.

In the late 1980's and early 1990's all six cities planned eventual private participation. This included: asset sales in Santiago, concessions in Buenos Aires and Lima, reform to an existing lease in Abidjan, a lease in Conakry and management contracts in Mexico City. Three of the sample cities failed to implement private contracts

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[1] Private participation in water and sewerage was more common in the nineteenth century, and some developed countries (for example, France and the U.S.) have a long history of private participation, as do a few developing countries (for example, Cote d'Ivoire has had a lease contract for decades).

[2] Information on the cases is from Abdala (1997) and Abdala and Alcazar (1999) for Buenos Aires; Alcazar and Xu (1999) for Lima; Haggarty and Brook Cowen (1999) for Mexico City (Districto Federal); Shirley and Xu (1999) for Santiago; and Clarke and Menard (1999a and b) for Conakry and Abidjan. The private contracts for Conakry and Abidjan cover urban areas above a certain size throughout the countries. Wherever possible our numbers refer only to the capital city unless otherwise indicated. When the inclusion of other cities had an impact on the contract (for example, Abidjan subsidizes the other cities in country), this was taken into consideration in our analysis to maintain the comparability of the case studies. We also draw heavily on the discussion of water theory in Noll, Shirley and Cowan 1998.

as planned. In Santiago and Lima a number of preparatory steps towards private participation were taken including negotiations with potential bidders but the process was eventually reversed. Santiago proceeded to introduce all of the planned regulatory changes in 1990 while keeping the utility under public ownership. Lima, however, introduced only a few of the regulatory reforms planned under the proposed concession. In Mexico City contracts with four private companies were introduced in 1993-94. These called for phased expansion of the contractors responsibilities, starting with fee for services such as metering, billing, and collection, and eventually covering operation and maintenance of the network. The latter stage of the contracts is already three years behind schedule, however, and there is no clear signal of when, if ever, it will be fully implemented. In Buenos Aires and Conakry private involvement was implemented as planned: in Buenos Aires with the signing of a concession contract in 1992 and in Conakry with a lease in 1989. Finally, Abidjan, which had had a lease since 1957, introduced changes in tariffs and investment responsibilities in 1987.[3]

We assessed how well these contracts met the three conditions using similar measures of information, incentives and commitment. We also assessed the supportive institutions; especially regulatory, judicial and political institutions, international constraints and reputational effects. We have been as careful as possible to identify variables that allowed us to compare different contractual arrangements and different institutional environments without mixing the two.

To gauge how well the regulatory contracts performed we need to measure the improvements in efficiency, and economic and social welfare. We evaluated efficiency

[3] Some have described the new contract as a concession but it failed to shift investment risk to the contractor.

gains though partial measures of labor productivity and non-wage expenses and looked at profitability and investment. We used a comprehensive measure of net benefits compared to a counterfactual for all actors: consumers, government, buyers and workers. Social gains were harder to measure since few of the cities collected health, income or similar information in sufficient detail to attribute changes to water system reform. Instead we analyze what happened to access, prices, waste and pollution and infer the effects on social welfare and the poor.

The next section considers the analytical framework for this report, following that we describe initial conditions in the water sectors and in the economic and political environments. In sections IV – VI we analyze how well the reformed contractual framework dealt with issues of information, incentives and commitment, and in Section VII assess the supportive institutions. Section VIII compares outcomes and in Section IX we consider some of the policy implications of our findings.

Analytical Framework

The importance of information, incentives and commitment in the success of contracts in improving efficiency is explored at length in World Bank 1995, Shirley and Xu 1998 and Alcazar and Brook Cowan, 1997. Briefly the argument is as follows: *information* asymmetries allow contracting agents to use their private information at the expense of their contractual partners. In regulatory contracts, asymmetric information arises because the firm can observe its costs and performance at much lower cost than the regulator (Laffont and Tirole, 1993). Information asymmetries can be reduced through competition or monitoring. Competition reveals information at lower cost than

monitoring and allows the regulator to compare the performance of rival firms. Although product market competition is rare in water, as we discuss in Section IV below, the regulator can use competitive bidding for the franchise to operate the system and yardstick competition to increase information.

Incentives can be used to induce the firm to reveal information and not to act opportunistically. The main incentives in our contracts were penalties, assignment of risk and reward, and price regulation. Optimal price regulation provides operators with the incentive to invest and improve efficiency, while providing the largest possible share of the resulting savings to consumers. Fees and penalties are likely to be less effective but may also induce operators to comply with the contract's goals.

Problems arise in assigning incentives because the contract may not assign residual rights and returns to the operator and investor.[4] For example, if the contract is a lease it may be difficult to assign incentives to the contractor to keep the assets in good condition because of the separation of investment and operating decisions. A concession provides stronger incentives to maintain the assets because the investor is also the operator, although these incentives diminish as the contract nears its end.

Commitment depends on the credibility of the contract. If the operator doubts that the rewards promised under the contract will be paid or the penalties for non-performance enforced, it will take action to protect its interest, actions that can work against the contract's objectives. Targets are credible if the regulator has the power to impose penalties sufficiently large to deter reneging and the regulatory body is disposed to apply them. Mechanisms to resolve disputes through arbitration or appeal raise the chance that

[4] These issues are dealt with at length in the literature on franchise bidding. See, for example, Laffont and Tirole 1993 and Williamson 1976 and 1985.

the contract can be sustained over the long run, but only if both parties see these mechanisms as neutral. Including consumers and other interested parties in the regulatory process can enhance enforcement, since they can increase information and add pressure for performance.

The operator might doubt that the government will adhere to its side of the bargain if the regulator is vulnerable to political pressure to confiscate the returns to the operator by setting prices too low. Because a large proportion of the investment in water are sunk, most revenues in a self-financing water utility are returns to capital.[5] Since investments in water are highly durable, a water company may be able to operate for years or even decades without recovering its fixed costs. Thus, the costs of expropriation of quasi-rents in terms of reduced quality and coverage are far in the future, beyond the time horizon of any government. This situation has led many governments to set water prices too low for investment to be recovered.[6] Since water is a unique good necessary for human survival, politicians may find it popular to under-price water or require companies to deliver water to non-payers. In addition, a government strapped for cash may delay or entirely evade payment of its water bills. Expropriation risks can be reduced by designing a contract to reduce the operator's exposure, such as a management contract or lease instead of a concession, creating a regulatory body independent of the ministry or political interference, and establishing neutral mechanisms for enforcement.

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[5] For example, over 80 percent of the costs of supplying water are fixed in the U.K. Armstrong, Cowan and Vickers 1995.

[6] World Bank 1994 found that gross revenues covered less of total costs in water systems than in any other infrastructure. Munasinghe 1992 reports that the average price of water sold covered slightly more than half the average incremental cost of production in World Bank water projects initiated from 1966 to 1981 and about 58 percent in projects from 1987-1990. Since about 35 percent of water was unaccounted for in the earlier projects, the price effectively covered only about a third of the incremental production cost.

Besides contract design, *institutions* are critical in determining whether the contract can achieve its goals. Four sets of institutions are particularly important for utilities. First, regulatory institutions such as rules governing the status, power, autonomy and staffing of the regulator determine the regulator's capacity to monitor and enforce the contract. Second are judicial institutions, including the laws supporting the contract and protecting property rights, the capacity and independence of the judiciary, and enforcement plus the traditions of compliance by government and citizens. Political institutions, such as checks and balances, reduce the scope for arbitrary actions by the regulator or the executive branch, while electoral and other political rules determine the relative strengths of parties favoring and opposing the contract. Finally, international constraints, such as openness to trade and capital flows or dependence on foreign aid, can give governments a stake in maintaining their reputations with foreign investors or donors.

A contract can meet the three conditions in a supportive institutional setting and still not improve efficiency or welfare if these are not its objectives. Hence our concern is not only with how well the contract meets its explicit objectives, but with how well these objectives coincide with the needs of the community.

Efficiency is important in keeping down costs, reducing dependence on government subsidies and freeing resources for investment in expansion and maintenance. It is also important to assure that service is supplied promptly and reliably and complaints quickly addressed.

Social benefits arise because the supply of clean water for drinking and hygiene and the removal of waste are necessary for human health and the prevention of

contagious diseases. Treating wastewater to remove pollutants can have important external benefits for downstream users, while reducing water consumption can prevent depletion of a water source where the replenishment rate is less than the extraction rate. Supplying water and sewerage has *equity* effects as well. Poor households may not be able to afford safe alternatives to piped water or sewerage, and pay a heavy cost for medical expenses and days lost due to illness from water borne diseases. Time-savings from proximity of improved water can allow poor households to spend more time on child care and practice better hygiene, as well as allowing more time for earning income.[7]

These gains occur through greater physical accessibility of water combined with sewerage. Expanding the system is not enough, however, people must also be willing and able to connect and consume the services. Hence, the gains require that the service be affordable at a price that people are willing to pay. The poor's willingness to pay for water usage is often sufficient to cover costs; indeed many pay a great deal more for water from a vendor. In Lima, for example, water from a vendor cost about US$2.50 per M^3 compared to a price of about US$0.40 per M^3 that could have been expected with a concession (World Bank 1994). In Conakry there were few water vendors, and they charged US$ 1.20 per M^3 while trucks charged US$2.40 per M^3, compared to a piped water tariff for small volume consumers that was expected to be only about US$0.35 (in 1989 dollars; World Bank 1989). Moreover, the amount of piped water consumers need to purchase to improve health is small.[8] Even in lower income neighborhoods most piped

[7] Esrey 1996 suggests that the time saved because water is nearby may allow more time for breast feeding, food preparation, income-generating activities that allow for the purchase of better health care and better food, more time for learning activities, such as visiting clinics to attend child care classes.

[8] The amount needed to sustain life has been estimated at only five liters per person per day (Roth 1987). However, usage of water for personal and domestic hygiene may be at least as important to health as the quality of drinking water (Esrey, Potash, and Roberts cited in Esrey 1996).

water is used for secondary purposes such as toilet flushing or watering gardens, rather than for drinking or personal hygiene.[9]

Willingness-to-pay cannot be inferred by simply extrapolating from the high prices paid for vendor water, however. Studies show considerable variability in willingness-to-pay, depending on available alternatives among other factors. As we will show people may undervalue quality and consume cheap but unsafe alternatives.

Willingness-to-pay problems arise more often for sewerage (World Bank 1994). More of the benefits are external to the consumer and sewerage is more expensive. For example, a sewerage connection in Buenos Aires cost a minimum of $800 (in 1995 dollars) in 1993 compared to $251 for water. Introduction of flush toilets would also require consumers to make costly investments in plumbing. Cheaper alternatives that remove sewage from the immediate neighborhood (such as private, lined pit latrines) have closely similar health benefits, but are also costly compared to water and may not be appropriate or viable in areas of high density or difficult topography. Even with pit latrines, and assuming water is hand pumped, sanitation will cost about 30 percent more than the cost of supplying water (Munasinghe 1992 p.283). Subsidies may be necessary where there are externalities from expanded access, but these are subject to well know distortions and administrative problems.

Social gains can also be realized by reducing the waste of water, where the opportunity cost of usage is high. Usage costs are high where current and future rates of

[9] Since a dual system, which supplies treated water for drinking and water that has not been treated to be potable for secondary uses, would require costly duplicate pipes, it has seldom been used. Roth (1987) documents that buildings in Turks and Caicos islands must have separate plumbing using saline water for toilets, while reclaimed water is used in cities in the Middle East and California for non-drinking purposes. These exceptions seem to be cases where raw water extraction would otherwise exceed replenishment and regulation has been able to internalize that externality.

extraction exceed replenishment rates or usage has external effects such as causing settlement of land that damages buildings or standing water that breeds insects. Metering consumption and pricing water above its opportunity provide incentives to reduce waste. Social gains also arise from treating used water when pollution has negative effects on downstream users. A tax on pollution forces those responsible to internalize the cost; treatment targets could also be part of the contract.[10]

As we shall show in the next section, problems of efficiency, access, affordability, waste and pollution varied in our sample. Economic and political circumstances were as important as water sector problems in motivating reforms.

Initial Conditions

This section compares the situation in the water sector in our cases as well as characteristics of the water resource that made it inherently more or less costly. It then examines the economic and political conditions that motivated reform and made it more or less likely to be sustained. In another paper (Menard and Shirley 1999) we deal at some length with these issues; we summarize that discussion here.

(i) Initial Conditions in the Water Sector. The cities we studied differed in size and income levels, and had correspondingly different sized systems, yet they shared many of the same problems (**Error! Reference source not found.**.1). All of the sample were experiencing rapid growth in some parts of the city through migration of poorer residents from rural areas or from outside the country to the outer edges of the metropolitan area.

<Table 1.1>

[10] This issue is complex and is discussed in more detail in Noll, Shirley and Cowan 1999.

Assuring access to water and sewerage was a key concern in all the cities, even in those with high coverage rates, such as Santiago and Mexico City. Mexico City had to expand at a relatively rapid rate to keep coverage high.[11] Although Santiago was growing more slowly, several poor communities without service were just outside the concession area, and increasing numbers of people were moving from shared housing to separate dwellings. The other cities had to raise coverage; Abidjan and Conakry also had to cope with populations growing at over 5 percent a year. In addition, rates of sewerage connection lagged behind water in all the cities and especially in the two African cases, while sewage treatment was (and is) minimal in all the cases.

Although magnitudes varied, service quality and waste of water were problems for the entire sample, with the possible exception of Abidjan. Lima and Conakry had the worst service before reform. In Lima 48 percent of the connected population received water service for less than 12 hours a day, 28 percent for less than six. In Conakry, interruptions were also frequent and the quality of piped water was very poor. In both cities there were large losses of water because of leakage and low pressure. Performance was better in the other cities, but there too water was sometimes interrupted, the number of leaks was high and increasing, pressure was inadequate and/or response to complaints was slow. The only system without serious service problems at the start of the reforms

[11] The numbers in **Error! Reference source not found.** understate the amount of the population that was not connected because they exclude squatters and poor suburban areas that are outside the utility's water district. In addition, the meaning of a connection varies: in our Latin American cases it generally refers to a hook up to internal pipes within the house, while in the African cities a connection is usually a standpipe in the yard. The standard for such pipes was less than 200 meters from the house, but that standard was not always met which can make control of access by the bill payer difficult. A connection in Africa typically serves a much larger number of people than in Latin America; for example, a connection in Abidjan serves an average of 15 people versus 5 in Santiago.

under study was Abidjan, which was already functioning under a lease with a private operator.

Low rates of water and sewerage connection, interruptions in service and poor water quality or contamination of food and water from untreated sewage caused health problems in all of the cities, as we can see in **Error! Reference source not found.**, and these reached crisis proportions in Lima and Conakry. Poor water quality, frequent interruptions, and water scarcity as well as irrigation of food crops with untreated wastewater and pollution of ocean fishing grounds with sewage have been blamed for a cholera epidemic that was centered in Lima and killed almost 3,000 people in Peru in 1991. In Conakry, consumption of well water contaminated by latrines and storage of water in unsanitary conditions accounted for high rates of infant deaths from gastro-enteric diseases. It was also responsible for periodic epidemics of cholera including a 1994 epidemic that killed 330 in Conakry alone (World Bank 1997, p.28 and p.4). Besides instances of mortality, morbidity was a frequent problem for unconnected consumers in all of our cases. [12]

<Table 1.2>

There is important variance in the cost and scarcity of raw water sources in the sample cities. Most of the other cities we studied relied on relatively clean water from

[12] Since customers without connections were predominately poor, the costs of morbidity were a high proportion of their income. For example, the medical costs and lost wages from waterborne diseases in poor neighborhoods in Lima were estimated to be about US$13 per capita a year in 1992 (Webb and Associates 1992). These households average five persons and an annual income below US$240; thus, if everyone was sick every year it would cost 27 percent of household income. Time spent queuing at standpipes can be significant as well. One estimate for Lima during the dry season was an hour waiting in line times seven trips a day, some in vain because water is interrupted while waiting (Webb 1992).

rivers or aquifers that they extract at a rate well below the rate of replenishment (**Error! Reference source not found.**).[13] The exceptions were Lima and Mexico City.

<Table 1.3>

(ii) Economic Conditions Leading to Reform. In Menard and Shirley 1999 we show that a core impulse for major reforms is the combination of sector problems, such as those described above, with a macro-economic crisis. In particular, rising inflation rates combined with rising public deficits and debt motivate water system reform. Rising inflation reduces cost coverage in the sector, since increases in nominal prices for water services typically fall behind inflation rates. As a result, the sector requires more government subsidies at a time when rising inflation and creates pressures to curb deficit spending.

In the years prior to reform, inflation was increasing in all of our sample, and especially in Argentina, Peru and Guinea (**Error! Reference source not found.**). All of the sample were running budget deficits at the time of the reform decision, which usually predated the reform by several years (**Error! Reference source not found.**). While we do not have numbers for the entire sample on government debt, it was high when the reform decision was taken in Peru, Mexico and Chile.

[13] Average annual rainfall in Conakry is about 4.2 meters (World Bank 1990c, p.46), in Abidjan about 2.0 meters, in Buenos Aires 1.0 meters, in Mexico City 0.6 meters, in Santiago 0.3 meters and in Lima 0.001 meters (Source: International Station Meteorological Climate Survey, Version 4.0). Buenos Aires is located on the banks of the Plate River with a flow of 20,000 M^3 per second while Santiago is served by the smaller but still adequate Maipo River supplemented by a deep lake and wells. Conakry's sources are distant but low cost because the system is gravity fed. Abidjan must rely on more costly pumping but supplies are ample.

(iii) Political Conditions Leading to Reform. The political circumstances that matter most to the subsequent contract are the relative power of potential winners and losers (Menard and Shirley, 1999). Typically water reform has high social benefits but low political benefits, especially when compared with privatization of other utilities. One reason for this is that water contracts usually produce fewer new resources with which politicians can reward supporters or compensate opponents. Another is that increases in water prices or cut offs of non-payers can be politically sensitive because water is an essential good. Hence reform is more likely where the political saliency of water is low and potential losers have low political influence or can be persuaded not to oppose reform.

Water system prices are likely to have lower political salience in cities where the opportunity cost of usage is low and the system is not near capacity (Buenos Aires, Santiago, Conakry and Abidjan), since these are cities where cost recovery would be less likely to require large price increases. As we will show, however, high prices are not the only factor determining salience. Water contracts will be controversial if consumers believe that the operator has been allowed price increases that are seen as unfair or in violation of the contract, or if they believe that their interests are not well protected in regulator decisions.

Expansions in water and sewerage typically benefit those urban poor without connections who now have access to service, while improvements benefit those who are already connected and who now received more reliable service, higher quality water, better pressure, or quicker attention to complaints. Contractors and investors can benefit from rents from building works and operating the system. Losers from new water

contracts are usually any workers who are laid off and bureaucrats who lose power and rents. Consumers who are connected may also lose if value of the service improvements is less than any price increases or the cost to them of better bill collection. As Menard and Shirley 1999 shows, reform occurred in our cases when a political change reduced the political influence of potential losers, in combination with sector problems and economic crisis.

Lobbying by those who stood to gain was not a factor since beneficiaries were disbursed and uninformed. Rather, reform happened when a regime change or other political event diminished the power of potential losers and/or their opposition was muted through compensation for their losses. For example, the original Buenos Aires concession did not require already connected consumers to pay all the cost of expanding the system; instead the design of the auction gave them a 26 percent decrease in prices. At the same time workers in the water system were offered generous and voluntary severance packages. Bureaucrats who might have opposed the concession had lost power with the change in regime, and were also subject to retrenching through early retirement. Later, when people without connections realized that they would have to pay much of the cost of expansion and when opposition politicians organized their discontent, the concession renegotiation spread this cost over all consumers.

Information

This section considers ways the contracts reduced information asymmetry through competition – product market competition, competition for the market and yardstick competition – and monitoring.

(i) Product Market Competition. None of our sample tried to introduce direct product market competition beyond tolerating water vendors (Mexico City, Abidjan, and Conakry) and self supply (Abidjan and Conakry)**.**[14] To some extent this was dictated by water's monopoly characteristics, but it was also due to the absence of models for competition in the sector. The transport and distribution of water, and transport and disposal of sewage, are network activities and like most networks exhibit engineering scale economies.[15] While engineering scale economies do not necessarily mean that the most efficient market structure is a monopoly, there have been relatively few attempts to create product market competition in water systems. One reason for this is the high cost of pumping water long distances and laying pipes, as well as the increases in leakage with distance, all of which mean that water will remain a local or regional business (Cowan 1994). Nevertheless, local systems with more than one reservoir or which rely extensively on wells, could potentially introduce competition to supply a central grid regulated as, for example, are power grids in the U.K.[16]

What explains the lack of experimentation with product market competition in water compared to other network infrastructure? London Economics 1998 notes that a greater percentage of the costs in water systems are in the noncompetitive network than

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[14] Permits for wells are very difficult to get in Buenos Aires and Santiago. Mexico City and Abidjan charge for well usage but the charge is waved for many users in Mexico City and seldom enforced in Abidjan.

[15] Scale economies in water systems arise first because the capacity of a canal or pipe is governed by its cross-sectional area, which increases in proportion to the square of the external dimensions of the conduit. While larger pipes must withstand more weight, within the relevant scale range strength requirements do not offset the volumetric gain from expanded circumference. Second, larger canals and pipes have less turbulence, so that effective capacity expands more rapidly than in proportion to the expansion of the cross-sectional area of the medium.

[16] Although some argue that this causes problems of quality control and assuring that a common pool resource such as the aquifer is not depleted, similar problems have been solved in other network infrastructure (quality problems in electricity and common pool problems in petroleum drilling, for example).

in the potentially competitive areas, reducing the relative efficiency gains from competition. Forty percent of the costs in electricity are in transmission and distribution, 60 percent in potentially competitive areas, while in water 66 percent of the costs are the network and only about 34 percent in potentially competitive areas. (London Economics 1998). Nevertheless, there are gains to be had and it may be that experiments in this sector will increase in the future.

Competition for the Market. By competition for the market we refer to the periodic auction of the right to operate the system under a management contract, lease or concession. Competition for the market has drawbacks that are not unique to water: it is intermittent and in the long intervals between bids the incumbent gains advantages that may make the threat of entry a feeble one. Competition for the market also faces a special hurdle in water systems because so few private companies have been willing to participate.

Five companies dominate the market for private contracts in water, although this may be currently changing.[17] Two of the dominant players are responsible for 70 percent of the projects managed by this group (Silva et al 1998).[18] Since the five companies also form consortia to bid on projects together, they are as accustomed to cooperating as competing.[19] Yet even with a limited number of players, a properly constructed auction with periodic rebidding could potentially reveal much information to the regulator and

[17] The entry of U.K. operators and other utilities (especially electricity companies) into the market for water service contracts has increased competition in the sector.

[18] The top two are Suez Lyonnaise des Eaux and Vivendi (formerly Génerale des Eaux); the rest are Aguas de Barcelona, Themes Water and SAUR International.

[19] For example, in Lima, Vivendi teamed up with Thames Water and Lyonnaise with Aguas de Barcelona; in Buenos Aires, Lyonnaise, Vivendi, and Aguas de Barcelona are all part of the winning consortium.

create a threat of entry that could discipline the incumbent operator as long as collusion can be prevented.

The cases we studied, however, made limited use of competition for the market and did not design the auction to enhance information. Santiago and Lima opted not to go ahead with plans to tender private participation. Chile's regulator also passed up opportunities to auction concessions for new areas or where the existing operator's license had been revoked or expired.

Mexico City contracted out services (meter installation, metering reading and billing) as a first step toward management contracts. Private consortiums were invited to submit bids, with unit prices based on a list of actions they must agree to undertake anywhere in the city for a specified number of people, with a premium or discount for fluctuations above 10 percent. These bids were then fed into a computer model that was to select the least cost number of providers (as long as it was more than one) and four companies were chosen. The drawback of this approach was that the bids were for the contracts in their entirety, including phases that have not been -- and may never be – implemented. As a result, the winning bid for say, zone one, might include a charge for metering that would not be the least cost bid if metering had been auctioned by itself. Thus, the bids were not really comparable.

Cote d'Ivoire, which has had a lease with a private operator since 1957 did not rebid the contract when it expired in 1986.[20] Instead, the government used the threat of an auction to win a 20 percent real reduction in the average tariff. In exchange for this price reduction, the government gave the operator more control over investment, and this

[20] The company's principal strategic partner was a French private water company, SAUR.

had the unintended effect of reducing competition by progressively eliminating bidding for investment, as we discuss in the next section.

Buenos Aires and Conakry were the only cases where competition for the market was effectively employed. Buenos Aires auctioned its concession and Conakry bid a lease for the lowest consumer tariff. Three bidders participated in Buenos Aires and four in Conakry, all private consortia affiliated with international firms. The Buenos Aires auction revealed more information than the bid in Conakry since the price reflected the bidders' assessment of investment as well as operating costs.

Yardstick Competition. Since water and sewerage are local in nature, there will be many independent water systems in most countries, and we might expect that there would be ample opportunity for comparative competition. One problem with yardstick competition in water, however, is that we cannot assume that the exogenous factors that affecting companies' costs are correlated (Clarke and Cowan 1998). Local differences in climate, topography and other endowments affect underlying cost and demand conditions, and make comparisons difficult. Yardstick competition also requires that companies not collude, suggesting that operators within a country should have different owners. Achieving ownership diversity in water systems may also be a problem since the market for operation of water companies is so thin. In countries with low credibility it may not be feasible to attract different private operators to smaller urban areas. The explanation given for why the lease in Guinea covers not only the capital, but all cities of a certain size, was that including the larger capital market was the only way to attract a private operator to the smaller cities.[21]

[21] Another contributing factor may have been the fact that Guinea, in contrast to the Latin American cases, had not decentralized water services before private participation. Cote d'Ivoire did have decentralized

The cases we studied made little use of yardstick competition. The most feasible environments for comparisons in our sample were arguably Mexico City and Santiago, since there was more than one operator in each city. As we have seen the bids in Mexico City were not comparable and as a result the price the city paid for metering and other services varied widely from zone to zone. Furthermore, the four zones were not designed to be comparable. Companies were asked to bid on a basket of actions before they know which zone they would operate or which actions they might be specifically asked to do at different points in the contract, and the number of zones was then decided based on these bids. As a result not only are there major differences between the zones that would make yardstick competition difficult, especially given the poor state of information, but also the companies face very different structures of pricing and incentives as a result of the contracting process. In 1998 the new (and for the first time elected) municipal government demanded all prices be equal to those of the least cost provider in the last stage of the contract, which might be considered a form of yardstick competition.

Although Santiago has more than one company they are not easily compared. The private company serves only about 5 percent of the population, compared to the state owned enterprise (SOE) that serves 87 percent of the city. The regulator employs a form of yeadstick competition since it models a hypothetical company with the assets, geographic conditions and markets of the real company, but with other parameters set according to best practice in Chile or worldwide. However, the model company is kept secret to reduce the risk that companies manipulate their reporting. Unfortunately,

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systems before 1974 that were centralized to assure that water prices across the cities were the same with Abidjan subsidizing the other urban areas.

secrecy also reduces the incentive effect of comparison competition, since companies are not sure what they are competing against.

Monitoring. Another way to reduce information asymmetry is through monitoring. All of the contracts provided for the operators to report regularly on their performance and most had fines for failure to report. However, three of the cities – Abidjan, Conakry and Mexico City – did not have a separate body responsible for regulating the operator(s). In the three that do have a designated regulator, only Santiago's is adequately staffed and able to compel the operator to provide enough prompt and timely information to be able to reduce information asymmetries through monitoring. In some ways the Santiago regulator has not been fully tested, since the operator is state owned, it may have lower incentives to use its information advantage to profit maximize. The regulator's powers were strengthened prior to the sale of the water company in 1999.[22]

Incentives

The incentive properties of the contracts in our sample affect performance by changing the behavior of consumers as well as operators. Depending on the structure of incentives, operators will be more or less likely to increase operating efficiency, expand coverage, prevent waste, discriminate among classes of users, maintain the system and share information with the regulator. The structure of incentives will affect consumer motivation to connect and to curb water usage. In this section we first describe the targets and the assignment of risk, then consider how tariff policy motivates operators and consumers, and conclude with a discussion of supportive institutions. We have

already considered the regulator's ability to extract information, which is also important to assuring that the incentive properties of tariffs support the goals of the contract.

Targets. One way to motivate operators is to set explicit targets and penalize the operator if it fails to achieve them. As we discussed, these targets give us some sense of how well the contracts are aligned with the problems of the sector. If we compare the contract targets in **Error! Reference source not found.** to the initial conditions just described, some striking gaps appear. The two cases with high opportunity cost of usage, Lima and Mexico City, effectively do not target waste: Lima because the concession contract was not implemented, Mexico City because the UFW targets are in a stage of the contract that has been put on indefinite hold. The three cases with the lowest rates of connection, Abidjan, Conakry and Lima, did not address have explicit access targets, despite serious health problems in the latter two. The contracts fail to address pollution in two of the cases where contamination has had serious external effects, Lima and Conakry.

<Table 1.4>

The absence of an explicit target does not mean that the objective was not addressed, since the operator could be implicitly motivated to achieve a goal through other incentives, which we consider next.

Assignment of Responsibilities. The assignment of risk and responsibilities has important incentive properties. In four of our cases the operator is not responsible for financing investment. If companies don't bear the risk of investment, they will have less incentive to conserve water when capacity is constrained and more incentive to expand.

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[22] Among other things, fines and penalties were raised, and the regulator was empowered to hire more people.

The operator was responsible for investment risk in Buenos Aires and Santiago. Although Santiago's operator was an SOE, government curtailed its borrowing and forced the company to finance most investment from retained earnings. It therefore faced an investment risk similar to the private operator under Buenos Aires' concession. Lima's operator was also state owned and nominally responsible for investment, but in practice has relied extensively on grants channeled through government or government guaranteed loans from donors for most new investments. Thus, Lima's operator had a low incentive to curb waste, but a higher incentive to expand should prices rise enough to permit positive returns to investment.

Under the leases in Abidjan and Conakry the operators run the systems and collect revenues, but they do not bear any of the financial risk of investments. In both, the operators are expected to turn over a portion of revenues to state operated agencies for investment, and compete for contracts to implement the investments. In practice, however, both operators have often retained these funds to cover the cost of government's overdue receivables; they have also had de facto monopolies over most new construction. Thus, despite the contractual assignment of responsibilities, these companies have a stake in expanding access, since they have leeway in pricing their construction services, but this incentive is lower than their motivation to confiscate funds due for unpaid bills.

These two leases provide no incentives for sewerage expansion, which is excluded from the leases in both cities.[23] They also provide less incentive for

[23] Abidjan's operator won a separate bid for a management contract to operate the city's sewerage in 1987. When the government stopped paying the company's management fee in 1992, the company began to withhold revenues due the government, although it continued to operate the system. The contract expired in 1997 and had not been renewed by mid-1998.

maintenance than a concession would be expected to provide. The Abidjan lease has been under the same operator for more than 30 years, which gives it some of the stability of a concession, however.

Finally, the operators in Mexico City bear limited responsibility for investment risk. The Federal Government pays a significant share of the investment costs for large projects bringing water from outside the Mexico City Basin. Responsibility for billing and collection and funding operational and local investment costs rests with the government of Mexico City (the Distrito Federal or DF). Thus the operators in Mexico City have little incentive to curb water usage, but some incentive to expand access, since the cost is subsidized by national taxpayers.

The Incentive Effects of Tariff Policy on Operators. Tariff policy strongly affects incentives to improve efficiency, expand access and reduce waste. **Error! Reference source not found.** compares three aspects of tariff policy for the cases we studied: the general policy and timing for setting tariffs, and how metered and unmetered tariffs are determined.

<Table 1.5>

The effects of tariffs on efficiency have been much researched (see Baron 1989 and Laffont and Tirole 1998). This literature concludes that, since the utility will have more information than the regulator, tariffs set on the basis of costs will be subject to manipulation and may distort the utility's behavior (as in the well-known example of rate of return regulation creating an incentive for overinvestment). Tariffs that are decoupled from a utility's costs, such as so-called price caps that are linked to a price index, will be less vulnerable to information asymmetries and more likely to motivate efficiency

improvements. If such tariffs are only infrequently adjusted to changes in costs, the operator is motivated to improve efficiency, since between adjustments any additional revenues from a gain in efficiency are retained in the firm. The gains can be periodically shared with consumers when the infrequent adjustments occur. In practice, however, even these so-called price caps are usually set initially and adjusted periodically according to cost information supplied by the firm; they may reduce but do not escape problems of information asymmetry.

Only two cities set tariffs in a way that reduces information asymmetry, Santiago and Buenos Aires. Santiago's tariff is inflation adjusted annually, and adjusted every five years to cover the marginal and average costs of an efficient benchmark firm. The benchmark is built using a mix of company information and national and international standards. The initial tariff in Buenos Aires was adjusted by a K factor based on the winning bid for the concession. K is adjusted whenever a weighted composite of many government indices and tariffs goes up by more than seven percent.[24] It is also subject to readjustment every five years excluding the first five years of the contract. This cost pass through arrangement has been the subject of disputes, partly because it is complicated and lumpy.

The other cities use cost/plus formulas that are more vulnerable to information problems and provide little incentive to increase efficiency. One notable exception was in 1987 in Abidjan when the regulated used the threat to rebid the contract when it expired to win a 20 percent reduction in tariffs for low volume users, 25 percent for high volume users.

[24] This was used instead of a simple price index, as in Santiago, because price indexation has been illegal in Argentina since a period of hyperinflation.

The second incentive effect of tariffs is on coverage. Tariffs that cover marginal cost and allow the operator a reasonable return on capital invested will provide the motivation and wherewithal to expand coverage in line with demand.[25] Buenos Aires, Santiago, Abidjan and Conakry have tariffs that cover marginal costs; they also reward expanded coverage. In Santiago and Buenos Aires the link is direct: tariffs are estimated to cover marginal cost and a return to capital and are periodically reviewed in line with investment plans. In Abidjan and Conakry the link is indirect. The private operators have a stake in the expansion of the secondary network since their returns increase with new customers, and they can earn construction revenues. In contrast, in the other two cities tariffs are below marginal cost and hence provide no incentive to add customers.

Metering also has an effect on the incentive to expand coverage. Assuming prices cover marginal cost, where consumption is not metered operators have a somewhat stronger incentive to increase numbers of users, since that is its main tool to increase revenues. With meters the operator can increase revenues by expanding service, but also by reducing interruptions in service and leakage and connecting large as opposed to small volume consumers. Cross subsidies have similar incentive properties to unmetered billing: some consumers do not pay the marginal cost of water and the utility has less incentive to serve

[25] There are no good recent estimates of marginal cost for the sample cities, but what estimates there are generally fit with our finding that the water system is more costly to operate in Lima and Mexico City. Analysis for a World Bank investment project estimated the marginal cost of water and sewerage in Lima at US$0.45. The average incremental cost (AIC) of groundwater and water from the Rimac River in Lima was estimated at US$0.25 per M^3 while water from the next available source (the Atlantic watershed) was estimated to cost US$0.53 per M^3 (World Bank 1993). Groundwater in Mexico City was estimated to have an AIC of US$0.41 and water from the next available source, the Cutzamala River, at US$0.82 (World Bank 1993). The rate setting agency in Mexico City (CAN) charged private, non-residential users $1.00 per M^3 to extract water from private bore holes in 1997 (field interviews). Nasser 1997 estimated the marginal cost of water in Buenos Aires to be as little as $0.15. World Bank estimates put the MC of water in Abidjan at $0.13 and Conakry at $1.00. The MC for Conakry seems high in light of what we know about costs there.

those customers. Metered tariffs also give the operator an incentive to reduce physical losses, as long as the return is greater than the maintenance cost. The incentive is higher when the system is near capacity, as it is in Abidjan and Buenos Aires. Thus, we would expect that where the opportunity cost of usage is high, capacity to supply users is constrained, or usage has a high variable cost (because of disposal costs, for example) metered pricing would be preferable. As we see in **Error! Reference source not found.**, however, the opposite prevails. Metering is low in the two cities with the highest cost of usage – Lima and Mexico City.

The Incentive Effects of Tariff Policy on Consumers. As discussed in section II, an optimal pricing and subsidy policy would give consumers an incentive to use enough water and sanitation for good hygiene, yet avoid waste or pollution. This suggests that most consumers should pay the marginal cost of water; only usage with external benefits or cost should be subsidized or taxed. Usage charges require metering, but since metering is costly, it may not make sense to meter where the cost of usage is low.

Another reason why consumers may not pay the marginal cost of water is the use of cross subsidies. Subsidized consumers have less incentive to conserve water, while consumers facing a higher rate, particularly large industrial users, have an incentive to drill their own bore holes. The cities in our sample used a number of pricing schemes with the intent of making water more affordable for the poor. Abidjan and Conakry used increasing bloc tariffs, where larger consumption blocs pay more, and the lowest bloc pays below cost. Buenos Aires, Lima and Mexico City charged customers classified as non-residential or industrial more than residential users, and also had low tariffs for low usage. Chile used a means tested subsidy that covered up to 60 percent of the cost of the first 20 M^3 of

consumption.[26] Only Chile's scheme seems to have made access more affordable for the poor, for reasons we document in section VIII.

VI. Commitment

Mechanisms to enforce the contract and resolve disputes play an important role in engendering commitment. The mechanisms used in the contracts we studied are summarized in Table 1. All the contracts except Mexico City and Lima specify penalties for reneging ranging from fines, forfeiture of bonds, and revocation of the contract.[27] Although the water operator in Santiago was state owned, under the law its concession could be revoked for non-performance and the company could be sued by consumers for failure to provide adequate service.

Table 1. Contractual Provisions for Enforcement and Dispute Resolution

	Buenos Aires	*Lima*	*Mexico City*	*Santiago*	*Abidjan*	*Conakry*
Enforcement of water contract requirements	Performn bond ($150 million), fines. Can revoke concession	None.	None.	Fines. Can revoke concession. Consumers can sue operator.	Fines. Can revoke lease.	Perform. bond $400,000 fines. Can revoke lease.
Dispute resolution	Courts. International arbitrage	None.	None.	Neutral arbitration panel. Courts.	International arbitrage.	International arbitrage.
Representa-tion of consumer & other interests in regulatory procedures.	Local governmt representatives on board. No consumer rep.	None	Municipal government control. No consumer rep.	None. Tariff setting secret.	None	None

[26] The consumer must be current on the bill for the remaining water services. The municipalities determine who is eligible for this benefit (and other direct subsidies) on the basis of house visits and a set of nationally determined criteria. The federal government allots the subsidy to the localities on the basis of income data; the amount is set to try to assure that no more than 5 percent of household income goes for water services. The funds are paid to the water companies, which have been enthusiastic about connecting poorer customers and informing them of how to apply for the subsidy.

[27] The draft concession agreement for Lima would have required a $50 million security deposit.

Four of our cases allowed operators to resolve disputes with the regulator by appealing to presumably neutral third parties: Buenos Aires and Santiago allow appeals to the courts; Buenos Aires, Abidjan and Conakry allowed for international arbitrage. In addition, Santiago allowed disputes over price adjustments to be settled by an arbitration panel with one member each appointed by the operator and the regulator, and one member jointly agreed upon. International arbitration is generally seen as a last resort, and is not effective in resolving ordinary disputes. Appeal to the courts is also an extreme step for an operator and only useful if the courts are indeed independent of government control, something we consider later. With the exception of Santiago, the only realistic course of appeal was to the federal (or in the case of Mexico City, municipal) ministry responsible for the water sector, seldom a neutral body. How the ministry reacted depended upon the institutional setting, which we consider in the next section.

None of the cases enlisted consumers in the regulatory process and few allowed other interested parties any official standing in decision making. Buenos Aires included representatives of the municipality and province on the board of the regulator, with perverse effects we consider later. Mexico City was the only case where the municipal water system was actually controlled by the municipal government, but as we shall see, this has not worked to improve the credibility of the contracts.

VII. Supportive Institutions

In this section we describe the institutional factors that supported the contracts. In particular we analyze how regulatory, judicial and political institutions reduced

information asymmetry, motivated the parties to comply and made it credible that commitment would be sustained and the contracts enforced.

(i) Regulatory Institutions. A survey of the regulatory characteristics for the sample raises serious doubts about the ability of regulatory institutions to collect and monitor information and apply penalties and rewards; they were also inadequate support for governments commitment to enforce the agreements (Table 1). The exceptions are Santiago, and, possibly, Buenos Aires.

Table 2. Regulatory Characteristics After Reform

	Buenos Aires	*Lima*	*Mexico City*	*Santiago*	*Abidjan*	*Conakry*
Delineation of regulatory responsibility	Separate agency.	Separate agency but under same ministry as company.	Three municipal agencies regulate quality, contracts & bill collection.	Separate agency	Four supervisory agencies plan and manage investment, debt, and supervision of contractor	State enterprise regulates & decides investment.
Autonomy & insulation from political interference	Has budget autonomy, but under political board.	Has budget autonomy but no political insulation.	No autonomy or political insulation.	Regulator's autonomy protected by legal status. High political insulation.	No autonomy or political insulation.	No autonomy or political insulation.
Power, & if powerful, discretion.	High nominal power, but by-passed in contract renegotiations. Recent fines, pricing decisions overturned. High discretion.	Low power.	Low power.	High power but subject to appeal. Little discretion.	Low power.	Low power.
Staffing skills	Inexperienced but improving	Weak.	Weak.	Strong	Split among many agencies.	Very weak.

Santiago's regulator is powerful, independent, politically insulated and guided by detailed laws that leave little room for discretion. It pays above civil service norms and its staff is regarded by most observers as competent, honest and hard working. Chile's strong bureaucratic norms of an educated and honest civil service subject to rule of law support the regulator's independence.

Buenos Aires set up an independent body that nominally has the power under the concession contract to compel information and fine noncompliance. However, the regulator's board is politicized and divided and that has reduced its credibility, and led the executive branch to intervene in the regulatory process. Even though the regulator has assessed fines and penalties, these have been abrogated in a subsequent renegotiation of the contract with the executive branch. Aggravating the monitoring problems, the original concession agreement in Buenos Aires suffered from serious information problems, which led the drafters to require the operator to perform specified processes rather than just to meet specified goals. These contractual problems were exacerbated by the inexperience of the staff of the regulator who, according to field interviews, intervene in the engineering decisions of the firm and do not adequately monitor the achievement of broader goals. Nevertheless, the regulator is superior to the others in the sample, and as staff gain experience and information, could improve.

Lima's regulator is nominally independent, but in practice has been dependent on the supervising ministry. Unlike other regulatory bodies in Peru, it does not have a board or governing council in which government is one of several stakeholders, as a way to insulate it from direct intervention by the ministry. Its staff is weak and focused more on control than regulation. Although the regulator can assess penalties of up to 30 percent of an enterprise's revenues for failure to comply with regulation, this power has not been used because there is no provision on how to enforce the penalties.

Abidjan's regulatory institutions were ill designed to extract the information necessary to monitor compliance. The private operating company is monitored by several government bodies that are often in conflict with one another and lack clear lines

of responsibility. For many years the agency in charge of building the water infrastructure was also the de facto regulator, even though another ministry was formally the regulatory body. In 1996 power was shifted to the formal regulator, but the private operator has been and is still able to by-pass the regulator, thanks to direct access to the president. The system has worked well despite these weaknesses thanks to political and international institutions that we describe below.

In Conakry there is no neutral regulator independent of other actors in the sector and information on the private operator is very poor. Instead a state enterprise plays multiple roles of investor, regulator and asset owner, and has been in constant conflict with the private operator. The state enterprise's staffing is weak and poorly paid and information on the operator is very poor. Since the contract covers urban areas in the entire country it is difficult to sort out activities in Conakry from elsewhere, although the importance of this is somewhat reduced by the fact that Conakry represents over 70 percent of the operator's activities.

In Mexico City there is no single regulator or operator and no clear targets to monitor. The system is not operated as a single corporate entity, and different types of costs and revenues are the responsibility of different organizations. There is one municipal entity responsible for building new infrastructure, another responsible for administration, and sixteen political sub-units of the municipal government (*delegaciones*) responsible for the operation and maintenance of the secondary distribution network. The 16 *delegaciones* and the other distribution and investment units operate as government departments with costs covered by government transfers. When the four private operators singed contracts to provide specific services none of this

administrative apparatus was eliminated. Regulatory responsibilities are split among three municipal agencies and the data to determine even operating costs are not consolidated. The agency in charge of monitoring the contracts is the closest to a regulator, but it acts more as a procurement control agency than a regulatory and has no responsibility for price setting.

(ii) Legal and Judicial Institutions. Legal and judicial institutions are important to the incentives properties of contracts in water and to credible commitment. Among the key institutions are the status of water property rights in law and judicial neutrality when government is a party to a dispute.

In our sample Chile represents one extreme in the protection of property rights. Water has long been treated as a private good in Chile, property owners can trade water rights, and the constitution explicitly protects private property. The water regulation has long allowed Santiago's operator to cut off non-payers, which helps explain why collection rates were 96 percent in 1996. Finally, only in Chile is the court system regarded as independent, and capable of ruling against government in a dispute with a water operator.

At the other extreme are Mexico and Guinea. In Mexico a federal law bans completely cutting off service to residential users for non-payment. In compliance with this law Mexico City's Financial Code states that service can be reduced to minimum "vital levels" but cannot be completely severed. In practice however, no consumers have ever had their service reduced for non-payment in Mexico City. Cut-offs are allowed in Conakry, but Parliament recently failed to past a law allowing fines to be levied on persons who repeatedly steal water. Nor can the company rely on the courts to force

government to pay its water bills promptly. Collection rates were 68 percent in Mexico City and 64 percent in Conakry in 1996.

Collection could be a problem for Abidjan, since the courts are weak, although not as weak as in Guinea. However, private users in Abidjan have an incentive to pay their bills. Connection charges for small users (with access pipes less than 15 mm in diameter) are only subsidized once; a user cut off for non-payment must pay the full charge to reconnect. No such incentive operates for the public sector however, and government delinquency is a recurrent problem in Abidjan.

In Argentina and Lima, laws permit the operator to cut off non-payers but enforcement is weak; large arrears on connections charges were an important reason for the renegotiation of the Buenos Aires concession. The courts are not regarded as independent in either country.

(iii) Political institutions. Political institutions can substitute for weak legal and regulatory support in some cases, although it sustainability is less sure. For example, checks and balances can restrain regulatory discretion, while electoral laws and legislative rules can make it hard for opponents of reform to overturn the water contract or force the government to approve lower price increases than promised in the agreement.

Chile's water contract is credible because it is based in laws that are difficult to change. Chile's Constitution requires a two-thirds majority to overturn legislation. The combination of electoral rules that tend to split votes among the two rival factions, and appointed Senators who tend to favor the status quo, makes it hard to obtain enough votes.[28] In addition, features of the water contract have served to reduce water's political

[28] See Baldez and Carey 1997.

saliency, despite relatively steep prices increases following reform. One is the technocratic, apolitical nature of the pricing regulation that reassures consumers that no special interests are being advantaged at their expense. Another is the means tested subsidy for water that benefits lower middle income consumers as well poorer users.

In contrast, Buenos Aires water regulation has been the subject of partisan dispute despite a large price drop at the time of reform and some of the lowest water prices in our sample. The initial credibility of Buenos Aires' concession with investors was built on the reputation effects of Argentina's sweeping and successful privatization and stabilization programs, the early public support for a reform that reduced tariffs and pledged to improve service, and the legislative consensus that accompanied Menem's ascension to power.[29] The likelihood that the regulation would be sustained was increased through constitutional amendments in 1994 that made drastic revision in utility regulation less likely by changing electoral rules in ways that made it harder for the majority to ignore the minority (Heller and McCubbins 1998).[30] These safeguards function at the national level, however, and the Buenos Aires water regulation has proved vulnerable to political interference from local government. This is partly because the regulator has a politically appointed board, with six directors, two appointed by the executive, two by the provincial governor, and two by the mayor of Buenos Aires.

[29] Not only did Menem's party win control of both houses of Congress, but the opposition allowed him to take power five months early rather than continue as a lame duck regime in a period of hyperinflation and declining growth. (Hill and Abdala in Levy and Spiller 1996).

[30] Prior to 1994 senators were elected by provincial legislatures from two-member districts by plurality rule. Since the 1994 electoral changes, senators are elected in three member districts with the first two seats going to the party with the most votes and the third seat to the second-place party. This made it even harder for an extreme faction to capture both houses of Congress and created more pressure for compromise with the opposition.

Partisan interests have increasingly divided the board.[31] The company has protected itself by appeal to the federal executive, which was influenced by international institutions, as we describe later.

The other cities had fewer institutional safeguards against expropriation, and instead designed reforms to reduce risk and relied on international institutions to give their commitment greater credibility. Cote d'Ivoire and Guinea opted for leases, which meant that the private operator did not put investment capital at risk. Ties between the government and local investors also reassured investors in Cote d'Ivoire.

Mexico City's reduced the financial exposure of private operators by using fee-for-service in the first two phases of three phase contracts. Risk was also reduced by not contracting for service for the entire city. The gradual phasing-in of private operating risk was expected to contain political opposition and to build private "confidence in the government's commitment to commercially viable services" (Richard and Triche 1994 p.15). Ultimately, political circumstances became less, rather than more, favorable towards reform, after the introduction of direct election of the mayor and assembly. Mexico City's handling of the contractors, including numerous delays, reduced rather than enhanced government credibility as a private partner.

As in Argentina, Peru's program of economic reforms and privatization gave it initial credibility, but the durability of Peru's regulatory promises was less secure. The regulator is subservient to the central government and, unlike other regulator bodies in Peru, has no legal standing to protest interference or board or council representing non-

[31] The governor was President's Menem's main opponent in his party and the Mayor's position was captured by the opposition party when the post became an elected one in 1994.

government interests. There were and are few checks on executive discretion, especially since President Fujimori suspended the legislature and courts in 1992.

(iv) International Constraints. International constraints can support contracts and partially substitute for weak domestic institutions. International constraints can affect both governments and operators. Openness to international trade and capital flows increases a government's concern with its reputation with international investors, while loans from aid agencies may influence governments water policy through conditions or by directly supporting expenses associated with the contract. Operators competing for contracts in global markets will be concerned about their reputation in other markets in the same country or globally, particularly if the contract is highly visible.

International constraints played an important role in some of our cases. Support from international and bilateral aid agencies were important to the credibility of the contracts in Guinea and Cote d'Ivoire. In Guinea, a price subsidy financed by the World Bank phased in the full increase in consumer tariffs over five years, which helped the private operator by keeping demand higher and receivables lower than they would been with immediate cost recovery. Support from the World Bank and the French government helped reassure the operators that they could enforce the contract despite weak local institutions. In Cote d'Ivoire the French government pressured the government to pay its water arrears.

Enforcement of the Buenos Aires contract has been strongly affected by the federal government's continuing concern to maintain Argentina's reputation with foreign investors, especially to support Argentina's fixed parity with the dollar. The water concession is a highly visible contract, and this helps explain why the executive branch

intervened in regulatory decisions and did not leave them to a regulator influenced by local partisan interests. Thus, the federal government ministry by-passed the regulator in the 1997 renegotiations of the contract. Subsequently, in 1998 when the regulatory board awarded a price increase of 1.6 percent versus the company's claim of 11.7 percent under the cost pass through provision of the contract, the operator appealed to the supervising ministry and the increased was raised to 4.6 percent. These ad hoc interventions protected the company's interest but cost the concession credibility with consumers and made the contract vulnerable to a change in executive policy.

As for the company's concern for reputation, interviews suggest that the Buenos Aires concession is seen as visible and important to the operator's reputation. Concern about their long term relationship as well as reputation may explain why the companies consulted for this study stated that they never considered suing government for egregiously violating the terms of the contract by, for example, not paying its water bills.

VIII. Outcomes

In this section we first summarize the characteristics of the regulatory contracts and relevant institutions, and then consider the effects on efficiency and social welfare. We measure efficiency gains by looking at how much the reforms improved economic welfare compared to a counterfactual. We also provide partial measures of improvements in operations. We measure social welfare gains in terms of how much the reform improved access to water and sewerage, reduced waste, and reduced pollution. [32]

(i) Comparison of Contract Characteristics. Based on the previous discussion we can assess the characteristics of the regulatory contracts in terms of information,

[32] We have post reform data to 1996 for all our cases. The post reform period to 1996 varies from four years (in Buenos Aires and Mexico City) to nine years (Abidjan).

incentives and commitment. As we see in Table 3 we would expect the best outcomes on all fronts except pollution in Santiago. Although competition was underutilized in Santiago, there was a strong monitor to collect information on the firm. Incentives were efficiently assigned, the operator was rewarded when the system expanded and received a return on sewerage as well as water, and there were no disincentives to serve the poor. Poor consumers could afford to connect and use water and sewerage, and users were motivated to conserve water through metering and marginal cost based pricing. The contract's legal basis, regulatory setup and enforcement mechanisms made it credible. One weakness in the contract was the failure to make polluters bear the cost of pollution.[33]

The other contracts did less well in meeting the three conditions and the institutional settings were weaker. Buenos Aires' contract did somewhat better than the rest, thanks to: the contestability of the concession arrangement, the incentives to improve efficiency and expand (provided by the assignment of responsibilities and rewards, average prices above marginal cost, the price cap, bonding and targets), and the credibility afforded by the government's concern with its international reputation. Abidjan and Conakry had poorer information because no single agency had clear responsibility for regulation and monitoring and enforcement of reporting requirements was poor. Competitive bidding and metered prices above marginal cost provided incentives to expand and reduce waste but these were diminished in Conakry by massive water theft. The African cities overcame their credibility problems by using lower risk leases, but paid a price in lower powered incentives for operators.

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[33] Instead farmers pay the cost of not being allowed to irrigate with untreated wastewater. To the extent farmers pass that on to consumers in Santiago as higher food prices, we could say that the polluters pay, but some of these products are exported.

The contracts in Mexico City and Lima were ill designed to address the cities' problems. Mexico City's contracts did not make expansion a goal and the incentives were mixed: one the one hand users did not pay the full cost of service, on the other the operators and the city did not pay much of the cost of expansion either. Because the responsibilities of the private operators were curtailed and their competition was limited, their capability and incentive to improve efficiency were also limited. This situation gave the operator and residential consumers little incentive to curb waste, while high prices for large industrial consumers encouraged them to drill their own bore holes.

Lima's regulation provided few incentive to expand since most users did not pay full cost for service and large cross subsidies meant that poorer consumers would pay the least, and most of those without service were poor. Ad hoc pricing rules and lack of competitive threat provided the operator with low incentives to improve efficiency. Rationing of service was the main check on waste.

Table 3. Comparison of Characteristics of the Regulatory Contracts

	Buenos Aires	*Lima*	*Mexico City*	*Santiago*	*Abidjan*	*Conakry*
Information:						
Competition for market?	Concession bid compet.	No	No	No	Contestable lease	Lease bid competitive
Yardstick competition?	No	No	No	Some	No	No
Separate monitor?	Yes	Yes.	Only of service contracts	Yes	No	No
Incentives:						
a. Operator						
Coverage targets?	Yes	No	No	Yes	No	No
Waste targets?	Yes	No	Stage III	Yes	Yes	Yes
Pollution targets?	Yes	No	No	Yes	No	No
Bears investment risk?	Yes	No	No	Yes	No	No
Respons. for sewerage operation?	Yes	Yes	Yes	Yes	No	No
Price cap or other efficiency tariffs?	Yes, but disputed index	No	No	Benchmark	Cost plus; periodic	Cost plus; periodic
Tariffs cover MC?	Yes	No	No	Yes	Yes	Yes
No or low cross subsidies?	No	No	No	Yes	No	No
b. Consumer						
Affordable for poor to connect to water?	No[1]	No	Yes	Yes	Yes	Yes, usage not afford.
To sewerage?	No[1]	No	Yes	Yes	No	No
Metered prices?	Few	Few	Increasing	100%	~100%	~100%
Pollution tax or other measures?	Treatment targets	No	Prohib. irrigation of foodcorps	Prohib. irrigation foodcrops	No	No
Commitment:						
Performance bonds	Yes	No	No	No	No	No
Dispute resolu.	Yes	No	No	Yes	No[2]	No[2]
Consumer repres.	No	No	No	No	No	No
Institutions:						
Expropriation safeguards?	Reputation, checks & balances	Reputation, no checks & balances	No	Law, checks & balances	Donors	Donors
Cutoffs allowed?	Yes	Yes	No	Yes	Yes, exc. Govt.	Yes, but no penality for theft
Independent, neutral regulator?	Yes, but political brd	No	No	Yes	No	No
Neutral enforcement?	Courts, but not indepen.	No	No	Courts, arbitration	No	No

[1]Became affordable after the 1997 renegotiation. [2]Does not include international arbitration.

(ii) Effects of the Regulatory Contracts on Economic Welfare. To assess the economic effects of the contracts we compared the achievements of the reformed company with a realistic counterfactual based on conditions most likely to pertain in the same company and city absent the contract. To do this we measured the net economic benefits of the changes attributed to the contracts using a partial equilibrium, cost-benefit methodology developed by Jones, Tandon and Vogelsang 1990 and previously applied to privatization (Galal et al. 19??). Using the same methodologyg for each of the cases, we projected the flows generated by the firm after reform to the different parties involved – consumers, workers, government, buyers – and compared them with the counterfactual flows.[34] We projected the counterfactual by assuming that operations would continue along pre-reform trends unless there was a reason to assume otherwise.

Unfortunately we only had sufficient data for the five cities shown in Table 4. These magnitudes are vulnerable to the assumptions we used to describe the counterfactual and must be looked at with caution. However, they give a sense of the impact of reforms.

[34] We projected the consumer surplus by assuming an elasticity based on studies of willingness-to-pay in the case study city or a city in similar circumstances; we assumed that demand was rationed by willingness-to-pay. Thus the net gain represents the net benefits from access at given prices, but does not include the effects of better quality of service (such as higher pressure or faster response to complaints), although we do adjust for interruptions in service. Nor does it include the effects on health or time, to the extent that these are not reflected in willingness to pay, or externalities from lower risk of epidemics. Government gains from any net increase in taxes or dividends or other revenues, minus the loss of quasi rents if the contract is a concession and any costs associated with the sale (such as the assumption of debt). Workers gained by getting shares in the utility (e.g. in Buenos Aires) or higher salaries (e.g. Chile), minus any losses from layoffs that were not compensated through some form of severance pay. Finally, the private investors gained by the amount of quasi rents (e.g. Buenos Aires and Lima) or profit shares and fees (e.g. Guinea). The methodology is explained in detail in the individual cases, which also contain sensitivity tests.

Table 4. Welfare Gains from Reform[1]

	Buenos Aires	*Mexico City*	*Lima w/out concess.[2]*	*Lima with concess.[2]*	*Santiago*	*Abidjan*	*Guinea[4]*
Welfare gains NPV in 1996 US$							
Total domestic (millions)	$1,419	NA	$ 43	$590	$284	NA	$23
Total per capita	$ 150		$ 6	$ 85	$ 64		$12
As % water sales last pre-reform year							
Of which (millions):							
Government	($ 169)		$ 40	$ 13	$241		$ 8
Consumers	$1,388		$ 57	$266	$ 4		$16
Workers	$ 43		($55)	$ 32	$ 39		$ 0
Domestic Investors	$ 160		$ 0	$280	$ 1[3]		$ 0
Consumer gains per capita	$147		$ 8	$ 38	$ 1		$ 8

[1]Methodology is explained in the cases; sensitivity tests are also given. [2]Lima without the concession is a comparison of the actual with a counterfactual of no reform; Lima with the concession is a comparison of the actual with a counterfactual of the concession implemented according to the draft contract. [3]Although Santiago's utility is state-owned a few shares are privately held. [4]Numbers for Guinea are for all urban areas under the lease.

There are two calculations for Lima. The "without concession" calculations compare the reforms actually introduced under public ownership with a counterfactual based on trends before these improvements were introduced. The "with concession" calculations compare the actual situation in Lima after reforms with a counterfactual projected on the basis of the targets in the draft concession agreement. It is clearly unrealistic to assume that all of these targets would have been fulfilled. Nevertheless, since Lima's gains with a concession are five times larger than the reforms under public ownership, it seems safe to conclude that the city would have been better off even if the operator had renegotiated considerable reductions in targets or increases in prices.

As we would expect from the previous analysis, the largest gains excluding Lima's concession were in Buenos Aires and Santiago. Since the systems vary in size we also calculated the gains per capita; these were largest in Buenos Aires, $150 per person, and in

Santiago, $64 per capita. The Santiago gains are smaller but striking since the system was one of the best operated before reform so the room for improvement was limited. The distribution of the gains was radically different. Buenos Aires' gains went largely to consumers, thanks to expanded access combined with a major price reduction at the outset of the concession. Chile's government captured most of the gains by requiring the company to pay dividend payments.

The gains in consumer surplus in Table 4 are understated because we could not quantify improvements in the quality of service. We know from field interviews that the quality of service (pressure and reliability) remained very high in Abidjan, improved in Conakry, Buenos Aires, and Santiago, and continued poor in Lima and in parts of Mexico City. Water quality in Conakry and Lima went from questionable to safe; water was already safe in all the other cities, although there are problems with appearance in parts of Mexico City.

Lima's reforms produced much smaller gains, which reflect the failings in information, incentives and commitment described above. The proposed concession would have done much better, in part because we have assumed away many of these contractual flaws. Nevertheless, welfare would likely be higher with a concession even if we relax these assumptions, because the private operator would add a new stakeholder to the negotiations. In a setting such as Peru, where there are few checks on executive discretion, a state owned firm is subject to political manipulation. Private investors would demand to be safeguarded against such behavior. Since the regulation proposed under the concession would provide incentives to expand access, improve reliability and curb waste, we expect that these would have improved. It would have been harder, given the institutional

weaknesses in Peru, to guard against excessive price increases since a private operator would take advantage of information asymmetries to earn monopoly rents. Also, the concession did not provide for subsidized finance to make connection charges affordable. Thus, many of the poorest consumers, who do not have access now, would probably not have had access under the concession either.

Guinea is doing better with the lease, despite its flaws and the weakest institutional environment in our sample. Consumer welfare went up because of the expansion of the system. Weak regulatory capacity meant that much of the gains were offset by higher prices.

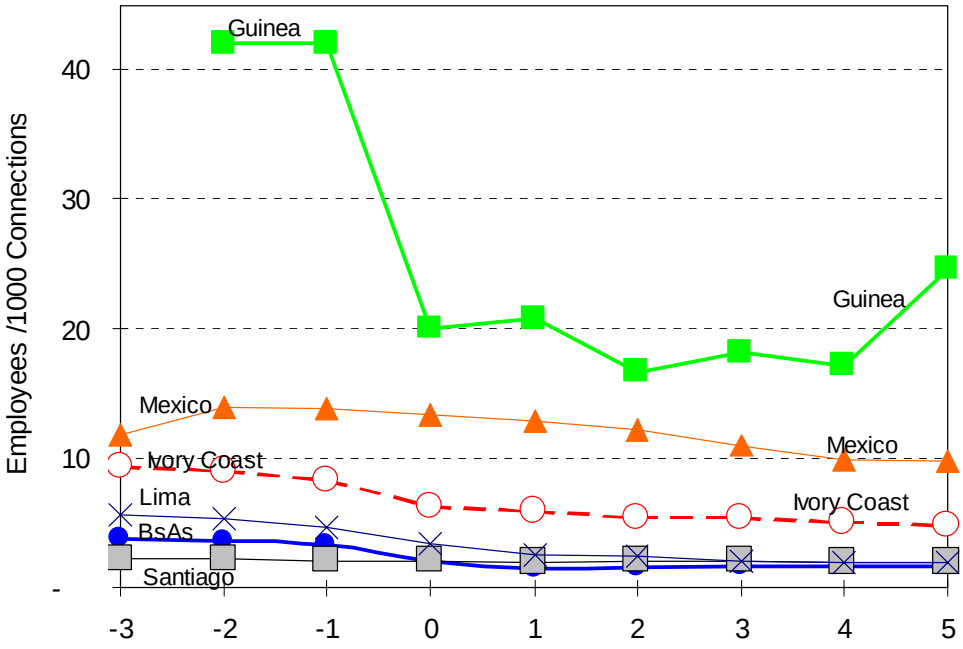
(ii) Efficiency and Investment. Some of the welfare gains just described resulted from more efficient operation and expanded investment. Number of staff per connection provides an indication of the extent to which the operator is concerned about cost minimization.[35] As we can see in Figure 1 this measure was reduced in all of the cities: through outsourcing and staff reductions in Abidjan, Conakry, Lima and Santiago; through leaner private operation in Buenos Aires; and through registration of existing connections in Mexico City. Labor productivity remained low in Mexico City because private operation was overlaid over a group of existing state agencies that were given little incentive to reduce employment. (The staffing numbers include only the state operators.) It also remained low in Conakry, notwithstanding layoffs at the time of reform and faster expansion of connections and production than staff thereafter. Political pressures to maintain

[35] This ratio overstates employment in the African cases since the company is responsible for all urban areas but connections outside the capital are not included in the denominator. Note that that would not explain why Conakry is so much higher than Abidjan. The numbers are not strictly comparable because, as we discussed, the definition of a connection varies. We also calculated staff per M^3 of water sold (production minus UFW) and the only change in relative labor productivity is that Lima has a higher volume of sales per employee than Santiago.

employment combined with cost plus pricing that gave the operator little incentives to reduce staff.

Figure 1. Labor Productivity

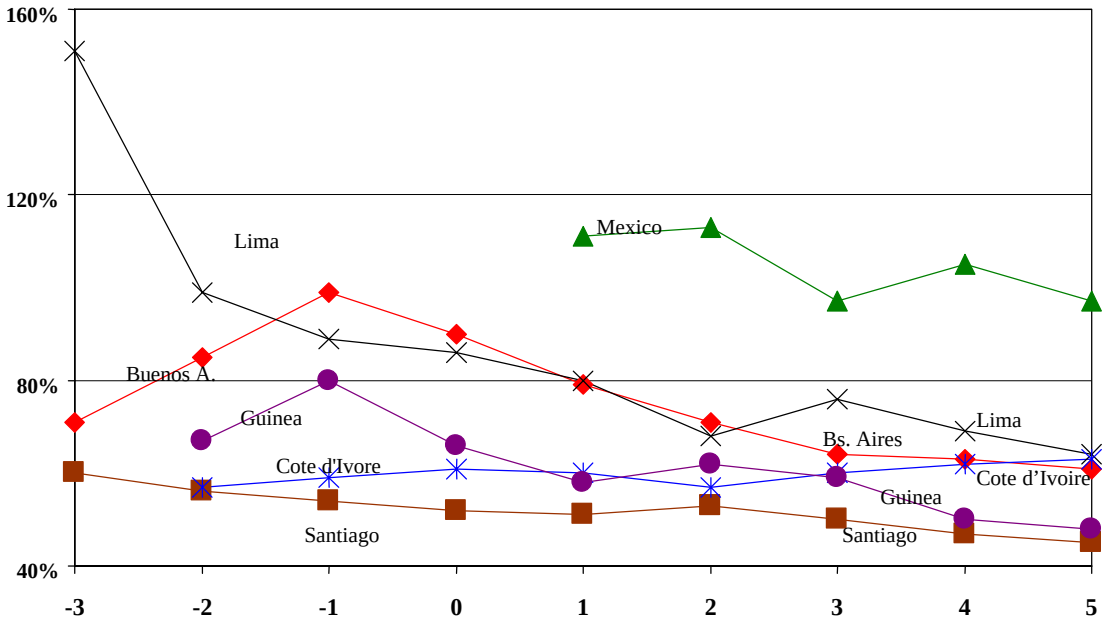
(Employees per thousand connections; year 0 = year of reform)



Anther indicator of efficiency is the extent to which revenues covered costs. As we can see in Figure 2 costs fell below revenues in all our cases except Mexico City. These rates were especially steep in Lima and Buenos Aires; the Buenos Aires case is striking because prices were also lower during the early years of the concession. Lima had some moderation of costs, but prices also increased. The opposite was the case in Abidjan and Santiago; these are low cost systems that continued to operate well throughout the period. There were some gains in Guinea but cost coverage was also due to large price increases.

Figure 2. Operating Costs as % of Operating Revenues

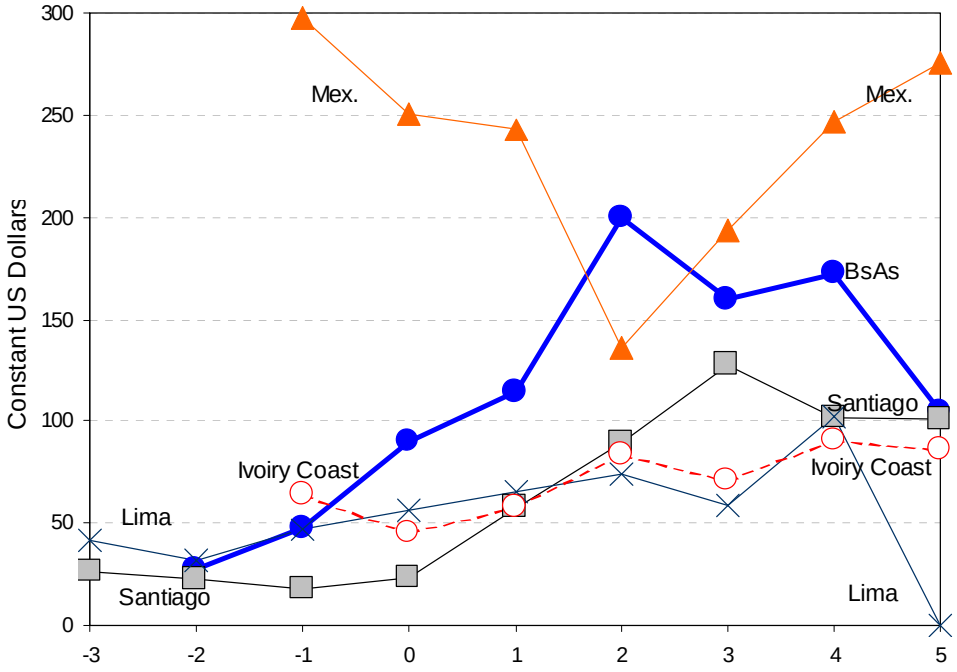
(year 0 = year of reform)



A final measure is fixed investment, which we calculate per cubic meter of water produced to adjust for the differing sizes of the systems we studied. Investment increased sharply in Buenos Aires and Santiago after the contract was implemented, and expanded less rapidly in Lima and Cote d'Ivoire (Figure 3). Mexico City's high investment levels reflect both the high costs of expanding the system because of its topography and the disincentive to minimize investment costs when these are largely paid by the federal government. We exclude Guinea from the figure because its investment was much higher than the others because of the very small scale of its system and the large foreign aid it received during the early years of the contract.

Figure 3. Fixed Investment per Cubic Meter of Water Produced

(Constant 1996 US$; year 0 = first year of reform)



Effects on Social Welfare and the Poor. In this section we assess the effects of the reforms on access to water and sewerage, in general and by the poor, and on waste and pollution. Unfortunately data on health and incomes is not disaggregated for our sample cities so we infer the effects by analyzing access and affordability.

(i) Access to Water and Sewerage. As described in the analytical framework, research suggests that water alone will not improve health as much as water combined with sewerage. Hence we expect better health outcomes from contracts that included sewerage.

We get some picture of the welfare of consumers who were connected through the gains in consumer surplus described above. This calculation, however, does not tell us how many people were not connected, nor does it address sewerage where that is provided separately.

Incentives to expand water coverage were provided in Buenos Aires, Santiago, Abidjan and to a lesser extent, Conakry. Table 5 shows biggest improvement in coverage of water connections in Abidjan, Conakry and Buenos Aires. Santiago's expansion is less because of initial conditions (almost full coverage when the reform started). As we would expect from the contract characteristics, sewerage expansion is believed to be minimal in Abidjan and Conakry while coverage of sewerage expanded in the other two cities (Table 5).[36]

Lima's concession contract promised much higher coverage of water and sewerage, but without the concession the incentives to expand were limited. Thanks to a donor financed investment project the system's growth did keep pace with the city's rapid population growth, which was not an insignificant achievement,. In Mexico City expansion in coverage was also limited by initial conditions. Part of Mexico City's growth shown in Table 5 was through the registration of existing but unregistered connections, which were about 30 percent of total connections before reform.

[36] The number of users served by a connection varies widely from 27 on average in Conakry to 5 in Santiago. Recall that the definition of a connection in some cases includes a standpipe in the yard. The cases also varied in how connections to multiple households were counted. For this reason we used volume of water produced rather than connections as the numerator in most calculations.

Table 5: Effects of the Reforms on Access and Waste

	Buenos Aires	*Mexico City*	*Lima W/out Concess.*	*Lima With Concess.*[3]	*Santiago*	*Abidjan*	*Conakry*
Coverage: water[2]							
Pre reform[1]	70%	95%[5]	75%	75%	99%	72%[6]	38%[7]
1996	81%	97%[4]	75%	85%	100%	82%[6]	47%
sewerage							
Pre reform[1]	58%	86%[5]	70%	70%	88%	35%[6]	*
1996	62%	91%[4]	70%	83%	97%	*	9%[4]
Growth in new connections (annual averages %)							
Pre reform[1]	2.1%	n.a.	4.0%		2.9%	4.0%	-0.1%
Post reform	2.8%	5.1%	4.0%		3.8%	6.7%	8.5%
Unaccounted for water[8]							
Pre reform	44%	37-47%	42%	42%	34%	13%	35-60%
1996	34%	37%	36%	30%	20%	16%	50%

[1] Pre reform dates are: Buenos Aires 1992; Lima 1991; Mexico City 1992; Santiago 1988; Abidjan 1987; Conakry 1988. [2]Does not include public standpipes. [3]Estimated on the basis of draft concession agreement. [4]1995. [5]1990. [6]for all urban areas under private operation. [7]1989. [8]Unaccounted for water (UFW) is the difference between volume of water distributed to the delivery system and water sold, and includes physical losses from pipe breaks and overflows as well as commercial losses from illegal use, under registration of users, etc.).
*The sewerage estimates in Abidjan and Conakry are not believed to have changed much.

Affordability and willingness-to-pay are hard to judge because we have no survey data on our sample. Prices are also difficult to compare because the cities vary in how much of the bills is collected and in the use of fixed charges, metering, etc. Table 12 gives several approximation of price using total revenues billed and collected, as well as an average monthly bill for the first 30 meters of consumption.

Table 6: Average Revenues /M^3 Billed and Distributed[1] and Average Bill for 30 M^3

	Buenos Aires	*Lima*[2]	*Mexico City*[2]	*Santiago*	*Abidjan*	*Conakry*
Average price M^3 water (US $)[3] using revenues **billed:**						
Pre reform	$0.21	$0.21	n.a.	$0.09	$0.85	$0.30[5]
Post reform	$0.18	$0.20	$0.37	$0.11	$0.75	$1.00[6]
1996	$0.24[4]	$0.35	$0.32	$0.30	$0.55	$1.19
Average price M^3 water (US $)[3] using revenues **collected:**						
Pre reform	$0.18	$0.15	$0.22	$0.08	$0.81	$0.13[5]
Post reform	$0.16	$0.18	$0.27	$0.11	$0.71	$0.62[6]
1996	$0.23[4]	$0.32	$0.22	$0.29	$0.51	$0.74
Average monthly bill for $30M^3$ for metered household, 1996	na	$7.87	$5.79	$7.69	$13.08	$23.66

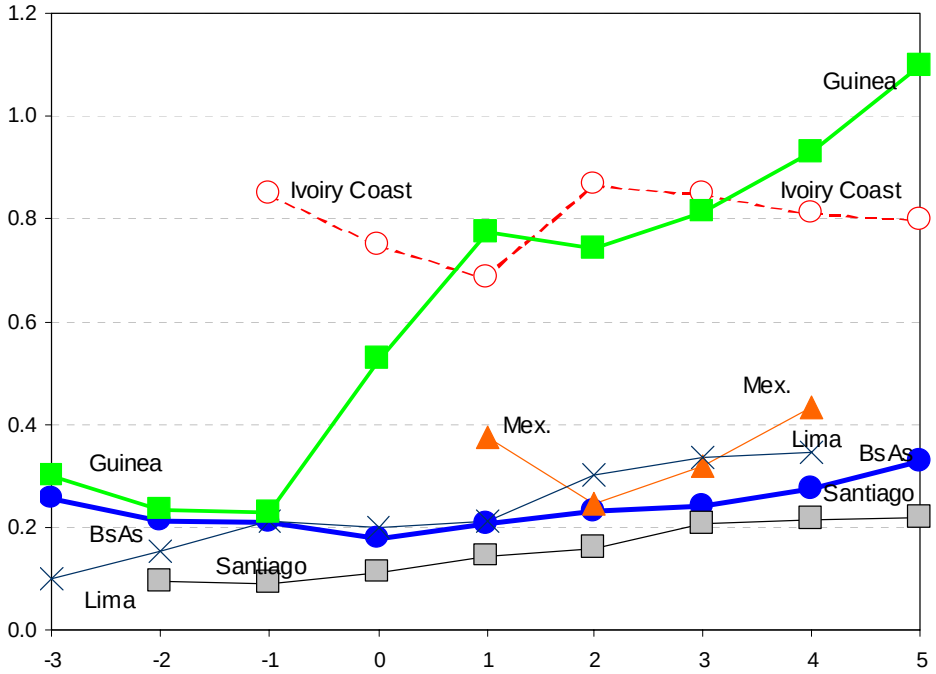
[1] Dates are: Buenos Aires pre = 1992; post = 1993; Lima pre = 1991; post = 1992; Mexico City pre = 1992; post = 1996; Santiago pre = 1989; post = 1990; Abidjan pre = 1987; post = 1990; Conakry pre =1987; post = 1995. [2]Includes sewerage. [3]Revenues net of indirect taxes and adjusted for collection rates /M^3 produced adjusted for UFW. [4]1995. [5]1984. [6] Excludes World Bank subsidy. With subsidy prices were $.34 billed and $0.19 collected.

If we ignore these problems and simply take total water revenues billed per cubic meter produced, we can see that prices are much higher in the two African cities than in the rest of the sample (Figure 4). This has created affordability problems in Conakry, but not in Abidjan. Despite major expansion in Conakry, an estimated 50 percent of the population are still not connected to piped water, almost none are connected to sewerage, and water prices are the highest in our sample by any measure in Table 6 even though incomes are the lowest. [37]

[37] We calculated effective prices in two ways in Table 6. First we report average revenues billed per cubic meter of water distributed (water produced minus UFW) and then we adjust average revenues for collection rates (using average collection rates since the lease began for Guinea). To take account of flat charges, we also calculated the monthly bill for the first 30 M^3 for a metered connection using the official tariffs.

Figure 4. Average Price of Water

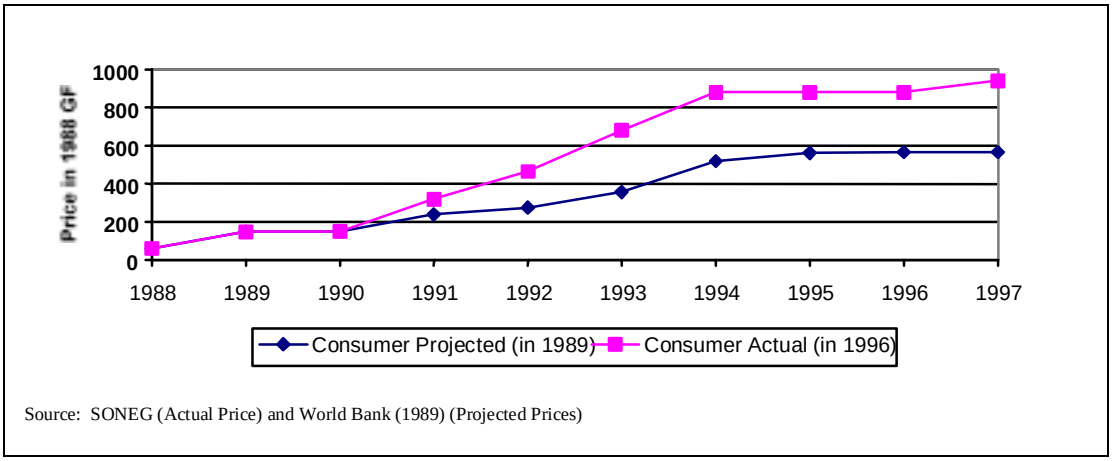
(Water Revenues per Cubic Meter Produced in 1996 US$)



Prices are high in Conakry because government and many prominent persons do not pay their water bills; for example in 1993 the government paid only 10 percent of its bill.[38] Thus, those who do pay must cover the investment costs for a system sized for a much larger number of consumers, and cross subsidize the government as well as many wealthy, non-paying users. This helps explain why the real price rose more than the (already steep) increase projected when the lease was signed (Figure 5).

[38] Although non-paying customers can have their service cut off, company officials report in field interviews that they seldom do so if the consumer is a government agency or a powerful individual. Smaller consumers who get cutoff for non-payment are sometimes able to reconnect under another name, relying on the anonymity afford by the lack of zoning, absence of clear street addresses or a registry or census of citizens. Illegal connections are also common because the pipes are close to the surface and there are no penalties besides service cut-off for non-payment or theft. A law intended to allow the operator to penalize and sue non-payers was rejected by the parliament in 1996. Nevertheless, even taking theft into account, some 27 percent of the population have no access to piped water.

Figure 5. Actual and Projected Prices in Conakry



Source: SONEG (Actual Price) and World Bank (1989) (Projected Prices)

Another reason why poor people cannot afford water in Conakry is that many people share a connection, while the price increases with the volume consumed.[39] There are estimates that in Conakry as many as 27 persons use water from a connection, which is usually a pipe in the yard (field interviews and data from the private operator). Household surveys suggest that there are strong social mores against charging neighbors and relatives for water in Conakry, in contrast to Abidjan where most connections are also yard pipes but charging is well accepted. Even though per capita consumption in Conakry is the lowest in our sample, if one consumer must pay for 27 persons, the bill quickly becomes unaffordable for much of the population. An average monthly residential water bill in Conakry was approximately US$29.58 in 1996 compared to the monthly salary of a top civil servant of only US$150.[40] Although at the time of the reform it was not expected that all poor consumers could afford water, it was expected

[39] For more discussion of the problems with increasing bloc tariffs see Boland and Whittington 1999.

[40] Based on average daily consumption of 37 liters per capita and 1996 tariffs of US$0.67 for the first 20M^3, US$0.85 for 20 to 60M^3 and US$0.92 for over 60M^3. The utility billed customers for a minimum of 20 M^3 even if they consumed less, hence the least a household could pay was $13.45 a month.

that about 15 percent of poor people would be connected and coverage would rise to 75 percent by 1995 (World Bank 1989).

The failure to connect and the lack of sewerage have had serious health consequences. Most unconnected consumers in Conakry rely on contaminated water from shallow, hand-dug wells. Although they stated in interviews that they prefer to use well water for secondary purposes, the number of public standpipes are few, the private market for water is thin and the rate of diarrhea is high. All of this suggests that people are consuming unsafe but cheap and easily available alternatives.[41] Taking into account theft and use of neighbor's connection, at least 27 percent were using wells as their primary source of water in 1993. Despite the improvement in water quality following the lease the city suffered a cholera epidemic in 1994.

Had the concession gone forward in Lima, the likely rise in prices combined with connection fees was expected to make service unaffordable for many low-income people (World Bank 1994). The water and sewerage connection costs were US$850 at the time of reform and could be paid for by a loan with a five-year repayment period and monthly interest rates of 1.2 percent. Combined with higher service tariffs under the concession, the water and sewerage bill for a newly connected household with a monthly income of US$200 to US$240 (43 percent of Lima's households) would be as much as 22 percent of income, which seems unaffordable for many poor families. As it is most of those people are not connected anyway because of the failings of the current regulation to address the

[41] There were 130 public standpipes for a city of 1.6 million people only 42 percent of whom were connected to piped water; by contrast Abidjan with 2.9 million and over 80 percent connected to piped water, had 300 standpipes. Thus Conakry had about a standpipe for about every 6,500 unconnected consumer compared to a standpipe per 1,740 unconnected in Abidjan. Yet, Durany and Morel à l'Huissier (1993, p. 20) found that less than 1% of households purchased water from vendors and less than 5% purchased water from connected neighbors in Conakry. A hand-dug 30 foot well can reach groundwater.

problems of the system. Cross subsidies provide no relief to users who cannot afford connection. Unconnected consumers in Lima rely on public standpipes or vendors. Typically water in poorer communities is stored in uncovered or partially covered metal drums, cement tanks or plastic tubs which easily permit contamination; water can also be contaminated by dust during the process of collection at public standpipes; and the quality of water from vendors is not high (Webb 1992).[42]

The concession in Buenos Aires included an infrastructure charge for new connections which was unaffordable for many. The original concession contract charged new customers the cost of the connection itself and part of the cost of expanding the secondary network, which resulted in a very high access charge, between $1,100 and $1,500. The contract also required the firm to provide financing but allowed it to select the term. The operator opted for two years, the minimum the contract allowed. Many unconnected customers were in very poor sections of Buenos Aires where the estimated average household income was US$245 a month. Since the average charge for a new connection was about US$44 a month for two years, these consumers would have had to pay 18 percent of their income just for the connection.

The 30 percent of the population that lacked a connection continued to consume water from underground wells contaminated by cesspools and as a result had higher rates of waterborne diseases than the rest of the city (Abdala 1996). [43] After many refused to

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[42] This water could be made safer by boiling but that may not be affordable either. The cost of boiling water for ten minutes, as was recommended during Peru's cholera epidemic in 1991, was estimated at 29 percent of the average annual household income in poor communities. Webb 1992. Based on the following assumptions: average slum household boils four liters per day, boiling one liter for ten minutes consumes .10 liters of kerosene, 1991 price of kerosene was US$0.35/liter, average annual 1991 household income in Lima slums was US$171.

[43] The cost of connection in Buenos Aires was estimated to be US$1,107 to US$1,528, and the average annual usage charge for a household was US$109 (in 1995 dollars, Abdala 1996). Although the investment and operating cost of a well and cesspool were higher (investment costs of $3,506 and annual electricity

pay, the charge for the secondary network expansion was eliminated in the 1997 renegotiation of the contract and the cost was spread to all consumers through a surcharge.

(ii) Curbing waste. Another measure of social welfare is the extent to which the system provides incentives to conserve water by reducing UFW and high rates of consumption. As discussed earlier, in systems where the opportunity cost of usage is low, the system has excess capacity, and there are few costs from standing water, the expense of repairing leaks and metering usage may be higher than the benefits. In the cities we studied with high UFW or consumption, usage cost was high in two (Mexico City and Lima) and high rates of usage and waste were accelerating capacity constraints or creating wastewater problems (Buenos Aires and Conakry). One mechanism to curb UFW is enforceable targets for waste or maintenance; as we have seen targets are enforceable only in Santiago and to a lesser extent in Buenos Aires. A second is for the operator to bear the cost of expansion; this was used in Santiago, Buenos Aires and Lima. Another incentive comes from prices that reflect the opportunity cost of usage combined with metering, which gives consumers an incentive to curb waste as well. The contract led to prices above opportunity cost in Buenos Aires, Santiago, Abidjan and Conakry, and metering was widespread in the latter three cities.

As we can see from Figure 6, UFW declined significantly in Santiago, and remained very low in Abidjan. Ironically these are cities with much lower opportunity and external cost of usage than Lima or Mexico City. Most of the UFW in Santiago was due to physical

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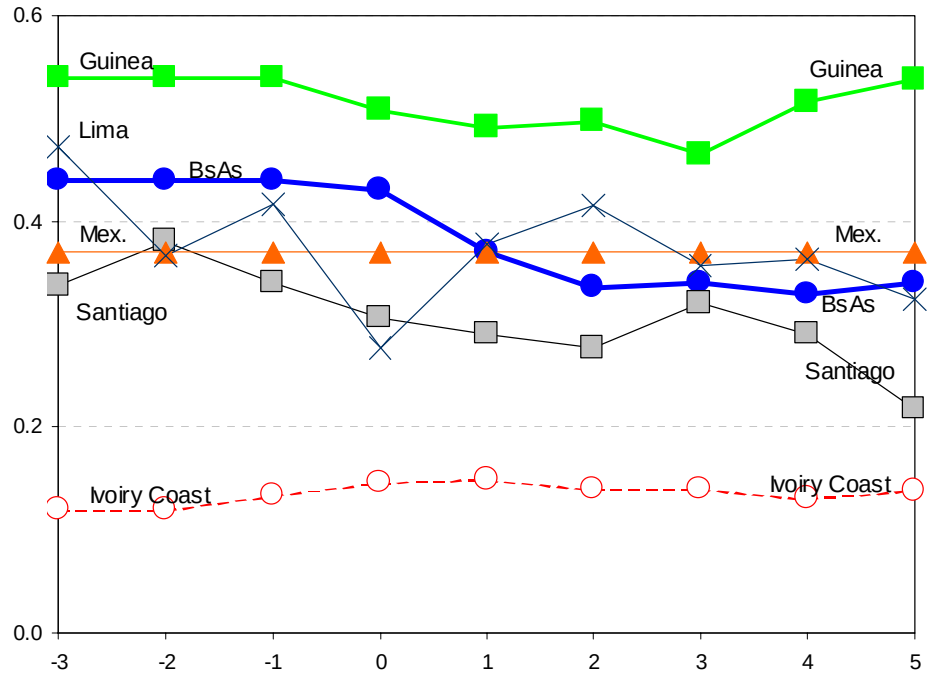
costs of $189 in 1995 US dollars), the investment cost was already sunk. Connection was mandatory and the company offered financing through 24 monthly installments at 12% interest rates. The government officials in charge at the time considered the cost affordable to all consumers and opposition to payment

losses, and was reduced through faster repair of breaks and better leak detection. Buenos Aires reduced commercial losses through better registration of users; there was also greater investment in repair and maintenance, but the operator has voiced concern about the continued high rates of consumption.

Figure 6. Unaccounted for Water

(As a % of water produced)



The reductions in UFW in Lima were largely reductions in commercial losses, through better registration and collection. The pre-reform numbers for Conakry are very poor, but it is clear that it continued to have very high UFW, almost half of water is unaccounted for. This is not surprising given the lack of operator incentives to invest in maintenance and the lack of institutions to combat theft and non-payment. The operator also has no incentive to curb waste to bring down operating costs since this might lead to lower prices. Although lower prices might expand demand, given the collection

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politically motivated (field interviews). To the extent that this was indeed the case, then the refusal to connect suggests that consumers placed too low a marginal value on clean piped water and sewerage.

problems described earlier the operator is understandably wary of connecting potential non-payers.

(iii) Pollution. The other cost of usage was pollution. Sewage treatment was and is minimal in all of the cities, and there are no pollution taxes or penalties that are effectively enforced. Because of the locations of many of our sample cities near oceans or rivers without downstream development, downstream users have not been much affected. Instead, the main externalities caused by pollution have been illness from: contamination of well water because of underinvestment in sewerage in Buenos Aires and Conakry, irrigation of food crops with untreated wastewater in Lima, Mexico City and Santiago (until 1991), and contaminated fishing grounds in Lima and Abidjan.[44] The failure to treat wastewater had another cost for Mexico City and Lima. Even though their groundwater is being diminished, they cannot recharge it because untreated sewage gets mixed with rainwater. In Mexico City rainwater and sewage must be pumped away; in Lima it is dumped into the ocean.

Sewage treatment can result in large increases in tariffs. It is estimated that treating all sewage in Santiago would cost over US$60 million annually (1994 US$) and raise water and sewerage tariffs by US$ 0.11 per cubic meter (1994 US$), compared to 1996 water rates of US$0.28 per M^3.[45] In our sample cities such rate increases would likely be politically difficult to enact, especially where sewerage is absent and the cost of water alone is high, as in Abidjan or Conakry. Santiago and Mexico City have been able to reduce the risk to health and food exports by prohibiting irrigation of certain crops with untreated wastewater. This indirectly applies the principal of polluter pays, since

[44] Sewage contamination of fishing grounds in Abidjan's lagoon was recently addressed with a deep water pipe.

the cities' residents are paying for their pollution through higher food prices, although not fully since much food production is exported. These measures are cheaper than sewage treatment, but do not abate the esthetic costs, the harm to tourism and fishing (in Chile), the risk to some of Chile's food exports and possible long run problems from accumulating contamination.[46]

VII. Lessons and Conclusions

Our cases illustrate how contractual design combined with supportive institutions can motivate major improvements in operating efficiency, social welfare and equity. They also suggest that countries with weak institutions can design contracts that compensate for some of these failings, much as Levy and Spiller 1996 found in telecommunications. The contrast of Chile and Guinea is an example. In Chile, bureaucratic norms, rule of law, checks and balances, and protections of property rights were all strong. These institutions enabled the Santiago water system to perform well under public ownership before the new regulations were implemented. The introduction of a regulatory contract that met the three conditions of reducing information asymmetry, heightening incentives and signaling credible commitment generated significant additional gains. Conakry, without any of Chile's strong institutions, was delivering unsafe water to a small proportion of the population with 60 percent unaccounted-for-water. Although the contract in Conakry could not overcome all of Guinea's institutional weaknesses, it was still an important improvement over any realistic counterfactual. Under private operation capacity more than doubled, water quality and service improved dramatically, the population served almost doubled and coverage expanded from 38 to 45

[45] See the case study for an explanation of these estimates.

percent. About half of the city's population is unable to access piped water (legally) under private operation, but we cannot assume that they would have had access to piped water under any reasonable counterfactual. On the other hand, it is reasonable to assume that Lima could have had better performance under the concession than was possible under public operation, even if the gains were only half as large as the draft concession targets would predict. The experience of Abidjan further suggests that institutionally weak countries can improve water operations through contracts, although Mexico City's experience shows that when only small responsibilities are contracted out, only small gains can be expected.

Our sample is small so results must be treated with caution, but the contrasting experiences of our cases imply that contracting out water services to private operation may be most useful to countries with weak institutions. The concern of global operators with their worldwide reputation and local relationship and their responsiveness to the incentives under the contract can propel improvements that would not have occurred under a public operator not subject to these motivations. Governments' concerns about its international reputation function more strongly when there is an international operator present, as illustrated by the Argentine support of the operator in Buenos Aires or Conakry's changed relationship with the water operator.

The risk of private operation in the presence of weak institutions is that consumers will be poorly protected and an operator motivated by profit will make service unaffordable. As we see in Guinea, however, the high prices are not primarily due to the operator's need to earn a return, but to the government's refusal to pay its water bill or to

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[46] Tree crops, for example, are still irrigated with contaminated wastewater.

allow the company to collect from well connected private consumers. This situation existed before the lease was signed, but with private operation the source of problems is more transparent which can begin to create pressures for its solution.

This is not to suggest that the contracts could not have done better in Guinea as in the rest of our sample. We conclude with some suggestions of ways to heighten the gains from reform by: (i) increasing social and external benefits; (ii) taking full advantage of competitive opportunities; (iii) designing regulation to reduce information asymmetries; and (iv) assuring political support by spreading benefits more widely.

How Could Equity and External Benefits Be Increased? Judging from our sample, more attention needs to be given to the external and equity effects of water services, including the social benefits from improving sanitation. Our sample suggests that it is particularly important to lower the cost of connection through financing, and reduce free riding by government. The experience of our sample suggest that cross subsidies do not benefit the poor and gives subsidized, metered consumers less incentive to preserve water. In addition high tariffs for industrial users in Lima and Mexico City encouraged larger industries to drill their own wells, further threatening aquifers.

The Santiago case provides evidence on how affordability can be addressed with fewer distortions, although only in countries with strong institutions and metered systems. While this might not be relevant for our entire sample, it would be applicable to, for example, Buenos Aires. The Chilean government gives the utility a direct subsidy to cover on average 60 percent of the first 20 cubic meters of consumption for those consumers certified as poor by their municipality; the consumer pays the balance and can

be cut off for non-payment.[47] This gives the utility an incentive to serve the poor and the poor an incentive to avoid waste. Very poor consumers are charged only US$ 5 to US$10 for a connection which they can pay in ten installments, while other low-income families pay the full charge of about US$1000 in 60 installments free of interest (Alfaro 1996).[48]

Although metering is initially expensive, it provides a mechanism for consumers to reduce their usage charges. Santiago's utility launched a campaign to provide consumers, particularly poor customers, reduce their water bill by detecting and fixing leaks. They found that many consumers were unaware that a toilet left running in a house for two days wastes $28M^3$ of water, equivalent to the average monthly consumption of a family of five in Chile (Alfaro 1996).

Reducing government non-payment is difficult but not impossible, as experience in other infrastructure suggests. It seems prudent to make cut offs automatic after a certain period, penalize nonpayment with fines and secure promises of prompt government payment before the contract is signed. How well this will work where enforcement institutions are weak is an open question. Projects in private power generation sometimes secure payment with international guarantees or by making a source of funds (such as oil revenues) hostage to the agreement. In a sense there turned out to be funds that could be held hostage in Guinea and Cote d'Ivoire since the operators withhold that proportion of the revenues they collect for government to finance

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[47] The proportion of the bill covered by the subsidy varies. The amounts are allocated to municipalities with the intent that no household will pay more than five percent of its income for water services. Thus, the amount covered depends on income and prices in a given water district.

[48] The rationale for this is that wealthy consumers do not have to pay the connection cost all at once, but in installments as part of their mortgage for the house, plus all consumers benefits from the externality of reduced risk of contagious diseases.

investment in water. The problem with this remedy is that it has high economic and social costs, since it reduces the money available to maintain the system and connect new customers, and creates uncertainty and distortions in management. Ideally a hostage can be found where the costs of non-payment are higher for those who would otherwise be tempted to free ride.

Enhancing Competition. Judging from our sample, there are several ways that competition could be enhanced in water systems. First, it seems worth while investigating why the market for contracts to operate water systems in developing countries has been so thin and why so little experimentation with product market competition has taken place. It could be that the criteria for tender are too restrictive and exclude smaller or less experienced private operators.[49] Potential investors could be surveyed to see if sale of assets might be more attractive than a concession since it allows the private operator to raise equity capital. It might make sense to split very large metropolitan areas into sub-areas, as has been done in Paris, for example. This could introduce yardstick competition and competition for larger consumers on the margin between concession areas, and make it less likely that the regulator is overwhelmed by a single large operator.

Second, opportunities for competition should not be by-passed, as happened frequently in our sample. Failure to bid or rebid contracts, to procure investment competitively where government bears the risk, or to design a proper auction were costly mistakes in our cases. Yardstick competition, however, seems especially difficult in water

[49] London Economics 1998 (p.42) argues that the minimum efficient scale is 500,000 people; although many privately operated municipal systems in California are much smaller **(CITE).** This suggests that it could make sense to split up larger systems to attract more bidders and make it less likely that the regulator

because of the information problems we described, which may explain its virtual absence in our sample. Splitting up large city systems might improve the chances for yardstick competition, if the division could produce reasonably comparable circumstances, as opposed to the very different zones in Mexico City. Individual services (metering, billing, etc.) could be more easily compared and would help regulators detect high transfer pricing. Third, it seems advisable not to give the successful bidder an exclusive franchise. Solo 1998 suggests that competition among water vendors can result in reasonable prices and reduce the cost of access for the poor. Regulation and better consumer information could reduce the tendency of vendors to collude or use Mafias to eliminate competition and curb the quality problems observed in Lima.

Improving Regulation and Reducing Information Asymmetries. Theory and practice in infrastructure privatization in developing countries have focused on reducing regulatory risk to operators, not surprising given past histories of under-pricing and current vulnerability to politically mandated regulation. In our sample, however, most governments did not try to confiscate returns to private capital by pricing below cost recovery, and monopoly rents as serious a risk as expropriation.

To protect against the risk of monopoly rents, the regulators in the cases we studied needed much better information on costs then they usually had. While it might be justifiable for a new regulator and operator to be ignorant about costs, it is harder to understand the lack of data on operating costs, investment and capital stock in Abidjan, which has had a private operator for over 30 years. Information requirements and penalties for non-compliance should be spelled out before a contract is signed. When a

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is overpowered by a single big operator. Where this is physically difficult and too costly, new developments could be supplied by a second operator.

private operator contracts to provide service in more than one urban area, the government should insist that city information be kept separate, to be able to assess performance against other municipal water companies and to hold the company accountable to the citizens in each service area. Pricing formulas such as price caps that are inflation adjusted annually but only raised every five years, might also help reduce the information required during the period between adjustments. Regulators could contract out data gathering and processing, which might also enhance the information available and make it more credible to the public.

Greater involvement of consumers and other interests in regulatory decisions might be another way to reduce the burden on the regulator. This was not tried in our sample, although the practice is common in developed countries. None of the cities gave consumers (or other affected interests such as downstream users or farmers buying wastewater) opportunities to comment on regulatory decisions, and information sharing with the public was minimal. Even in Chile, where rules are clear and transparent in other ways, tariff setting is secret and consumers are ill informed about their rights and have no standing in the regulatory process. In Buenos Aires, public outcry was partly responsible for the regulator's decision to drastically reduced the proposed increase of water prices in 1998, showing that consumer activism can be a powerful check on company power. But it also illustrates the risk that consumer opposition will prevent price increases needed to assure investors a reasonable return. This risk is not a necessary result of consumer activism per se, but of a weak regulatory framework that gives consumers little information about the process, opportunity to provide comments before decisions are taken, or confidence that regulatory procedures are fair and

systematically applied. Comparative data about customer services (time to repair a burst pipe or respond to a billing mistake, for example) and costs could be standardized and published.

Metering is another device to increase regulator and consumer information and give consumers more control over their bills. As we have discussed, metering is usually not considered worth the expense in cities with ample water and no capacity or disposal problems. This ignores the loss of consumer control over the total bill when billing is based on consumption estimates, as in Lima, or a complex series of property characteristics, as in Buenos Aires. Complex unmetered billing also creates more opportunities for the utility or the consumer to manipulate information and gives more leeway for arbitrary action by the regulator.

In several of the cases we studied the regulators were weak because the underlying bureaucratic and legal institutions were vulnerable to political interference and had few safeguards against corruption or rewards for competence. Experience with public sector management reforms suggests that weak rule of law or weak bureaucratic norms of honest and competency can usually only be overcome in the long run. What can be done immediately is to try to simplify the regulatory burden. For example, transparent rules and rule making and standing for those affected by regulatory decisions (including consumers) in the decision process might help, as would more competition. Simplification of mechanisms governing the inevitable revisions and renegotiations of contracts and more transparent and published rules for revision should also help reduce the risk that the operator or the government tries to capture rents to the disadvantage of the consumer.

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