IMPACT OF PRIVATIZATION IN AFRICA: SENEGAL WATER

One of Eight Papers from a Project Entitled:
Assessing the Impact of Privatization in Africa
Funded by the Norwegian Trust Fund
Managed by the Investment Climate Department and Africa Private Sector and Infrastructure Department of the World Bank

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October, 2006

These studies focus on identifying and explaining results of various forms of privatization, defined broadly to include any significant transfer of management or ownership from the public to the private sector (that is, management contracts, leases, a*ffermage* contracts, concessions and full and partial divestiture). The first goal is to measure performance quantitatively to the extent possible with available data. The second goal is to explain that performance in terms of how the privatization was conducted. A key feature of the study is that performance covers equity as well as efficiency. That is, we attempt to measure the impact on various stakeholders: primarily consumers, workers, the government, and the new owner or operator. In sum, a successful privatization is not just one where the deed gets done, but where performance improves substantially and the results of that change are distributed equitably with sizeable public benefits to help build and sustain political support. The cases include failures as well as successes. One can learn at least as much from the former as the latter. The goal is to help replace faith-based policies with ones that are fact-based. The opinions expressed here are the sole responsibility of the authors and do not reflect those of the World Bank.

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ONAS	*Office National de l'Assainissement du Senegal* (national sanitation company)
SDE	*Senegalaise des Eaux* (private water operator)
SONEES	*Societe Nationale d'Exploitation des Eaux du Senegal* (old national water company)
SONES	*Societe Nationale des Eaux du Senegal* (new national water company)

EXECUTIVE SUMMARY

Initial conditions for Senegal's water sector reform were mixed, with poor financial performance despite relatively good engineering and technical capacity. The difference was due to low prices and the attendant lack of funds for investment plus, perhaps, poor financial management. Key features of the reform package included:

- **unbundling** the sector with separate organizations for sewerage, rural water and urban water;

- a new **state-owned asset-holding company** (*Societe Nationale des Eaux du Senegal*, SONES) to own the assets, oversee the entire sector, and be responsible for planning and financing investment;

- A private operator responsible for production, distribution and collection of urban water under a 10-year ***affermage*** contract.

- Notably, there was **no regulatory agency**: operator tariffs were set in the contract, the GOS sets consumer tariffs with the advice of SONES and inputs from SDE and the mediation role was played surprisingly well by officials at the responsible ministry; and,

- A sophisticated financial model to help balance financial and service goals.

The winning bidder was *Senegalaise des Eaux* (SDE), with the following shareholding: the French Societe d'Amenagement Urbain et Rural (SAUR) (57.8%), private Senegalese investors (32.2%), the government (5%) and former SONEES staff (5%).
Our primary task was to assess the net benefits of this process and the table below summarizes our bottom-line answer. The total gains were large, at 228 billion FCFA (US$ 457 million) and annually averaged 50% pre-privatization sales.

Impact of Water Privatization

Stakeholder	Net Present Value (1995)		Share
	FCFA million	US$ million	
Domestic	**232,814**	**466.4**	**1.02**
Consumers	157,687	315.9	0.69
Employees	-4,861	-9.7	-0.02
Government	73,081	146.4	0.32
Owners	1,198	2.4	0.01
Others	5,710	11.4	0.03
Foreign	**-4,959**	**-9.9**	**-0.02**
Owners	1,861	3.7	0.01
Lenders	-6,820	-13.7	-0.03
Total	**227,855**	**456.5**	**1.00**

Consumers were clearly the big winners, receiving about 70% of the estimated net gains, thanks to a roughly 50% increment in water consumed. But government also did very well, with about a third of the net benefits. On the other hand, workers and foreign donors were losers, though each lost only about couple of percent of what the winners gained. These results are of course sensitive to assumptions, but a Monte Carlo risk analysis suggests that the net benefits are much more likely to be larger than our base estimate rather than smaller.

What explains these considerable gains? We identify two sets of factors. First, the reformers did a world-class job on the institutional side. They took the time to "do it right", did their homework, spent a lot of effort on bringing all the stakeholders on board, got the regulatory principles right, and selected a form of contract appropriate to their goals. A very important feature was the flexible and professional attitude of the officials at SONES and the responsible ministry. An important illustration is what happened when the private operator discovered after the fact that critical technical information in the bid documents was wrong. This is common enough, but elsewhere it all too often leads to a hiatus or even exit of the operator. In Senegal, after tough negotiations, the technical efficiency targets were revised amicably. Some structuralists argue that all these good things happened because of the choice of the *affermage* form of contract, the creation of a state-owned asset holding company and no independent regulator. We would suggest instead that had the key features mentioned at the beginning of the paragraph been embodied in a different institutional model (lease contract with a regulator), results would likely not have been materially different.

The second set of factors is incentives. SONES has applied a high-powered incentive system in the contract with SDE. There are two key elements. The first is a very creative two-part compensation structure with many of the efficiency properties of the much better known two-part utility pricing. Briefly, SDE is paid for water at two rates. The bulk of the water is compensated at the bid price. But at the margin (around the levels set by collection and

technical efficiency targets) they are compensated or penalized at the full tariff rate which is approximately twice as high. That is. they receive a low average price but a marginal price which is roughly doubled. This provides an extraordinary incentive to achieve the targets. How important this is in practice of course depends on how hard these targets are, which is the second key element of the scheme. In fact, they are very hard to achieve. The technical efficiency (water billed over water produced) target is 85%, which is at European levels. SDE claims that even in Europe it cannot be achieved except in special conditions which do not apply in Senegal and is unachievable. SONES claims that it is possible. Regardless of who is right, it is clearly a very tough target. Three important results are thereby explained. First, SDE has developed a world class leakage identification and repair scheme which has been the object of study by European water companies. Second, SDE's achieved technical efficiency of about 80% is very high by the standards of less-developed countries (LDCs). Third, SDE's profitability has been low because they have been paying a penalty on a significant volume of water at the high rate.

In sum, if you want a success story of infrastructure privatization in Africa (or elsewhere in the LDCs), Senegal water is a prime candidate. It is certainly head and shoulders above the other seven cases we cover in our larger study.

1. WHAT WAS DONE? [1]

In assessing the state of Senegal's water sector at the outset of reforms, you need to distinguish between financial and technical conditions. Technical standards at the state-owned SONEES (*Societe Nationale d'Exploitation des Eaux du Senegal*), though far from ideal, were quite good for Africa (figures provided below in Section 2) and the managers and workers were generally well regarded. Financially, it was another story, especially following the 1994 devaluation of the CFA which halved the value of the currency and created a severe financial crisis for the country. The GOS was unwilling to set tariffs to cover costs and the company lacked the power to collect bills, particularly from public sector clients. By 1995 it was unable to settle its accumulating arrears with suppliers, let alone undertake necessary investments. The government (especially the responsible Minister at the time) then decided that a reform of the ***sector*** was necessary in order to build a ***sustainable*** structure that could provide the necessary improvement and expansion of the system without having to depend on government subsidies.

A steering committee was created in early 1994 with representatives of all government agencies concerned with water at the time (the ministries of Finance, Hydraulics and Industrial Development) as well as the offices of the President and the Prime Minister. The Committee carefully evaluated various reform options and studied the experience of other countries with the aid of an international consulting firm. It then decided to dissolve SONEES and designed a new structure for the sector with the following key elements:

- Further unbundling of the sector with separate organizations for sewerage (ONAS) and urban water (rural water had previously been made the responsibility of the Directorate of Hydraulics).

- A new state-owned asset-holding company (*Societe Nationale des Eaux du Senegal*, SONES) to own the assets, oversee the entire sector, and be responsible for planning and financing investment. It would have a 30-year concession contract and shorter performance contracts with the government. Unlike many asset-holding companies it did not sign the contract with the operator and was specifically prohibited from taking over operations if the operator departed.

- A private operator responsible for production, distribution and collection of urban water under a 10-year *affermage* contract.

- Notably, there was no regulatory agency: operator tariffs were set in the affermage contract and the GOS sets consumer tariffs with the advice of SONES and inputs from SDE and .

[1] In this section, we rely heavily on: Clarissa Brocklehurst and Jan Janssens, *Innovative Contracts, Sound Relationships: Urban Water Sector Reform in Senegal* (Washnington DC, World Bank, 2004). This is an excellent and comprehensive study, in part because one of the co-authors was a major player in the reform. If you are familiar with this, you'll learn nothing from this section and should move on to Section 2. Here we only give a summary of their much more comprehensive work.

- A financial model to help set tariff levels to ensure both financial viability of the sector and help the government achieve its goals in that sector.

- A Long-Term Water Project at the Ministry of Agriculture and Hydraulics officially to coordinate planning and policy. Unofficially, its coordinator and the Director of Hydraulics in the Ministry have played a very important role in executing the mediation part of regulation.

An international competitive bidding process for the affermage contract was then organized in two stages:

- pre-qualification, in which four pre-bidders were invited to comment on a Request For Proposal, then the final version was sent to all four;

- Actual bidding, which in turn was done in two stages: first submission of a technical proposal (all four participated). One bidder was eliminated for non-compliance. Following clarifications with other bidders, another was eliminated (for non-compliance with further essential requirements). The remaining two were then asked to submit financial bids. The winner was then selected based on the lowest rate per cubic meter.

The winning bidder was *Senegalaise des Eaux* (SDE), which was established in December 1995 with the following shareholding: the French Societe d'Amenagement Urbain et Rural (SAUR) (57.8%), private Senegalese investors (32.2%), the government (5%) and former SONEES staff (5%). This has been the structure governing the sector since mid-1996.

2. WHAT WERE THE RESULTS?

2.1. BASIC QUESTION AND ITS ANSWER

Senegal water is widely regarded as a success story, with even persistent critics acknowledging this. But conventional wisdom is sometimes wrong. To what extent do the data support this conclusion? One of our principal assignments is to test this with some rigor.

To avoid suspense, Table 1 gives our bottom line answer. What does it say? First the total gains were large, at 228 billion FCFA (US$ 457 million). This is about 10 times sales in 1995. However, this is comparing a stock (Net Present Value: NPV) with a flow (sales in1995), so we calculate the Annual Component of the Perpetuity Equivalent of the NPV (the annual perpetuity which would yield the same NPV: ACPE). The ACPE as a percentage of sales is 50%. That is, the average annual gain after privatization was equivalent to one-half of total revenue in the year prior to privatization. These are very substantial gains, so the conventional wisdom is upheld, in spades.

Table 1: Impact of Water Privatization

Stakeholder	Net Present Value (1995)		Share
	FCFA million	US$ million	
Domestic	**232,814**	**466.4**	**1.02**
Consumers	157,687	315.9	0.69
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How were these gains distributed across stakeholders? Consumers were clearly the big winners, receiving about 70% of the net gains. But government also did very well with about a third of the net benefits. On the other hand, workers and foreign donors were losers, though each lost only about couple of percent of what the winners gained. In the balance of this section we explain how these results were obtained.

2.2. METHODOLOGY

Throughout this set of cases we attempt to identify the impact on various stakeholders. But in this paper, we go further and do a systematic welfare analysis which results in the kind of numbers generated above. We first do a benefit-cost analysis and then distribute all benefits and all costs to the stakeholders to which they accrue. The methodology is described in detail in an appendix to our main report, but here we provide a summary. The basic benefit-cost framework is Harbergarian, so we capture second-order effects as prices adjust in each market from which the enterprise demands and to which it supplies. We have adapted the model so that distributional effects are also derived. The core of the work is in a one-hundred line market module which incorporates such standards as price, quantity, taxes, subsidies and consumer surplus, but also less common features such as rent-seeking, non-price rationing and externalities. There are 18 of these market modules (seven for outputs, five for inputs, one for labor plus others for the impact on things like foreign exchange and domestic capital markets. Consistency is maintained across markets through profit and loss, cash flow statements and balance sheets. We cover a fifteen-year period after privatization, including seven years of actual data and eight years of projections. We do all this twice, once for the privatized enterprise and once for the counterfactual enterprise as we conjecture it would have performed without privatization. The net benefits of privatization are then the difference between the two runs. The impact on each stakeholder follows.

2.3. CONSUMERS

A primary goal of the reform was to increase the benefits to consumers. To what extent was this achieved? Privatization can impact consumers, for better or worse, in three ways:

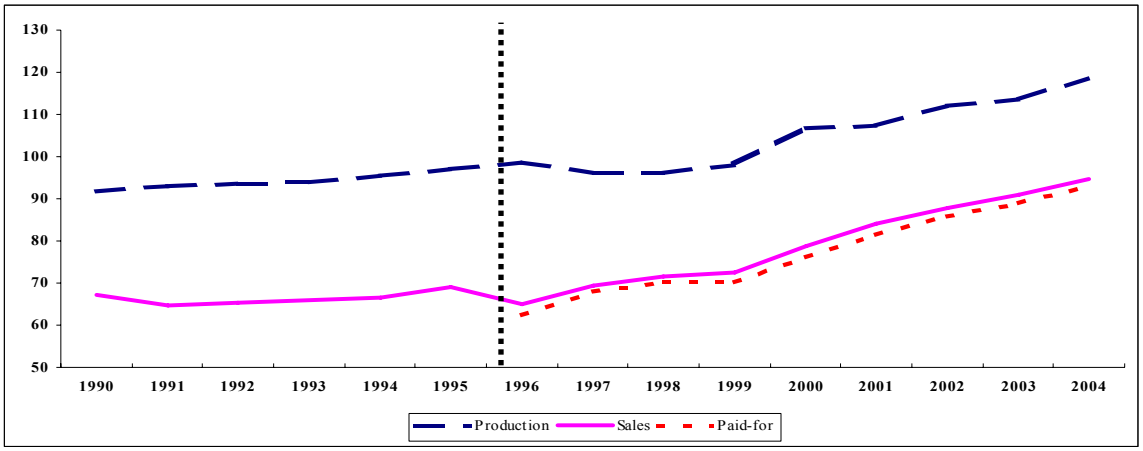
- access to greater quantities, either through additional supply to existing consumers or through increased access by new consumers;
- price changes; and
- quality changes either through purer water or improvements in service (billing reliability, response time for service calls, etc.).

A common result in water privatizations around the world is that quantity and quality improved, but at the expense of much higher prices. How did this work out in Senegal?

2.3.1. Quantity of Potable Water

Figure 1 provides a historical series of the quantity of water produced, sold and paid-for since 1990 while Table 2 compares growth rates for the pre (1990-1996) and post (1996-2004) periods. First consider production. The pre-privatization period saw steady but unspectacular growth at an average annual rate of 1.2% whereas the post-privatization period saw unsteady growth averaging 2.3%. Just comparing the growth rates makes it look like progress was twice as fast under private management. However the latter average ignores the sources of the variance in the later period. In 1996 it appears that peak use of the existing capacity was reached. Then deterioration of the existing network, coupled with significant cuts in electricity, resulted in a decline in production in 1997 and 1998. Then in 2000 production jumped due to the coming on line of the Ngith treatment plant which expanded capacity by 23%. That expansion appears to be the primary reason that output increased in the latter period. Adjusting for that, there is no convincing evidence that private management was any better than public management at using existing extraction capacity. Since it is doubtful that funding for Ngith would have been obtained without the reforms, the growth can be attributed to the process in general, but not to the heightened technical and managerial skills of the private operator.

Figure 1: Production and Sales of Potable Water (million m^3)



Source: Table 19 in Appendix A.

Table 2: Average Annual Compound Growth Rates Before and After Privatization (%)

	1990-1996	1996-2004
Production	1.2	2.3
Sales/Billed	-0.5	4.8
Paid-for Water	NA	5.1

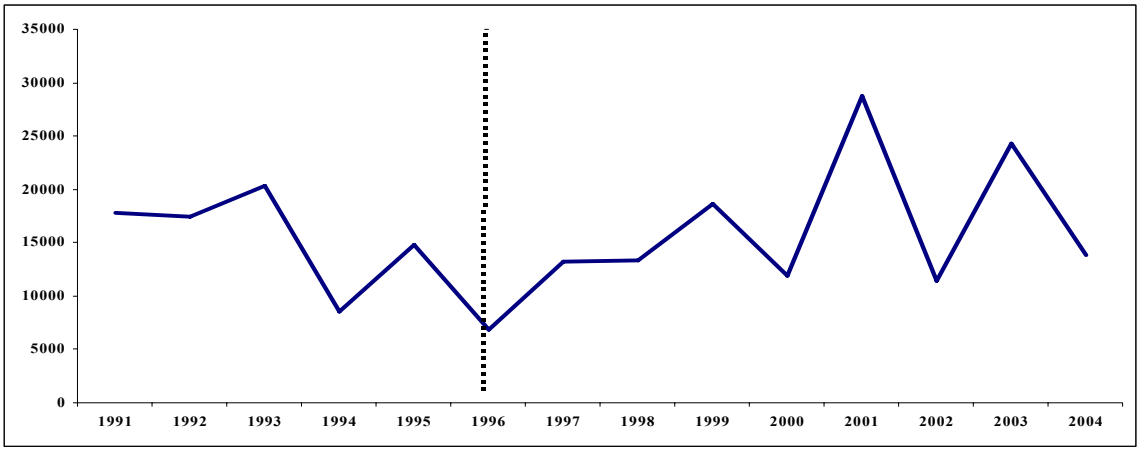
Source: Table 19 in Appendix A.

Water distributed, however, shows a very different picture, going from flat-line to steady growth at about 5% per year. This is the sort of clear performance kink that one looks for as evidence of improved management. The paid-for water series shows similar growth in the post- period, but no pre- data are available. So, we have no evidence of trend in produced water, but marked improvement in distributed water (and almost certainly in paid-for water as well). Why this differential performance by the private operator? And just how good is 5% anyway? We'll try to answer both questions below. Here we only emphasize: that the most important thing is water to the consumer; that this is better measured by billed than by produced water; and it is billed water where the performance kink occurred, so reform has helped make consumers better off in terms of the quantity of potable water.

How was this gain distributed? Did it go to more water for old consumers or to increased **access** by new consumers? This is an important question, because water is storable, so getting water for more hours per day just adds convenience while getting access for the first time means drinking safe water. For example, we would argue that giving two consumers access for 12 hours a day is better than giving it to one for 24 hours. Figure 2 provides some evidence on this issue by showing the annual increase in connections. There is a 7% increase in the post- period average over the pre-, but the average ignores a clear change in trend, from downward in the pre- period to upward in the post-. We will attempt to quantify this effect in our counterfactual section below. Here we only note that new connections accelerated after privatization and that the welfare impact that water provided to these

connections was significantly more valuable than additional water provided to pre-existing connections.

Figure 2: Number of Additional Connections



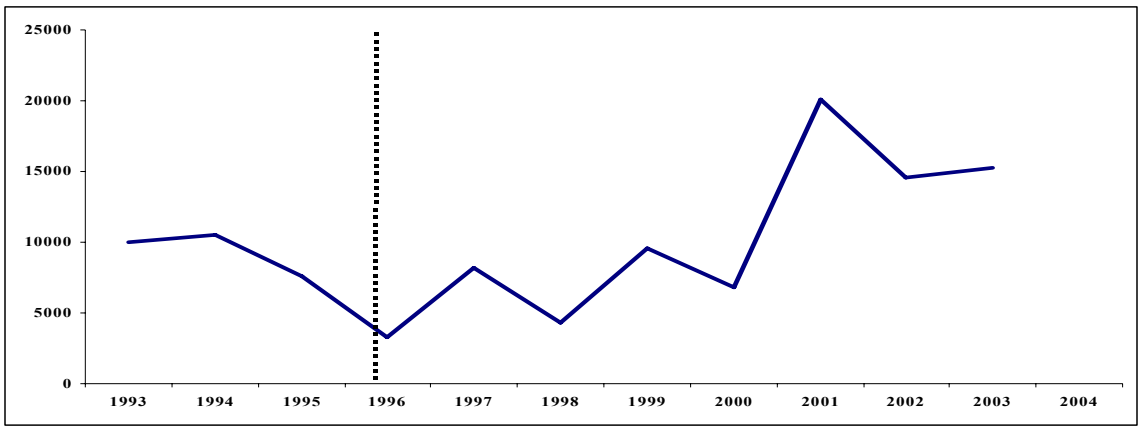
Source: Table 20 in Appendix A.

Cutting distribution on a different dimension, have the poor benefited? Special benefits to the poor were to have been provided in four ways:

- Subsidized tariff at low consumption levels: household consumption under 10 m^3 per month is priced at a "social tariff", which is cross-subsidized from higher consumption levels;
- Expansion of public standpipes: which usually serve poorer neighborhoods;
- "Distributing the Deficit": meaning shifting from a policy that cuts off poor neighborhoods at the expense of rich ones, to equal cuts; and
- Social connections: which are subsidized connections for households meeting particular poverty criteria.

With no adequate comparative data available on the first three points:, let us examine the fourth. As Figure 3 shows, the number of social connections had been on a declining trend until 1996 and an upward trend since then. So, while the program was designed to give special assistance to the poor, there is only a single piece of evidence to show that this happened.

Figure 3: Number of Social Connections



Source: Table 20

So overall, privatization has resulted in a noticeable increase in the quantity of water that reaches consumers and in the number of customers with access to water. What about the quality of water provided to these customers?

2.3.2. Quality

Water quality data are available only since 1996, so a standard comparison of pre- and post-privatization cannot be done. Instead, we assume that pre-privatization levels were reflected in the target measures set in the private operator's performance contract. This probably overstates the quality levels before privatization but we prefer to use conservative assumptions. The two measures of water quality presented in Table 3. The table shows a clear improvement after privatization: microbiological conformity during the post- period has averaged 96.6% (versus 96.0% pre-) and physical-chemical conformity has averaged 97.7% (versus 95.0% pre-). That is, starting from a very high level, things got better and a bit faster than targeted.

Table 3: Indicators of Water Quality

	pre-1996	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average 1997-2004
Microbiological Conformity											
Target (%)		96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
Actual (%)	96.0	96.0	95.0	95.4	96.7	97.5	97.9	97.1	98.0	97.7	96.9
Physical-chemical conformity											
Target (%)		95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Actual (%)	95.0	98.8	97.1	96.3	96.8	98.3	98.1	98.7	98.95		97.7

Sources: SDE, SONES.

The other dimension of water supply is quality of service. Available data, such as they are, are given in Table 4. It shows the number of claims and complaints rising substantially but

the speed of resolution also increased by 2003. Given the absence of any time series overlapping pre- and post- we draw no conclusions from this.

Table 4: Indicators of Service Quality

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number of registered claims						28,104	79,705	53,571		82,857	90,493
Resolved claims within required time						23,868	65,807	47,970		71,536	75,256
(%)						84.9	82.6	89.5		86.3	83.2
Number of complaints						20,642	53,789	44,130		64,783	57,445
Resolved complaints within required time						17,840	44,984	39,176		55,203	54,673
(%)						86.4	83.6	88.8		85.2	95.2
Number of leaks	29,585	28,363	32,620	34,083	36,619	36,036					

Sources: SDE, SONES and SONEES.

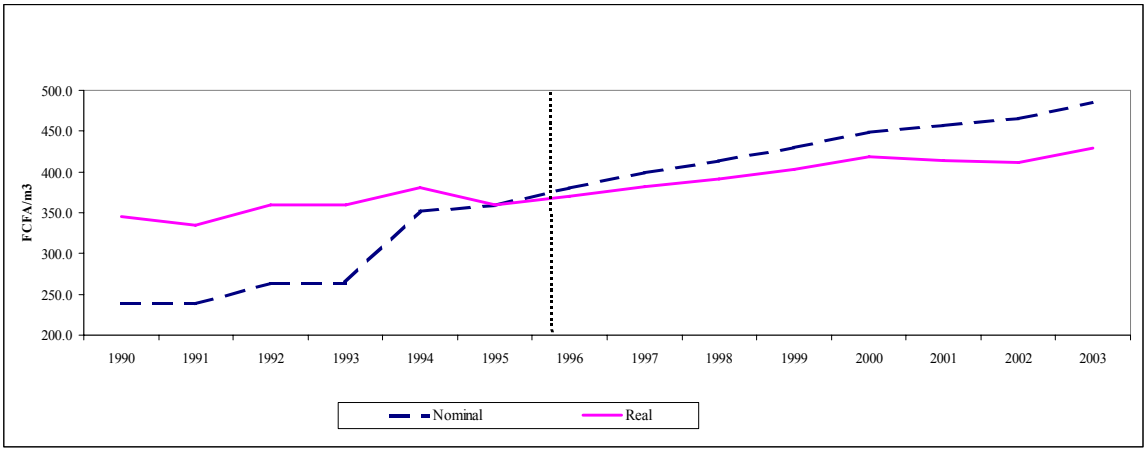
Some would argue that hours of service is a key indicator. We treat this as simply the primary means by which additional water is provided to old consumers. We treat the important difference between water going to old and new consumers in detail in a later section.

2.3.3. Price

What about prices that consumers paid? The actual tariff structure is rather complex but

Figure 4 provides an indicative average price paid by consumers both in nominal and real 1995 prices. Prior to the reform, the average tariff underwent two major increases (one of 10.5% in 1992 and the other of 33.6% following the FCFA devaluation in 1994). The compound average annual rate of increase was 8.1%, but this was a high inflation period, and the real increase was a mere 1.2% annually. Since 1996, the nominal tariff has increased steadily, at an average annual rate of 3.5%, which translates into 2.1% in real terms. The 3.5% rate of increase after privatization was a decision made before privatization. Using the financial model, this was the compromise reached between maintaining a politically acceptable rate of increase on the one hand and the need to eventually cover all costs and make the sector sustainable. So, while nominal tariffs increased more slowly after privatization, what matters is real tariffs and these went up a bit more rapidly. But, this is clearly not one of the Latin American cases where rates jumped substantially.

Figure 4: Nominal vs Real Average Price of Water for All Consumer Groups



Source: Table 21 in Appendix A.

What about the impact of this increase on various groups of consumers? Figure 5 shows the trends for major groups, and Table 5 gives the average annual increases in the tariff of major consumers before and after privatization. With the exception of small gardeners, all groups appear to have been subjected to comparable increases in tariffs in both periods.[2] As for small gardeners (*petits maraichais*), their tariffs were subjected to higher increases in order to encourage conservation. The most important result is that prices went up half as fast in nominal terms under the reform structure but by several multiples in real terms.

[2] Note that the data show that among the major consumer groups, only small gardeners were subjected to a high tariff (which explicitly aimed at discouraging previously excessive consumption). The tariff for government agencies increased by the same amount as that of other groups, despite the explicitly stated goal of the reform to discourage excessive consumption by these agencies. According to the ICR (p. 7), "Significant results have ... been obtained in the action plan to reduce the water consumption of state agencies, which decreased from 27,700 m^3/day in 1996 to 22,700 m^3/day in 2003. This is below the reduction target of 10,000 m^3/day ..., but the target proved elusive because the initial baseline was actually overestimated." In our view, one major explanation for the lack of achievement of the target is the tariff, which remained too low to discourage consumption.

Figure 5: Selected Nominal Price Series for the Largest Water Consuming Groups

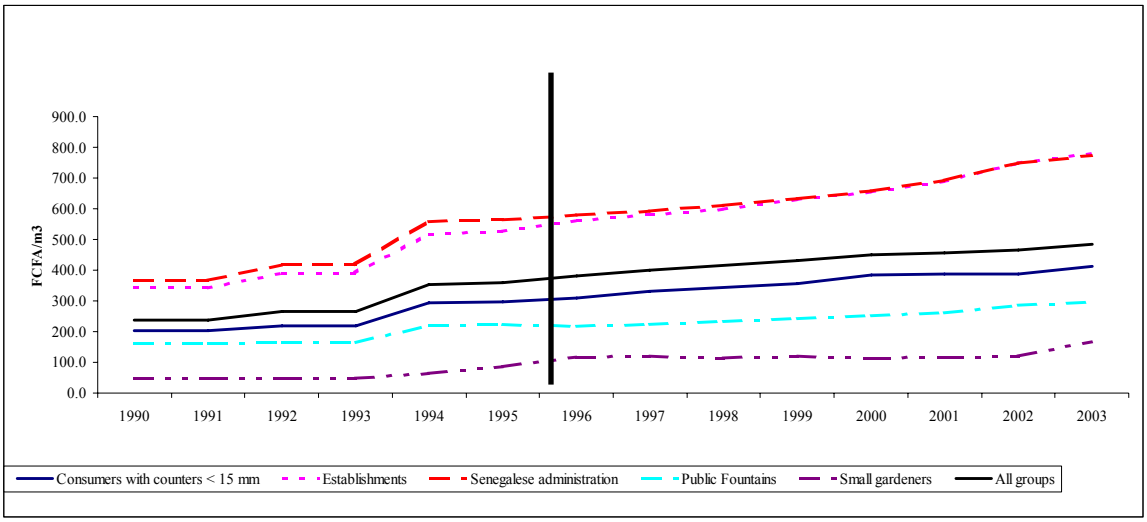


Table 5: Average Annual Increase in Tariff Before and After Privatization (%)

Major Consumer Group	Nominal		Real	
	1990-1996	1996-2003	1990-1996	1996-2003
Consumers with meters < 15 mm	7.4	4.1	0.6	2.7
Establishments	8.5	4.8	1.6	3.4
Senegalese administration	7.8	4.2	0.9	2.8
Public standpipes	5.1	4.4	-1.6	3.0
Small gardeners	15.9	5.2	8.6	3.7
All groups	8.1	3.5	1.2	2.1

Sources: Table 21, Table 27 and Table 29.

Table 6 compares the average tariff paid by consumers in Senegal with that in other countries/regions. Trends here of course tell us more about Foreign Exchange rates than tariffs, and should be ignored. But comparing countries in any given year can be useful. Two points are worth noting:

- Pre-privatization tariffs in Senegal were already high in comparison with other countries, in Africa as well as Asia; and,

- Privatization in Senegal brought prices to a comparable level to other West African countries.

Table 6: Average Prices ($/m^3) Paid by Consumers in Senegal vs Other Countries

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Senegal	0.85	1.00	0.93	0.64	0.72	0.74	0.68	0.70	0.70	0.63	0.62	0.67	0.84	
Uganda						1.05	1.06	0.81	0.73	0.54	0.56	0.54	0.54	0.58
Mozambique						0.20	0.29	0.28	0.40	0.32	0.31	0.36	0.41	
West Africa					0.67	0.73	0.68							
Asia					0.36						0.24			

Sources: for Senegal, SONES. For Uganda, Jammal/Jones *Uganda Water*. For Mozambique, Gokgur/Jones *Mozambique Water*. For West Africa, World Bank *Water Benchmark Indicators: West Africa*. For Asia, ADB *Water in Asian Cities Utilities' Performance and Civil Society View*.

In sum, high prices have not been a contentious issue with Senegalese consumers: prices were high before privatization and grew only slightly faster after. But the quantity of water, access and quality all improved, so consumers almost certainly were net winners from privatization.

2.3.4. Welfare Measurement

What do consumers gain from more potable water? Answering this question is central to ascertaining net benefits in the utility sector, so we give a detailed explanation.
It is not the cash value of what they pay for the water because that is offset by foregone consumption or saving elsewhere. Rather, it is the value of the excess of what they are willing to pay above what they actually paid (consumer surplus). There are three ways of measuring this (plus combinations). We illustrate these using a stylized version of the largest market (small consumers) with round numbers for prices and quantities that reflect the orders of magnitude that actually obtained in 2001/2002 (price = 400; quantity without project = 30; and quantity by project = 10).

The World Bank's economic evaluation of the project uses the standard methodology with a price elasticity of demand (ε_D) of -0.2. This is illustrated in Box 1 with consumer surplus measured at the far right as the little triangle between price and willingness to pay. This produces a consumer surplus of 2500 million FCFA for the 10 million m^3 increment attributable to privatization in this year. That is, on average, the benefits of water are FCFA 250/m^3, compared to a price of FCFA 400. This value is dependent on the elasticity: as the absolute value of the elasticity increases, the value goes down, and vice versa. We do not debate the particular value here, but deal with it below as a key sensitivity parameter.

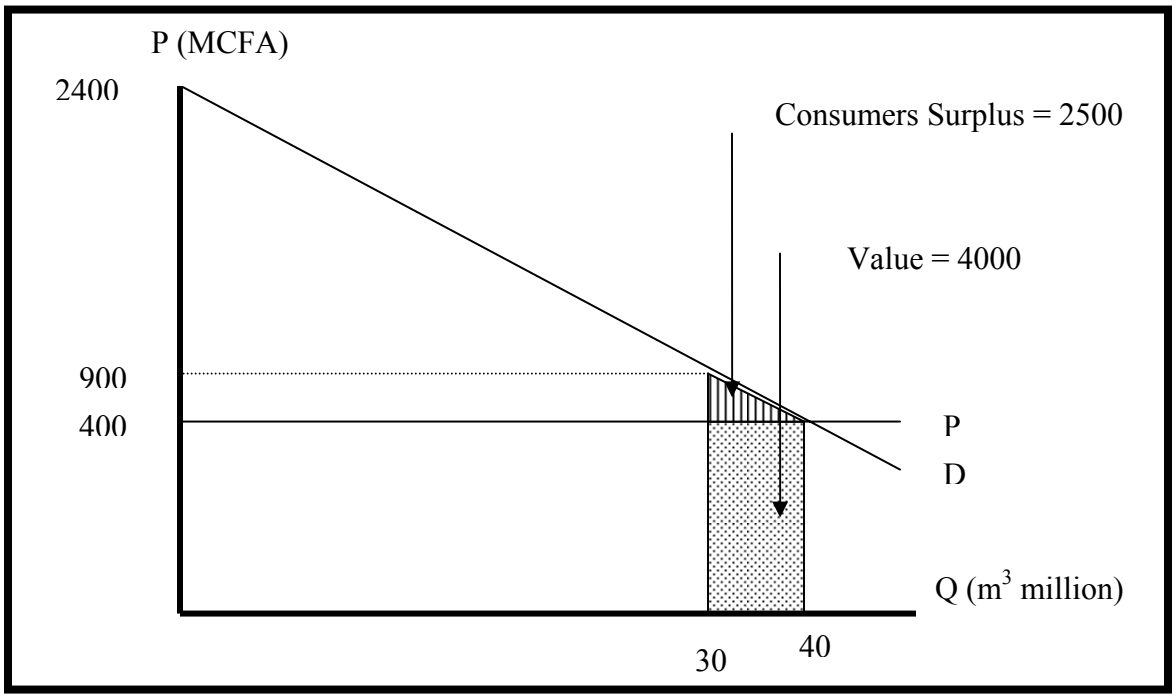
The approach illustrated in Box 1 assumes that everyone who is willing to pay FCFA 400 for water, gets it; that is, there is no unsatisfied or excess demand. This is often/usually not the case in LDC utility sectors, and is certainly not the case in the Senegal urban water sector. Box 2 shows how this excess demand is dealt with, illustratively assuming excess demand of 20 m^3 without privatization and 10 with. Now water is considerably more valuable to the consumer, averaging FCFA 600/ m^3

Both of these approaches assume consumption is at the margin. That is, it is the highest value uses that are satisfied and only the lowest valued uses go unsatisfied as would happen if there were price rationing. If you believe the linear demand curve displayed (with ε_D =-.02 and interpreted as an arc elasticity) then it says that some households are willing to pay as much as 2400 FCFA per m^3 of water at the high end. But at the low end some households are willing to pay only 400 FCFA for washing the front steps. Which of these values should be used? For consumers who already have access, then using the low value is fine because they already were getting the high-value water. However, when households first gain access to water, they are willing to pay the full 2400 for some of it and some of the consumer surplus is measured between the price line and the demand curve at the far left, a much greater value than at the far right. But some of it also goes to low-value uses, so what we intuitively want is some sort of average price. We do this using a modified Harberger/Jenkins model with excess demand and non-price, random rationing as shown in Box 3[3]. The shape of the consumer surplus triangle will be unfamiliar to most, but it just says that intuitively that the average consumer surplus per unit is exactly half the difference between FCFA 400 and FCFA 2400. Measured this way, consumer surplus is FCFA 1000/m^3, or four times as much as the standard measure because it allows for some highly-valued infra-marginal water. Does this value meet the common sense test? Is it reasonable to assert that some consumers in Dakar would be willing to pay 2400 FCFA for the first m^3 of water delivered to their home? Well, a liter of bottled water goes for about 300 FCFA, which translates into 300,000/m^3. Bottled water is both more desirable (cleaner) and less desirable (you have to lug it home instead of turning on the tap), but valuing tap water at 1/125th of bottled water would not seem outrageously high.

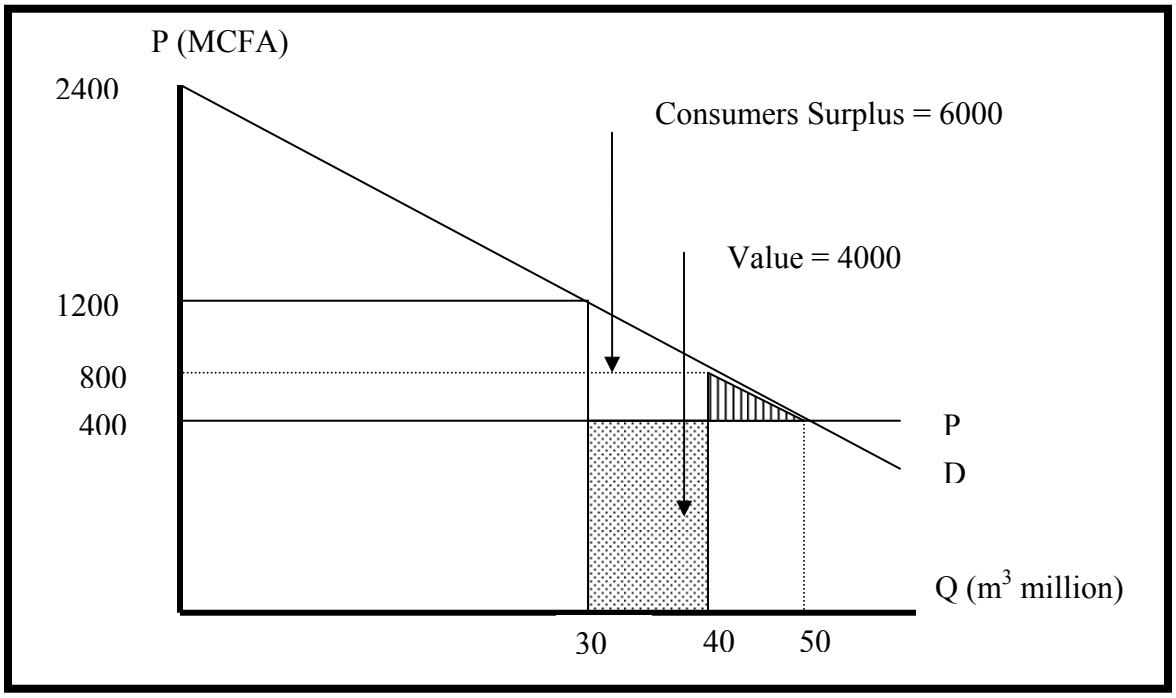
Obviously, this is not some minor technical methodological issue, but rather something that cuts to the heart of evaluating water (and other public utility) projects and policies. *When a household first gains access to water at FCFA 400 per m^3, is the consumer FCFA 250 better off as in the conventional marginal model or FCFA 1000 as in the infra-marginal rationing model?* Since the rationing model will be new to most, we doubt that it will be acceptable to most, let alone many, readers, so we will also report the conventional results. But we'd like the reader to try the thought experiment of placing themselves in the position of just getting water for the first time and asking which of the answers in the italicized sentence above would better describe their change in welfare. One of the authors was without water for four days while working on this report and its restoration did not make his household marginally better off, but euphorically better off. This experience may color our judgment, but we think that it would be true for most people, and getting access to water for the first time does not result in a small gain in welfare, but a major one. And that gain would seem to us to be a multiple of the price actually paid for water, rather than a fraction of it. While there are problems with the rationing model, we believe that it is much more representative of the actual change than the conventional one, and so we use it in our base run.

[3] Arnold C. Harberger and Glenn Jenkins. *Cost-Benefit Analysis for Investment Decisions* (Kingston, Ontario: Queen's University, 2002).

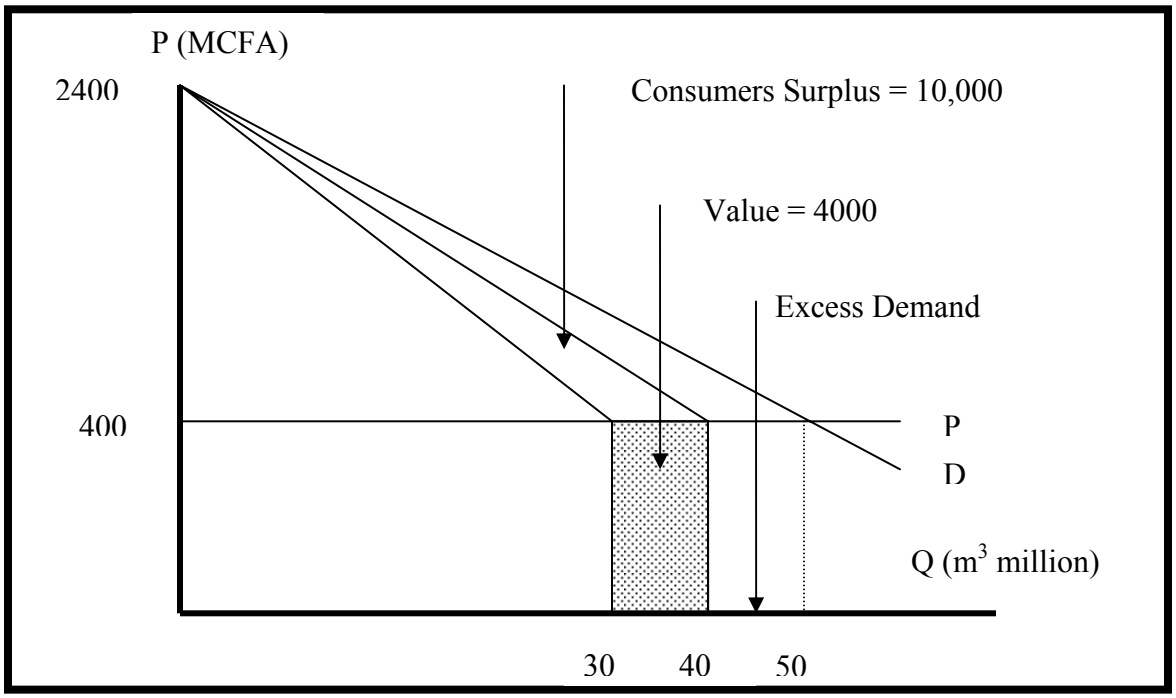
Box 1: Standard Measure of Consumer Welfare
(price rationing and no excess demand)



Box 2: Consumer Surplus with Excess Demand and Price Rationing



Box 3: Consumer Welfare With Excess Demand and Random Rationing



The foregoing does not apply to all water, only to that supplied by new connections. We know the total number of new connections[4] but not the volume supplied. So some of the new water went to old consumers, warranting the standard consumer surplus measure, and some to new consumers, warranting the new measure but have no basis for knowing how much went to each. We arbitrarily set the ratio at 50/50 in the base run and deal with the resulting ambiguity in our sensitivity analysis.

To implement the rationing model, we also need to describe how excess demand was calculated. We started with 1998 demand projections for urban water in Dakar,[5] subtracted actual sales in Dakar to get excess demand there, and then scaled that up proportionally system-wide and down proportionally for each consumer sub-group.

The foregoing applies to six of the markets in our model, broken down by pricing regime:

- private consumers;
- establishments;
- Senegalese administration;
- public standpipes;

[4] Appendix A, Table 20.

[5] International Finance Corporation, *Approvisionnement en Eau Potable a Long Terme Pour la Region de Dakar*, Seminaire, Dakar 2 et 3 mars 1998. Projections, provided in low, medium and high case scenarios, appear to be based on various assumptions regarding: population growth, consumption per person per day, price elasticity and revenue elasticity.

- small gardeners; and,
- others.

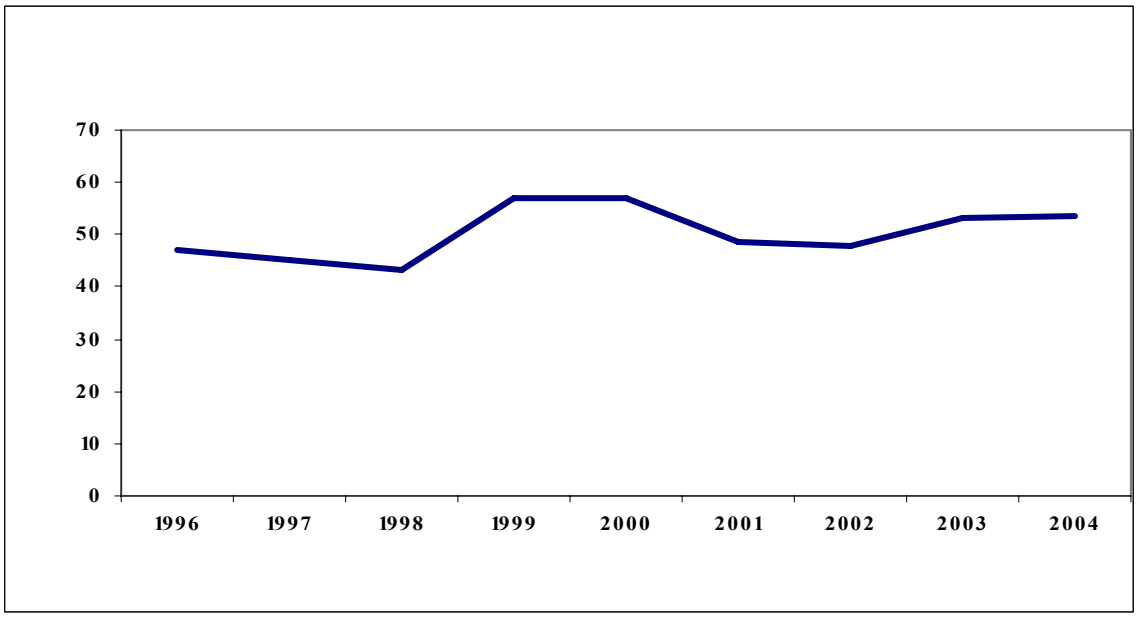
There is, however, a seventh market, namely water stolen or not paid for. Since this doesn't appear on the books of SDE, it is often ignored, but it does benefit some consumers. One may wish to discount these benefits on moral grounds; or one may want to give them extra weight if they largely go to the poor. We don't make either argument, but treat this like any other market, except for two details. First, the price paid to SDE is zero. Second, not all the resulting consumer surplus goes to consumers. Some of it is paid as rent to facilitators who make the illegal connections or connive in meter misreporting. That is merely a redistribution. But some is also lost to the real resource costs of rent-seeking (the time, materials and worry that go into avoiding the law). How much goes to each? We confess to having no empirical basis for answering this question, so we arbitrarily set the breakdown at one-third each (consumers, rent-seekers, and resource-costs). Some will undoubtedly be uncomfortable with this casual empiricism. So are we, but we think that it is better than assuming rent-seeking to be zero, as we do in the other six markets.

How did we estimate the size of this market? The billed but not paid-for component comes directly from the commercial efficiency indicator described in detail below. The stolen component is a little harder. We know technical efficiency (also described below), but do not have data on its three components:

- system leakages (due to old or faulty pipes);
- theft; and
- metering inaccuracies: we were told that the best quality meters guarantee an accuracy of only +/- 4%, and that it has been generally observed that, as they age, meters tend to understate the readings.

This tripartite breakdown is not monitored by SDE or SONES. We do have data on the number of leaks, as given in Figure 6 below. But that is a weak proxy for volume because a break in a big main is weighted equally to a break in a connection to a single house.

Figure 6: Average Annual Number of Leaks
(per million m^3 of production)



Given these limitations, we constructed an order-of-magnitude estimate starting from the best guess of a source with first-hand knowledge of the SDE operation. He gave the following proportions (relative to production) for 2004: 11% for system leakages, 4% for thefts and 5% for meter understatement. We used these figures as 2004 benchmarks and backcast to earlier years. The broad parameters of the backcast were clear from this and other interviews:

- Post-privatization percentage reduction in theft was much more rapid than for leakages because the latter was heavily constrained by infrastructure and management discretion was limited. Major reductions in leaks did not begin until the introduction of a state-of-the art leak-management system in 2004. And leaks actually increased significantly in 1999 when the Ngith capacity expansion allowed more sustained high-pressure in the system.

- Pre-privatization there was little progress and no reason to assume relative changes in the composition of unaccounted-for water; and,

- The most stable element in the series was metering inaccuracies and the least stable was leaks, which were variable in number and even more variable in volume.

We quantified these generalizations by assuming a 5% annual reduction in theft and a 2% reduction in meter under-reporting during the privatization period with leakage as the residual. No change in composition was assumed in the pre-privatization period. A graph depicting the resulting trends will be given below after we add projections and counterfactuals.

2.3.5. Projections and Counterfactuals

2.3.5.1. General Considerations

Thus far we have dealt with the factual scenario. Here we outline how we made projections through 2011 and developed the non-privatization counterfactual. The projections are straightforward: except as noted below, we relied on the Financial Model.[6] Telling a counterfactual story is considerably more subjective. In telling the story of what would have happened in the absence of privatization, we rely on two principles.

- **Conservatism:** in our base run we try to be cautious in estimating the gains from privatization. We do relax this a bit in the Monte Carlo model described below by allowing for asymmetric distributions of the relevant parameters.

- **OOM Tolerance:** We believe that imperfect order-of-magnitude (OOM) estimates of the right numbers are preferable to perfect estimates of the wrong numbers.

We illustrate these principles in some detail with the first counterfactual assumption below. While the same principles apply to the rest of the counterfactuals, we do not belabor them via repetition.

2.3.5.2. Quantity of Water

As we have seen, a major source of increased output was the expansion of the Ngith plant. A key counterfactual is whether or not this would have been done in the absence of privatization. Part of the answer is easy: interviewees from all sides were unanimous in asserting that it could not have been funded *at that time* because the donor community was in no mood to do so and the borrowing power of the GOS was limited. The hard part is deciding whether this meant it would not have been built (in the time frame we evaluate) or whether its construction would only have been delayed, and if so, by how much. The case for delay is that donor attitudes soften over time in the face of overwhelming social need, so that someday, someone would have provided funding. We think this is a sound argument, witness the World Bank's current more flexible attitude towards private-public partnership. So the counterfactual is that Ngith would have been built anyway, but with a lag. But how much of a lag? We conjecture that the likely minimum would have been four years, so applying the principle of conservatism we set the lag at that length, though we think it much more likely that it would have been longer rather than shorter. And, the principle of "OOM Tolerance" says that we are much more comfortable with this ad hoc approach compared with the extremes of having been built at the same time or never having been built at all.

With this assumption in place, the volume of water delivered to consumers is a function of production and distribution efficiency which we defer to the section on Enterprise Impact. But the bottom line is a lot more water delivered to consumers, totaling 250 million m^3 over 15 years. This is an annual average increment of 16.6 million m^3 or about 50% more than

[6] . The version we used was labeled "Modele eau Senegal 15dec04_ct" and dated 12/24/2004.

was provided pre-privatization.

2.3.5.3. Price

How would prices have been set in the absence of privatization? Would the sector have stuck to the discipline imposed by a financial model or would the GOS have eventually succumbed to the temptations of social pricing and a lack of financial discipline? While we are generally disposed to the latter argument, we can make no strong case for its application in Senegal, so our counterfactual is that prices would have been the same under public or private operation; that is, that pricing was a matter of government policy independent of privatization.

2.3.5.4. Quality

Earlier results showed a small gain in water quality after privatization, albeit if from a high starting level. One could argue that these resulted from the incentives in the private performance contract. But the effect would be small and notoriously controversial to value, so we assume counterfactual water quality to be the same. Similarly for service quality.

2.3.5.5. Summary

The only consumer gains we attribute to privatization are due to increases in consumer surplus following from the earlier construction of Ngith and the greater production and distribution efficiencies to be described later. We estimate the 1995 NPV of these at 157,687 million FCFA. It would be much easier to tell a story with greater consumer gains than with smaller as we shall show in the sensitivity analysis.

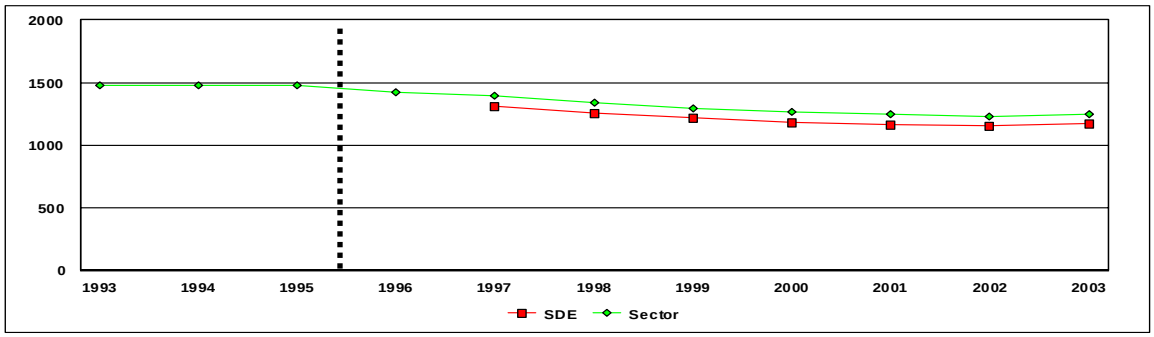
2.4. EMPLOYEES

2.4.1. Factual Results

How did employees fare with privatization? SDE's labor union representatives had two main complaints: a decline in employment and a reduction in worker wages and benefits. How do these views square with the data?

As Figure 7 shows, employment in the sector (SDE plus SONES), declined both before and after privatization, but decelerated slightly from -1.9% before to -1.8% per year after. Virtually all of this was at SDE as SONES levels were stable. The decline (about 20 workers per year) was not accomplished by lay-offs but by natural attrition (retirements, deaths, voluntary resignations) and firings for cause, according to company officials. However, union officials claimed that there were about 10-15 "involuntary" resignations per year.

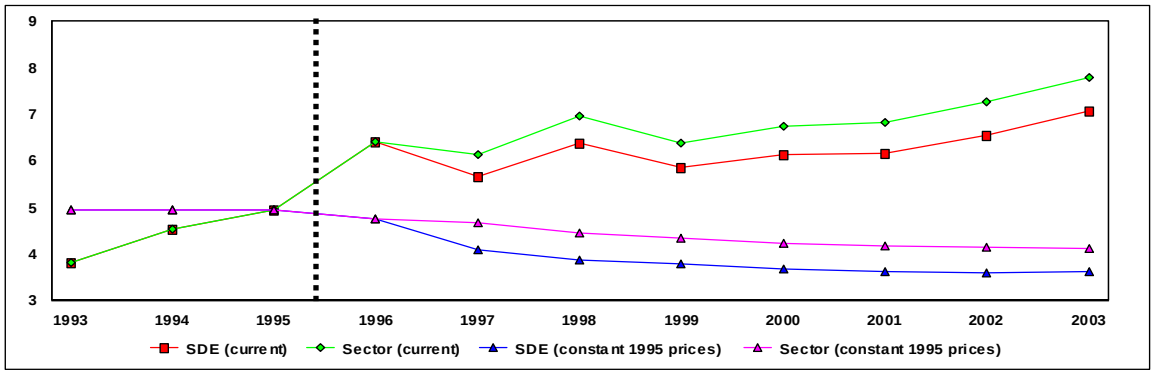
Figure 7: Number of Employees



Source: Table 22

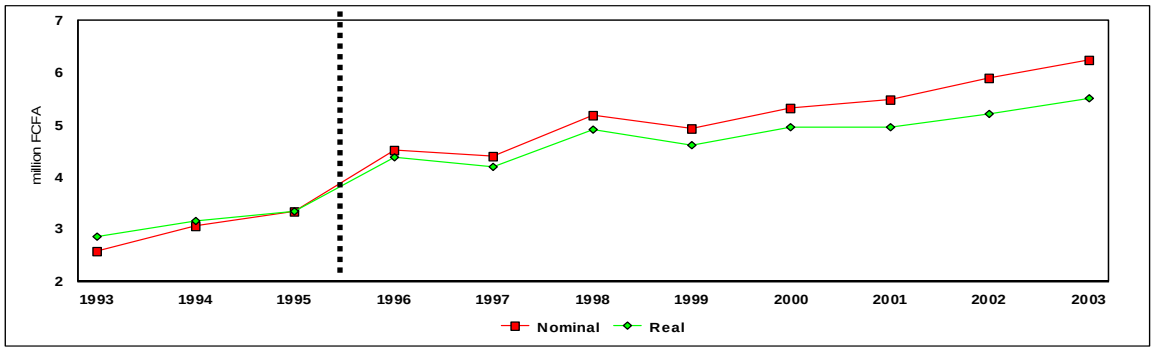
What about compensation? Figure 8 shows that while the sector's total nominal personnel costs show a steady upward trend (at an annual average rate of 2.8% after privatization compared to 19% before), the price-adjusted series was declining steadily (at an annual rate of -2% after privatization compared to -1.3% before). How does this translate to the average per worker? As Figure 9 shows, average wages and benefits have continued to increase during the whole period, although at a substantially lower rate after privatization: nominals at 20.5% before privatization compared to 4.8% after, and real compensation at 15.3% before compared to 3.3% after. That is, the effective average compensation policy before privatization provided a very generous adjustment over inflation and that after privatization continued to provide an increment over inflation, but a much less generous one.

Figure 8: Total Labor Costs, Current vs Constant 1995 Prices (billion FCFA)



Source: Table 22

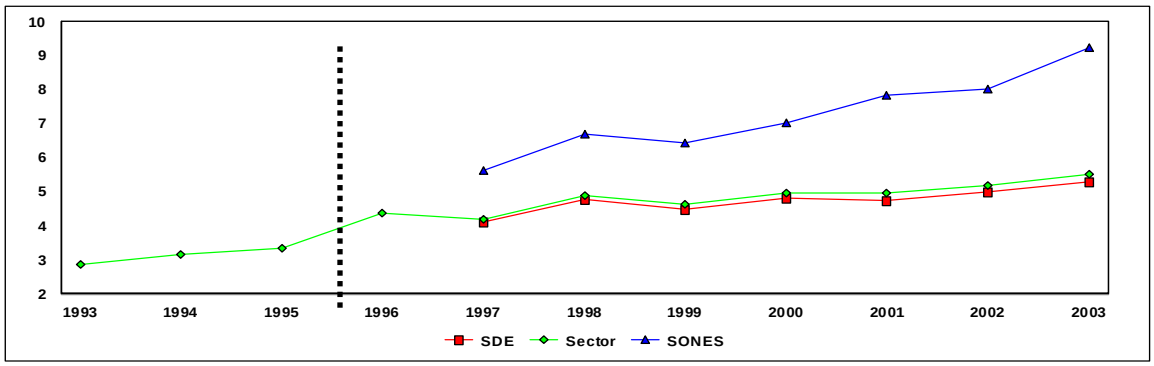
Figure 9: Average Unit Labor Compensation for the Sector (Nominal vs Real)



Source: Table 22

However, the average wage could conceal some important differences among classes of workers. One breakdown is straightforward, namely that between SDE and SONES. As shown in Figure 10, average SONES compensation was initially about 40% more than that at SDE. This is easily explained qualitatively in terms of the much higher average skill level. However, real average compensation at SONES rose at an 8.5% rate (10% nominal) while that at SDE rose at about half that rate (4.3% real and 5.7% nominal). The lower rate of increase in wages at SDE is presumably due to cost-conscious private management. The higher rate of increase at SONES is due to some combination of changing composition, incentive wages and possibly less cost-conscious public management.

Figure 10: Average Real Unit Labor Cost (million FCFA/person)



Source: Table 22

What about trends within SDE itself? Did the SDE/SONES pattern repeat itself, with higher skilled managers and engineers, sometimes highly paid foreigners, getting bigger increases so that workers did worse than the average portrayed above? Unfortunately, we could obtain no data on compensation by class to support such an analysis. One piece of the answer is clear: the number of expatriates actually dropped from 14 in 1996 to 4 in 2004. To the extent foreigners are much better paid, workers would therefore have had a higher than average gain, not lower. It remains possible that the four expatriates plus Senegalese managers received such huge increases that the workers did lose, though that is mathematically unlikely given the small number of

individuals at the top. In any event, it was not the case when SDE introduced a new salary grid beginning in February 2005, which resulted in increases averaging annual rates of 2.4% for laborers, 1.5% for mid-level workers and 0.8% for executives.

2.4.2. Projections and Counterfactual

Projections again follow the financial model. Given pre/post and SONES/SDE wage growth rate comparisons, it seems highly likely that wage policy in an un-privatized sector would have been more generous. We therefore use a counterfactual real compensation growth rate at the average of the sector (excluding the large jump in 1996 which was privatization related) before privatization and SONES after. This makes the real counterfactual rate (between 1996 and 2003) 6.8% versus the privatized 3.5%. For the employment counterfactual we assume employment unchanged from 1996.

2.4.3. Welfare Implications

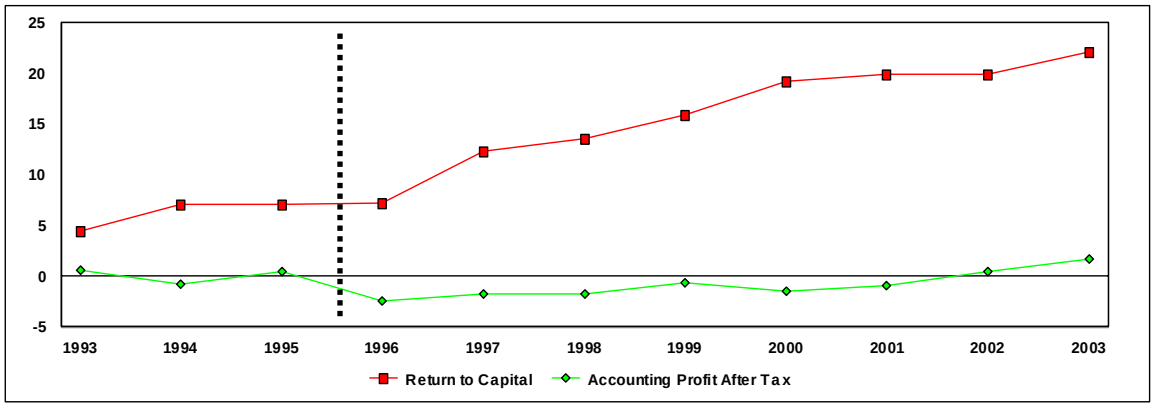
How do we value the loss in employment? Some might think that this depended on the dispute as to whether or not some of the attrition was "involuntary". This would be correct if we were only concerned with workers actually at SDE. However, our perspective is broader and covers Senegalese workers as a whole. From this perspective, and regardless of why the departures took place, there were about 20 fewer jobs per year in Senegal so workers as a class lost. Given prevailing unemployment, we value these at the full time stream of wages and benefits forgone. Similarly, for the lower level of wages. Although workers gained absolutely relative to inflation after privatization, we argue that they would have had still higher wages in the absence of privatization, so the differential is a cost to workers. Our estimate is that the 1995 NPV of these two factors totaled -4,861 million FCFA or -2.1 % of the net benefits. These costs need to be placed in the context of the benefits to consumers and government, but they are costs.

2.5. ENTERPRISE IMPACT

2.5.1. Factual Results

Figure 11 shows both accounting and total return to capital (TRC) (for SONEES before and SONES plus SDE after). Not surprisingly, accounting profit was essentially zero in the pre-period, but the fact that it then turned negative may surprise some. TRC shows a quite different trend, from flat to steady growth at 17.4% per year. Why the difference? Depreciation, interest and taxes. TRC is technically quasi-rents plus (in this case, modest) returns to non-operating assets, but is equivalent to the accountants' concept of EBDIT (earnings before depreciation, interest and taxes). The details needn't concern us here. What is important is that the sector is clearly making significant strides towards financial sustainability as per the financial model.

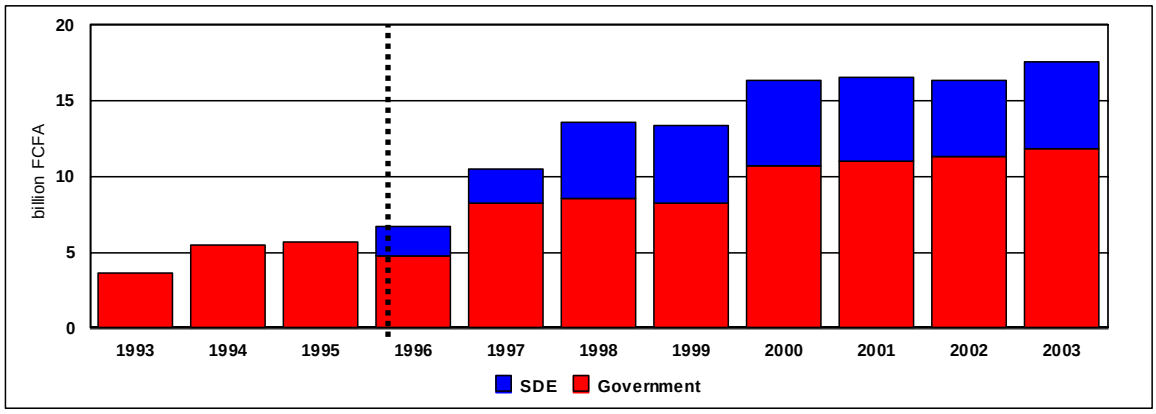
Figure 11: Water Sector Return to Capital vs Accounting Profits



Source: Table 23

Who gets this surplus? Some goes to creditors as interest but the rest is divided between SDE and the government (as direct taxes plus return to SONES for investment). How much to each? Figure 12 gives an estimate of the shares going to each side.

Figure 12: Distribution of Sector Surplus



Source: Table 25

This is a key figure for understanding the impact of this privatization. It says that about two thirds of the surplus goes to the government and one-third to SDE. Or, by giving SDE surplus roughly equivalent to what the government was getting before privatization, the government doubled its own return. Not a bad deal. Or, the increment in the surplus was divided roughly 50/50 between the government and the private operator.

If performance, measured by TRC, has clearly improved after privatization, was it due to improved efficiency or to favorable price effects? Table 7 sheds some light on this issue by decomposing annual changes in profit into price and quantity effects for its main components and averaging them for the pre- and post-privatization periods. This table is one of our favorite ways of comparing enterprise performance in different periods. To interpret it, look at output in the pre- period: the table says that while sales went up an average of 2.58 billion

per year, all of the gains were due to favorable price effects: quantities actually went down. Contrast that with the same set of lines in the post-period. Here, improvements in quantity and price both contributed about equally to improved sales. Of course, this has to be sent against inputs before conclusions on efficiency can be drawn.

Table 7: Price and Quantity Effects: Pre vs Post Privatization

(annual average in billion fcfa)

	Pre (1993-96)	Post (1996-2003)
Output		
Price Effect	2.90	1.37
Quantity Effect	-0.32	1.45
Total (Value) Change	2.58	2.81
Intermediate Inputs		
Price Effect	0.55	0.05
Quantity Effect	0.14	0.51
Total (Value) Change	0.69	0.56
Employee compensation		
Price Effect	0.57	0.50
Quantity Effect	0.01	-0.14
Total (Value) Change	0.58	0.36
Profit		
Price Effect	1.78	0.82
Quantity Effect	-0.48	1.07
Total (Value) Change	1.31	1.90

Source: Table 26

The bottom three lines summarize the overall story. Increases in annual profits after privatization were due more or less equally to favorable price effects (mainly output prices) and improvements in real efficiency, increases in profits before privatization were due solely to favorable prices. It looks as though pre-privatization prices were set to keep the enterprise from losing money, consistent with the soft-budget constraint theory and, as expected, efficiency gains were negative. Efficiency (measured as the ratio of intermediate inputs to output) also showed a clear improvement.

A major source of these gains was: technical efficiency (the ratio of the volume of water billed to water produced) and collection efficiency (the ratio of the volume of paid-for water to water billed). Table 8 provides a time series for technical efficiency for Senegal since 1991 and compares it with levels achieved in other countries of sub-Saharan Africa and the average of 50 Asian cities. With an average pre-privatization level of 70%, a significant improvement has been achieved post-privatization with the steady rise to the 79.9% level in 2004 (a post-privatization average of 76.3%). If the standard in developed countries is about 84%,[7] this is certainly an impressive achievement. But it also answers the earlier question of whether or not the 5% gain in water sales was "good". In one sense it is not good: in Mozambique comparable post-privatization gains were two or three times as high. But that

[7] SDE disputes that average as not truly representative of developed countries performance at the national level and suspects that it relies on a small sample of companies in specific urban areas. Their reasoning is that national figures would reflect networks of different ages, topographies and a mixture of urban and rural areas. Under such conditions, only small countries could achieve a national level of 84%. We are not engineers and so cannot judge the merits of these competing views. It is certainly true that SDE is at the frontier for developing countries and may even be at the frontier for developed countries as well.

is because it started with a technical efficiency ratio that was less than half as high, so there was a lot of room for improvement. Senegal, on the other hand, started with a level that was already good and improved it to something approaching standards in developed countries. And that would seem to qualify as "good" performance.

Table 8: Technical Efficiency Senegal vs Other Countries (%)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Senegal	69.6	69.9	70.2	69.5	70.8	69.5	72.1	74.4	73.9	73.9	78.1	78.5	79.9	79.9
Uganda					32.7	39.6	40.4	47.7	54.5	56.5	57.4	59.6	60.8	61.8
Mozambique								46.3		43.1	46.8	46.7	42.9	44.2
Asia					65.0									

Sources: for Senegal, SDE and SONEES. For Uganda, Jammal/Jones *Uganda Water*. For Mozambique, Gokgur/Jones *Mozambique Water*. For West Africa, World Bank *Water Benchmark Indicators: West Africa*. For Asia, ADB *Water in Asian Cities Utilities' Performance and Civil Society View*.

Table 9 provides a similar time series for collection efficiency. As can be seen, the story is basically the same as for technical efficiency: good even under public management by developing country standards and then improvement to developed country standards.

Table 9: Collection Efficiency Senegal vs Other Countries (%)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Senegal	90.1	96.0	98.0	98.0	97.0	97.0	97.2	97.7	98.2	98.3
Uganda	60.0	60.0	60.0	60.0	61.0	75.0	85.0	92.0	92.0	100.1
Mozambique		64.1		70.1		58.3	58.1	68.1	64.9	71.7
Asia	87.7									

Sources: for Senegal, SDE and SONEES. For Uganda, Jammal/Jones *Uganda Water*. For Mozambique, Gokgur/Jones *Mozambique Water*. For West Africa, World Bank *Water Benchmark Indicators: West Africa*. For Asia, ADB *Water in Asian Cities Utilities' Performance and Civil Society View*.

2.5.2. Investment and Capital

A considerable portion of the gains noted above were due to investment and the resulting greater stock of capital. The project, funded primarily by the World Bank at an estimated cost of $157 million, ran from July 1996 through June 2004. It had 3 main objectives (as stated in the ICR document (December 21, 2004):"(a) sustainability, by improving management, pricing and cost recovery and reducing Government subsidies for industrial, domestic and irrigation water; (b) poverty alleviation and health, by increasing access to safe potable water and adequate and more affordable sanitation for the urban poor; and (c) private sector participation, by engaging a private company to manage urban water supply." Its main component was the primary source for the investments made by the sector in Table 10 (contrast this with the non-existent investment prior to 1997).

Table 10: Investments Made by Sector (million FCFA)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
SONEES											
SDE					6,088	2,628	3,247	2,505	3,058	2,824	2,811
SONES					8,156	52,676	19,168	13,183	7,784	13,470	20,053
Sector					14,244	55,304	22,415	15,688	10,842	16,294	22,864

For investment projections, we rely on the financial model. The counterfactual follows from the investments necessary to accomplish the output changes described earlier. We distinguish three forms of investment. First there was the major expansion of capacity described in the previous paragraph. Corresponding to our output assumption we argue that despite the reluctance of the donor community, pressing social need would have led this to eventually take place in any event, and we arbitrarily set the lag at four years. The second type of investment was the investment by SDE that led to improved technical and commercial efficiency. Since we argued above that these gains would not have taken place in the absence of privatization, it follows that neither would the corresponding investment. Third, there is ongoing replacement investment financed by SONES. This would have to be done in any event to prevent deterioration in performance, so the counterfactual matches the factual.

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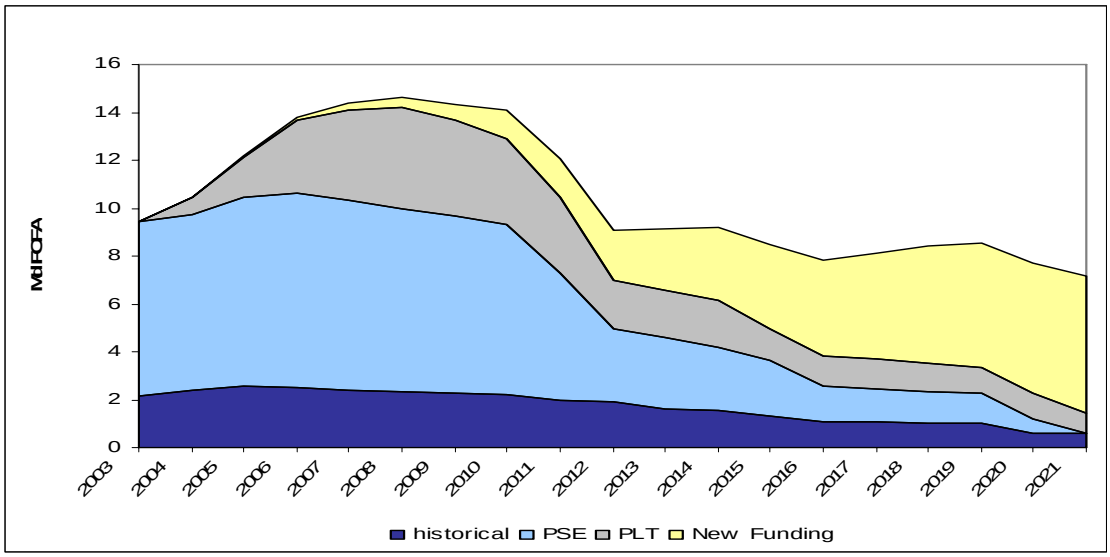
On the financial side, Figure 13 gives the financial model's debt service projections. The counterfactual question is whether the terms and conditions of the loans would have been any different without privatization. For the major donor funding we assume that it wouldn't. Since our model stops in 2011, we capitalize remaining loan principle payments (but not interest) to reflect the fact that the bulk of the benefits of those payments occurred prior to 2001. Resulting flows are given in Figure 13.

Figure 13: Debt Service Requirements in the Water Sector



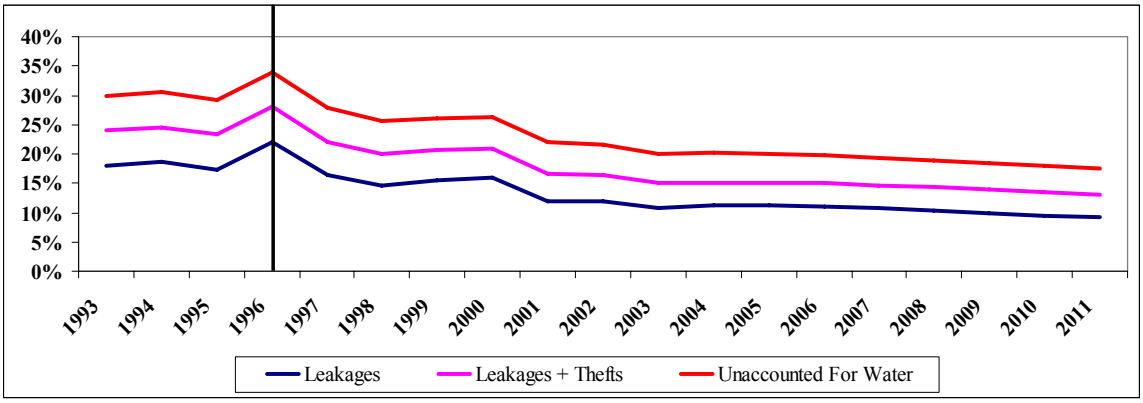
It is important to take account of the subsidy element implicit in donor lending. The World Bank loans to the GOS at highly concessional rates who then on-lends to SONES at something approximating market rates. We did not have access to government accounts, but proxy the subsidy as follows. For a loan where principal payments are deferred ten years and then made for thirty years straight line, and interest payments at .75% compared to a commercial rate of 6.25%, the subsidy element is 36.3%.[8] The resulting subsidy on the water component of the World Bank credit amounts to $US 71 million. However, since in the counterfactual we assume that this is not forgone, but only delayed, what appears below as a benefit of privatization for the government and a cost to the donor, is only the present-value difference of about $US 5 million.

2.5.3. Projections and Counterfactual

On the output side, total production and price assumptions were discussed earlier. Here we deal with efficiency assumptions. Projections under privatization were taken from the financial model. For the technical efficiency counterfactual we first noted that it had been roughly stable at 70% for the last six years of public operation. However, SDE informed us that during the long negotiation stage, a thorough evaluation of the existing process showed a level of only 68.2% upon startup of SDE operation. Consequently, we used this level as the counterfactual. Figure 14 gives the resulting long-term trends (note that it is a stacked graph: the top line is unaccounted-for water [1-technical efficiency]; the gap between the top line and the middle line is undercounted water; the gap between the bottom two lines is theft; and the bottom line is leakages).

[8] 1-(NPV of Payment Stream)/(Amount of Loan).

Figure 14: Projections of Technical Efficiency and its Components



For commercial efficiency, discussions at SDE suggested that at 98.3%, they were reaching an asymptotic limit on efficiency so we projected that same rate forward. For the counterfactual we assumed no change in the level achieved in 1995.

On the input side, employment assumptions were discussed previously. For intermediates, prices were assumed independent of privatization. Quantities were based on technical efficiencies for each major input category (electricity, fuel, chemicals and other) and then multiplied by the counterfactual output and price to get intermediate costs. How then did we get the counterfactual efficiency ratios? The various input/output ratios were highly discontinuous and exhibited no discernable trend before and after inflation. This is presumably in part due to: technical change, imperfect deflators, and the fact that the firm was reasonably well managed technically before and after privatization. Accordingly we projected using the 2004 ratios and used identical ratios for the counterfactual

.

2.5.4. Welfare Implications

The enterprise is not a stakeholder per se. Rather, the benefits of the changes flow to the owners and other claimants on capital whom we discuss below.

2.6. GOVERNMENT

The first source of benefits to the government was its share of the operating surplus of the firm. But we calculated this at factor cost, so indirect taxes must be added. This is not as easy as one might think: direct data (from the government, SONES or SDE) are not available and indirect methods (applying a tax rate to a sales base) are imperfect because the structure of indirect taxes on water is rather complex (depending on location, type of consumer and level of consumption) and has undertaken significant changes in the past 10 years. For example, while individual consumers in cities with sewage services paid one rate of 11% before 2001 regardless of their level of consumption, starting in 2001 they paid 1% if they consumed up to 40 m^3 in 60 days and 19% if they consumed more. For small gardeners, while they were charged a rate of 11% before 2001, starting in 2001 they paid 20% on their first 3000 m^3 in 60 days and 19% for higher levels. Still the indirect method is the only one

we have, so we applied the approximate rates provided in Table 11 based on data provided by SONES. Resulting estimated indirect tax payments are given in Table 12. For completeness, Table 12 also reports direct taxes, though these were already included in the governments' share of surplus reported earlier. Subsidies must also be considered. We have explicit numbers for 1995 and 1996 and guestimated them for 1993 and 1994 proportional to sales. To get a consistent series for the water sector alone, in the pre-privatization period we also deducted the estimated share of the sanitation sector in SONEES.

Table 11: Estimated Average Tax Rates on Water Consumption (%)

	Until 2000	Starting 2001
Consumers with counter < 15 mm	11	11
Establishments	11	19
Senegalese administration	11	19
Public standpipes	12	20
Small gardeners	11	19
Other	11	19

Source: SONES

Table 12: Net Taxes Paid by Sector (million FCFA)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Indirect Taxes											
SONEES (net of explicitly reported subsidies)	507	532	-832	-676							
SDE					969	571	521	501	703	657	710
SONES					52	113	96	103	99	91	91
ONAS						15	17	23	9	23	380
Sector	507	532	-832	-676	1,021	699	634	627	811	771	1,181
Direct Taxes											
SONEES	0	0	0	0							
SDE				1	1	121	247	346	455	687	988
SONES					0	1	1	2	1	1	731
ONAS					0	1	1	1	1	1	1
Sector	0	0	0	1	1	123	249	349	457	689	1,720
Grand Total	507	532	-832	-675	1,022	822	883	976	1,268	1,460	2,901

Sources: SONES and SDE for post-1996 numbers. For 1993-1996, numbers were estimates based on SONEES reports.

The final element of the return to the government was the subsidy portion of foreign lending, which was detailed in the previous section.

The 1995 NPV of these gains totaled 73,081 million FCFA (US$ 146 million), or 32% of the net benefits. Clearly the government did well. Table 13 gives the sources of these gains.

Nearly two-thirds came from the change in the return to its ownership share of the sector: previously, it had been putting money in; now it is taking it out, albeit largely for reinvestment by SONES in the sector. Indirect taxes went up with output and direct taxes went up with profitability. This was slightly offset by smaller revenues in other markets (for example: with lower employment there were lower collections of payroll taxes).

Table 13: Sources of Government Gains

Source	Net Present Value (1995)		Share
	FCFA million	US$ million	
Indirect Taxes: Water	15,413	30.9	0.211
Direct Taxes: Water	6,657	13.3	0.091
Direct & Indirect Taxes: other markets	-1,229	-2.5	-0.017
Net Ownership Return	45,420	91.0	0.622
Subsidy From World Bank	6,820	13.7	0.093
Total	**73,081**	**146.4**	**1.000**

2.7. FOREIGNERS

Two costs were borne by the World Bank: the subsidy component of the loan and the cost of technical assistance. The former was dealt with earlier. The primary component of the latter was 534.5 person-weeks of staff time valued at US$ 1,217.5 thousand. Since this averages only US$ 2,278 per week, it clearly includes only salary and perhaps fringes. We therefore add a 65% mark-up for overhead, bringing the total to US$ 2,078.9 thousand. Converted to a 1995 NPV, these costs totaled -6.820 million FCFA or -6.2% of the total. Of course, that is what the donors are in business for, and in this case they got a considerable return on their money.

Additional technical-assistance costs were borne by the French Development Agency (AFD) and the German Cooperation Agency (KFW). We have no information on these but believe their contribution to this project to be small enough to be ignored.

Benefits also accrued to the foreign owners of SDE. These were covered in the Enterprise Impact section. We estimate their 1995 NPV to total 1861 million FCFA, less than one percent of the net benefits. Clearly they did not do well, at least not yet. The reason for this is the very tough performance targets which we will explain in detail below.

2.8. IMPACT ON THE BROADER ECONOMY

2.8.1. Externalities

What has been the impact on the economy other than the water sector stakeholders already described? The first possibility is externalities (or spill-over, or third party effects). Water

projects, including this one, are commonly justified on the grounds of positive consumption externalities: even those not consuming commercial water benefit from a lower risk of the spread of communicable diseases; government benefits from reduced health care costs; and employers benefit from reduced absenteeism and higher productivity. However, these benefits do not apply to consumption by all new consumers. In the absence of treated piped water, some would either boil their water or buy bottled water. Getting access to piped water for such people helps them through both price and convenience, but does not generate any externalities. Relatively well educated and well-off consumers presumably fall in this category. So only water to the poor and less educated generate positive externalities, and then only when it is new access rather than additional water which is used for marginal purposes other than consumption. We could find no data to allow identification of such consumers. Still it is important, so we proxy it by additional consumption from standpipes, which largely serve the poor. Similarly, we have no data on the magnitude of the public health externalities so arbitrarily use 10% of price as a marker. This can readily then be scaled up or down according to the reader's priors.

There are also negative production externalities to be considered. These follow from withdrawal of additional water from the ?? river system and include both environmental costs and the impact on alternative users of the water for irrigation. We were told that the extraction by Ngith was so small relative to river flow that no such effects existed in this case.

2.8.2. Second-Order Effects on Related Markets

When additional and/or more reliable electricity is supplied, considerable benefits accrue to commercial users in the form of increased profitability and to workers in the form of additional employment. We see no similar effects in water. More generally, as enterprise efficiency improves, there are macro-economic activation effects in terms of increased saving, investment and jobs. Given the increased surplus generated by water privatization, this is potentially significant. The best way to capture this is by an economy-wide general equilibrium or other macro model, but that is beyond the scope of this study. Instead, we first note that the gain in surplus is split between foreigners and the government. The former benefits France (through SAUR's share in SDE) and can be ignored. For the gains to government, we use the standard expedient of assuming they ultimately result in lower taxes and use the common estimate that this is worth and additional one-third of the purchase price to the businesses and individuals who otherwise would have paid the taxes and now can invest.

When the project demands additional resources, prices can go up, benefiting suppliers and hurting consumers. This does not apply to tradable goods, but only to non-tradables, such as electricity, labor and domestic capital. The one market significantly affected was construction where the Ngith project was a significant fraction of fixed capital formation in one year.

2.8.3. Attitudinal Changes Towards Economic Reform

One successful sectoral reform can beget another. Did water reform have this impact in Senegal? It may well have made later reforms more likely. However, given our companion analysis of electricity privatization, the sign of any such effect would have to be negative. We do not attempt quantification.

2.8.4. Welfare Impact

The quantifiable effects in this section totaled 5,710 million FCFA or 2.5 percent of net benefits. Not much action here, but you never know until you check.

2.9. SENSITIVITY ANALYSIS

2.9.1. Monte Carlo Analysis

Obviously, there is uncertainty in our projections and even more in our counter-factual story. The most common way of dealing with this is to wave some verbal homage at the problem and then forget it. Those that do attempt quantification most commonly do a sensitivity analysis in which key variables are perturbed by a small symmetrical amount (say, +/- 10%) and the relative importance of each reported as a "sensitivity" indicator (percentage change in NPV or IRR over percentage change in the variable; an elasticity). This is certainly a step in the right direction, but it has two drawbacks which we try to correct.

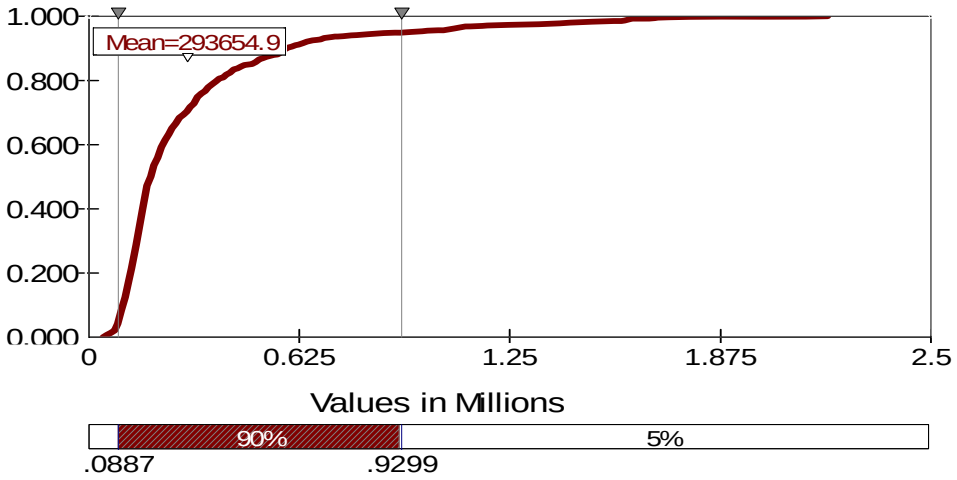
First, not all uncertainty is created equal. Ask yourself what the most important variable is in our counterfactual. Our answer going in (and going out) was the lag in the expansion of the Ngith plant. Our base assumption was four years. But the distribution is asymmetric and the variance is quite likely to be large; it is much more likely to be longer rather than shorter, and it is impossible to be more than four years less but entirely possible that it be four or even six or nine years longer. Similarly, our base elasticity of –0.2 cannot go above zero, but could well be -1 or less (with the lower values resulting in increased consumer surplus). Contrast this with, say, the leakage ratio which is just as likely to be over the truth as under it. To adjust for such differences in our sensitivity analysis we adopt Monte Carlo analysis, the first characteristic of which is that it allows specification of a different distribution (normal, Poisson, etc.) and variance (standard deviation) for each variable. We use this provision judiciously: our default specification is normal, and we use something else only where there is a strong basis for believing to the contrary.

A second problem with the most common approach is that it doesn't give you a bottom line. Take two projects with comparable NPVs but quite different tables of sensitivity. Which is better? Monte Carlo analysis fixes this by doing successive runs with random draws from all sensitivity values, calculating the resulting NPVs and repeating the process thousands of times if necessary until the resulting composite NPV converges.

2.9.2. Total Net Benefits

The distribution of the Monte Carlo analysis is given in Figure 15. Note first that the mean of the runs is 296,655, about 25% higher than our base run. The reason for this is our relatively conservative assumptions and the fact that there is more upside potential than downside. Similarly, the distribution is asymmetric, positively skewed and has a high variance with a maximum of 2,193,038 and a minimum of 43,817.

Figure 15: Distribution of Total Net Benefits



Which parameters are most responsible for this variance? This is measured in Table 14 by a stepwise linear regression with net benefits on the left and the parameters on the right.[9] Parameters with zero coefficients are omitted. Since consumers have two-thirds of the net benefits, what matters for them is what matters for the total. What the table then says is this. They are sensitive to two sets of factors: first, those that determine the amount of water (lag in construction of Ngith, counterfactual leakage); second, those that determine the valuation of that water (demand elasticity, relative shares of random and price rationing, and the counterfactual price growth).

[9] Regression coefficients in the table are normalized. A coefficient of 0.65 means that a 1 standard deviation change in the independent variable produces a 0.65 standard deviation change in the dependent variable.

Table 14: Sensitivity of Total Net Benefits

Variable	Regression Coefficient
Demand elasticity	0.633
Counterfactual leakage ratio in 1996	0.115
Random/price rationing shares	0.109
Annual growth in counterfactual output price	0.070
Counterfactual lag (in years) in increased capacity	0.069

2.9.3. Government

The second largest net beneficiary was the government but its distribution is quite different. As shown in Figure 16, the Monte Carlo distribution of its benefits is normal and symmetric. The mean is 74,009, quite close to our base of 73,081, with a minimum of 121,268 and a maximum of 31,225. This just says that our base run is as likely to be an under-estimate as an over-estimate, and that the government certainly did well; it is just a question of how well.

Figure 16: Distribution of Government Net Benefits

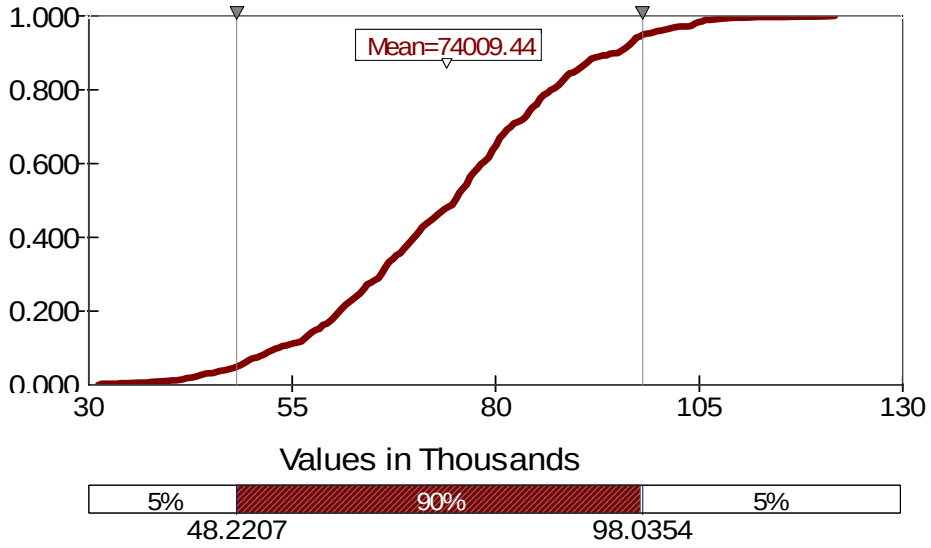


Table 15 identifies the parameters to which government benefits are sensitive. These include the two items identified above as affecting the quantity of water, but also others (excess demand and theft). These additional variables appear in part because the government value is much smaller, and so it is sensitive to much smaller effects. Also theft is a wash for consumers (less for thieves means more for others, and vice versa) but affects government revenue. In addition, the government is affected by the degree to which the un-privatized company would have not reduced, but increased employment.

Table 15: Sensitivity of Government Net Benefits

Variable	Regression Coefficient
Counterfactual leakage ratio in 1996	0.804
Counterfactual employment growth	0.515
Counterfactual lag (in years) in increased capacity	0.271
Counterfactual theft ratio in 1996	0.229
Counterfactual annual increase toward full capacity of Ngith	-0.054
Factual excess demand (1993-1996)	0.019
Factual excess demand in 2011	0.018
Factual annual fuel price increase	-0.011

2.9.4. Sensitivity Conclusion

We could have gone into much greater detail in each of the above sections, and could have added others for each of the stakeholders. However, this should be enough to make our basic point. Any Benefit-Cost analysis involves the risk of error due to projecting an unknown future. Our variant adds the further risk of trying to tell a counterfactual story. We suggest that this Monte Carlo analysis supports our repeated contention that our base run is conservative and that it would be much more reasonable to tell a more positive story about the consequences of privatization than to tell a less positive one. Further, looking back at Figure 15, it would impossible to tell a negative one.

2.10. CONCLUSION

In sum, our work does nothing to dispel, and much to reinforce, the conventional wisdom that privatization of the water sector in Senegal was on balance a success. There were clear improvements for consumers (quantity, access and price), and government, with labor and the World Bank losing only a little.

3. WHAT EXPLAINS THESE RESULTS?

In answering this question, we will at several points find it informative to compare the results here with those in Senegal's electricity sector. You now know what happened in water. In Electricity, briefly, the company was fully privatized in 1999, but the Government of Senegal revoked the sale eighteen months later. A second tender was organized and a winner selected, but negotiations broke down and the company is once again a public enterprise. Details may be found in our companion paper. Here we only note that this was a markedly different result from water and cross-referencing success factors in some areas helps explain both results.

3.1. EXTERNAL FACTORS

We start with "external factors" outside the control of the players in the reform process.

Initial Conditions: From the technical side, SONEES was relatively well run, so good technical people were available to SDE from the start. But this also limited the degree of progress that could be achieved: for example, when you start with technical efficiency of 70% and the developed country standard is 85% you're not going to get major increases for long. Moreover, the fact that consumers had been paying high prices before privatization made the necessary annual increases much less controversial than they would have otherwise been.

Crisis and Devaluation: World-wide, countries generally make tough choices such as privatization only in an environment of crisis. The 1994 CFA devaluation halved the value of the country's currency and forced the government to take, and the people to accept, reforms that would not have been possible in a more benign environment

Luck: The reform benefited from good timing in terms of the attitudes of the international community. The mid-1990s was the peak of the donors' enthusiasm and this helped Senegal get the critical $223 million that helped make the reform possible. More importantly, it was also the peak of private sector enthusiasm for bidding on such deals. If water reform had been delayed until 2001, for example, would the results have been any different from electricity, when only two bidders could be found and the winner bailed out before signing?

3.2. INTERNAL FACTORS

Turning to internal factors, what did the policy-makers do right? Well, pretty much everything, but here are some of the more important things. We won't bore you by reciting the liturgy (use transparent and competitive bidding…). Rather we will focus on the doctrinal elements which Senegal water sheds particular light on.

Do Your Homework. A senior official at SONES, when asked the reason for the difference in results between water and electricity, replied: "Because we did our homework". Having reviewed the written record of both cases, we think that this is an important part of the answer, though by no means the whole answer. They had a clear goal, learned from other countries, and the quality of the work in integrating their learning was excellent. Neither they nor the World Bank skimped on the effort, with the latter putting in at least three times the manpower into water that they did into electricity.

Involve All Stakeholders. An official of a Senegalese consumer advocacy group, when asked the same question, replied "Because the water people

listened." Although his group had tried to get involved in both sectors, they were shut out in electricity but welcomed in water, including having a seat on the SONES board. Similarly, the attitude of labor unions has been quite different in the two cases. In water, they initially resisted the idea, but were brought on board through a variety of means. In electricity, workers felt ignored and angry enough to disrupt production in the early stages of the privatization. In water, the Gos, with the help of the World Bank, organized a series of seminars designed to keep all stakeholders informed and provide a forum for legitimate concerns to be aired and dealt with.

Don't Skimp on the Financial Model. Much of what the reformers learned was embodied in a well-designed, comprehensive, financial model which allowed them to set both operator and consumer rates intelligently with due consideration of the tradeoffs involved. Further, as we understand it, it has since been regularly updated by capable Senegalese (something which hasn't happened in some other countries).

Build Political Commitment. Reform requires tough decisions, both at the outset and during the likely expected crisis along the way. Initially, that commitment, we are told, was unequivocal on the part of the Minister in charge of Hydraulics, who, as a senior member of the cabinet at the time, felt confident enough to take tough measures and was looking at the reform as his crowning achievement. But what explains the commitment of the new government in 2000? In electricity, one result was throwing the private owner out. Why didn't that happen here? We're not entirely sure, but believe that part of the answer was SDE's record of success. And this in turn was due to all the other things the reformers did right.

Pay Careful Attention to Regulation: Conventional wisdom is to have an independent regulatory body. Senegal water doesn't. They are quite proud of what they call "regulation by contract" because it avoids the well-known difficulty of regulation. Given the success of the model, their approach certainly deserves consideration. But it is misleading to say that they have avoided the problems with regulation. Rather, they have solved them in a non-standard way. The fact that the operator tariff is spelled out in the contract is hardly unique; rather, it is ubiquitous in lease and affermage contracts. And someone still has to set the consumer tariff; here it just happens to be someone else. The key is the quality of the financial model and the understanding of the people who use it, and not the name on the building in which they sit. Similarly, someone still has to deal with dispute resolution, but here it is officially special tribunals. In practice, informal methods have been used. Most importantly and revealingly, in 1998 SONES and SDE agreed to revise contractual technical efficiency targets after SDE developed information that the information in the bid documents was incorrect. Why this amicable solution rather than the divorce that similar disputes caused in Senegal Electricity and Mozambique Water? There is no simple panacea such

as "be flexible". Rather it is the result of a larger nexus of trust following from consensus building and homework. However, one mechanistic feature did help, namely using objective arbitrators acceptable to both parties. The head of the Long Term Water Project at the Ministry of Agriculture and Hydraulics played a particularly important role as have international donors (one SDE official referred to the process as "regulation by the World Bank").

Choose an Appropriate Form of Contract. Use of the affermage lease/concession likewise deserves consideration given Senegal's success. To what extent was the success due to this choice? We shall discuss this in our final section.

Get Incentives Right: this warrants more detail, so we will give it.

3.3. INCENTIVES

As economists our bias is that more often than not, a private contractor will do exactly what the government asks, so long as it is made worth their while (and is technically feasible and within their control). In looking for internal determinants of success, we therefore begin by examining the incentive structure.

3.3.1. Primary Incentive: Remuneration

How is SDE remunerated? The starting point is that the government reasonably does not want to pay for water that is **lost** (dribbles into the ground or evaporates), **stolen** (illegal connections) or **given away** for free (not billed or bill not paid). So, primary compensation is based on water actually paid for, and not for water produced. The simple way to do this would be to just pay a flat rate per m^3 of water paid for. While his provides a useful benchmark for comparison purposes, what is actually done is considerably more complex. This is spelled out in a 14 page annex to the contract which, being dense with formulae and definitions, is not understood by everyone involved. For example, one of the most important, if not the most important, factors determining success is formula 11 of the Annex:

$$\mathbf{R_{e,n} = P_{e,n}(V_{p,n}\,\eta'_{f,n}\,\eta'_{r,n}) + T_{m,n}\,\{(V_{p,n}\,\eta_{f,n}\,\eta_{r,n}) - (V_{p,n}\,\eta'_{f,n}\,\eta'_{r,n})\}}$$

where:

$R_{e,n}$ is the actual remuneration of the operator,
$P_{e,n}$ the bid price,
$V_{p,n}$ the volume of production,
$\eta'_{f,n}$ the target technical efficiency,
$\eta'_{r,n}$ the target collection efficiency,
$\eta_{f,n}$ the actual technical efficiency,
$\eta_{r,n}$ the actual collection efficiency and
$T_{m,n}$ the tariff (before taxes).

We will not bother with the technical details here. We will just provide a simplified English translation. First, a few definitions and simplifications:

- Bid Price: the price paid to the operator per m^3 of water and the bid variable in the tender document, as described later.

- Tariff: the weighted average price billed to consumers.

- TCER: the combined technical and collection efficiency ratio, produced by multiplication. That is, water billed divided by water produced, multiplied by water paid for divided by water billed, which reduces to water paid for divided by water produced.

- Indexing: the two prices and the targets are adjusted annually through processes described later. These are ignored in the translation below.

The formula then has two parts in any given year:

Remuneration = Water Produced*{(Bid Price)∗(Target TCER) + (Average Tariff)∗(Actual TCER – Target TCER)}

We find it easier to think of this as consisting of two statements. The government says:

- For a given volume of water produced, we'll pay you two rates. Up to the target paid-for volume {(Target TCER)∗(Water Produced)} we'll pay your bid price. But if you do better than the target, then the excess will be compensated at the full tariff rate. And, symmetrically, if you do worse than the target then we will penalize you at the tariff rate.

- For a given level of combined technical and billing efficiency, if you produce more water, you will be paid at your bid price adjusted for the difference between the target and actual efficiency. That is, if your efficiency is the same as the target, then you will be compensated at your bid price. If your efficiency exceeds the target, then you will be compensated at a higher price than your bid. Conversely, if your efficiency falls short of the target, you will be paid less than your bid price.

That is, the government really, really cares about improving technical and collection efficiency and is willing to pay a bonus for performance which exceeds the target and to impose a penalty for performance which falls short. The bonus is potentially substantial since, for example, in 2003 the bid price (appropriately indexed) was \$0.49 while the tariff was \$0.83. At the margin, therefore, delivering more water by improving efficiency is worth \$0.83 while delivering more by increasing production is worth only about \$0.49 (assuming operation at the target efficiency level). This is a powerful incentive.

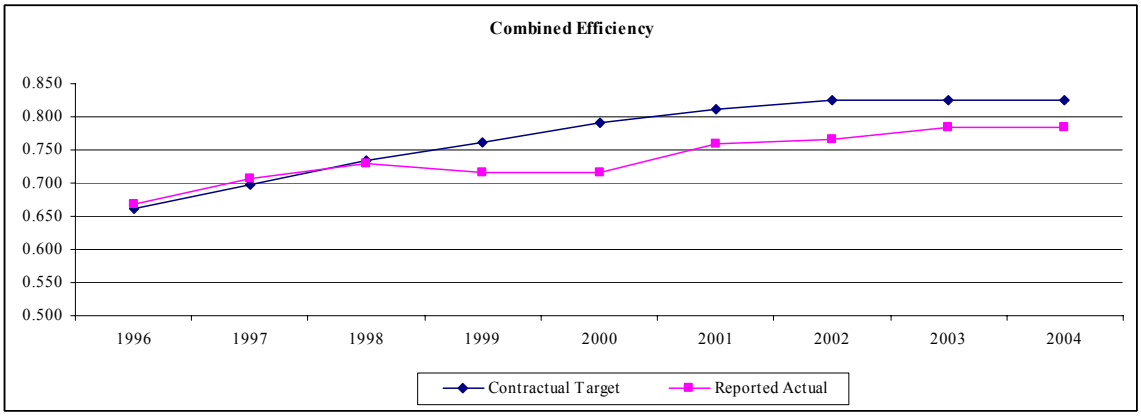
Of course, it matters critically how hard a target is set. Figure 17 displays the actual performance after privatization together with the target. As can readily be seen, actual

performance has fallen short of the target since 1999. Table 16 breaks this down into two subcomponents.

- While collection efficiency targets were matched or exceeded every year since privatization, technical efficiency targets have never been achieved since 1997. Nor had they been achieved before privatization. Post-privatization levels have been greater than those before privatization, though below target.

- The main reasons for the under-achievement appears to be that the targets were very tough to begin with as explained earlier and rose steadily through 20002.

Figure 17: Combined Efficiency: Target vs. Actual



Sources: Table 19

Table 16: Technical and Collection Efficiency: Target vs. Actual

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Technical Efficiency														
Target (%)	77.0	78.0	78.0	78.0	78.0	69.5	72.6	75.6	78.6	81.6	83.6	85.0	85.0	85.0
Actual (%)	69.6	69.9	70.2	69.5	70.8	69.5	72.1	74.4	73.9	73.9	78.1	78.5	79.9	79.8
Collection Efficiency														
Target (%)						95.0	96.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0
Actual (%)						96.0	98.0	98.0	97.0	97.0	97.2	97.7	98.2	98.3

Sources: SDE, SONES and SONEES.

This under-achievement in combined efficiency has resulted in a penalty paid by SDE as shown in Table 17.

Table 17: Computed SDE Remuneration Based on the Formula

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Basic Remuneration (million FCFA)	15,372	16,150	16,910	17,563	20,509	21,448	23,214	24,160	25,204
Efficiency Bonus (million FCFA)	241	339	-152	-1,746	-3,212	-2,284	-2,670	-1,978	-1,974
Total Remuneration (million FCFA)	15,613	16,489	16,758	15,817	17,297	19,164	20,544	22,182	23,231
Efficiency Bonus/Pre-Tax Profit (%)	-52	-36	-11	-247	-383	-240	-165	-84	-84

Note: these are our computations of SDE's remuneration based on the formula in the contract. The actual amount reported by SDE may differ by including other adjustments not considered in this table.
Sources: authors' calculations.

The bottom line for now is this: SDE has done an admirable job of increasing technical and collection efficiency, both compared to earlier accomplishments in Senegal and to other SSA countries. It seems obvious that a major part of the explanation is that they were given substantial incentive to do so. SONES got the incentives right and the operator responded just as one would expect.

Responding of course involves more than just wishing. SDE has established a very impressive system for dealing with missing water, with. features that SDE claims are state-of-the-art world-wide and groups come in from Europe to learn how they have done it. Given their incentives, is this particularly surprising?

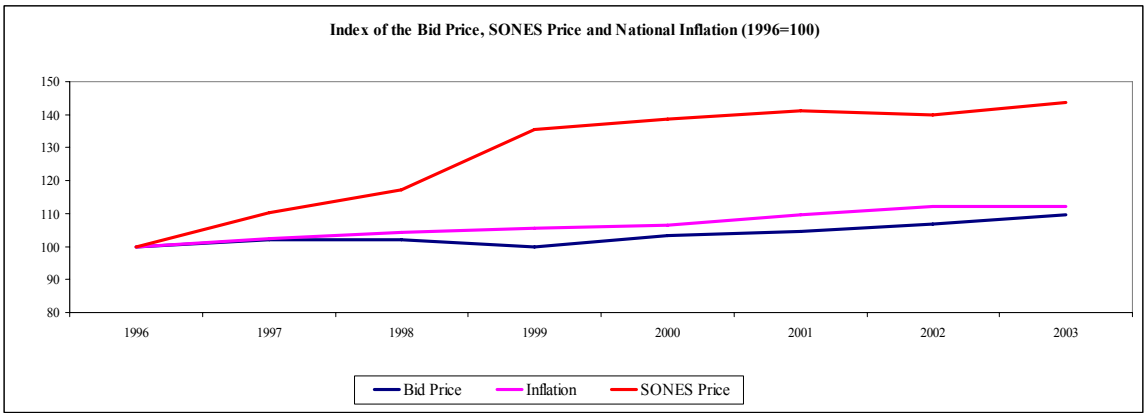
3.3.2. Secondary Incentives

Since the operator is remunerated based on output only, he has every incentive to save on costs. In addition, his bid price is indexed annually to reflect increases in his major inputs. Specifically, the annual increase in the bid price equals:

0.10
+ 0.24 * increase in the monthly index of average wages for 173.33 hours for a worker of category 6, echelon 1, of the Collective Convention of Water
+ 0.16 * increase in the index of african household consumption published by the Statistics Office
+ 0.18 * increase in the average cost of kwh in average tension
+ 0.06 * increase in the price of fuel oil 180 published by the Statistics Office
+ 0.04 * increase in the price of pipes published in France * increase in the VA tax rate applicable to this commodity * increase in import duty)
+ 0.22 * increase in index of non-taxable intermediate goods published by the Monitor of Public Works in France –statistical supplement- aggregate index of non-taxable industrial sales * increase in the VA tax applicable to these goods * increase in import duty applicable to these commodities

As Figure 18 indicates, such indexation has resulted in lower increases than the average national inflation. By contrast, the average price paid to SONES has increased substantially more than inflation. <<this is good for the government, not for the operator>>

Figure 18: Index of the Bid Price, the SONES Price and National Inflation (1996=100)



Sources: SDE, SONES.

In addition to the above incentives, the contract provides penalties in any of the following circumstances:

- there is a general unjustified interruption of service in a distribution service center: the penalty is 0.2 m^3 for every hour of interruption and for every subscriber

- there is an unjustified partial interruption of service cutting water to more than 100 subscribers for more than 10 hours: the penalty is 0.5 m^3 per private subscriber and hour of interruption, without such a penalty exceeding that of the general interruption.

- when the pressure remains unjustifiably, and for more than 3 hours, less than planned: the penalty is 0.1 m^3 per hour of deficiency per subscriber in the zone of the occurrence

- in case of non-production of documents as stipulated by the present contract, after notification by the farming-out authority or the SONES without response for 20 days: the penalty is 1 million FCFA

- In case of insufficient production in the NGNITH treatment plant, a monthly penalty Pm will be applied as follows: Pm = (60,000m^3 Jm – Pn,m) 85 FCFA
  where:
  Jm is the number of days in the month
  Pn,m is the production in cubic meters of the plant during that month

These represent important safeguards for proper operation during the year. No data were available on whether they have occurred.

3.3.3. Wishful Thinking Targets

SDE's performance contract includes the set of performance indicators presented in Table 18. Achievement by criterion is then multiplied by its corresponding weight and results are added up. However, results are not likely to influence performance because no incentives are included.

Table 18: Performance Indicators in SDE's Performance Contract

Description	Unit	Criteria	Criteria(%)	Completion(%)	Difference	Weight	Result
Technical Aspects							
Static return: Vs/Va	%	95	95			5	
No. observations	No./yr	260	100			1	
Water loss	%	26	26			5	
No. leaks	No./yr	33660	100			1	
Water quality							
Bacterial quality	%	96	96			10	
No. samples	no./yr	7280	100			1	
No. samples	no./yr	2316	100			1	
Service quality							
Intervention <1-2 hours	%	100	100			1	
Restore service:12-18 or 24 hrs	%	100	100			1	
Non-estimated bills	%	98	98			1	
Reaction to complaints:<24 hrs	%	100	100			1	
Decrease in complaints	no./yr		100			1	
Network renewal							
Diameter of distribution network	km/yr	17	100			3	
Connections	no./yr	6000	100			3	
Meters	no./yr	14000	100			3	
Financial aspects							
Monthly SONES payment	%	100	100			1	
Bill collection	%	95	95			1	

Source: SONES.

The same applies to SONEES's performance contracts with the state. The second performance contract, for example, covering the 5-year period between January 1, 1990 and December 31, 1994 includes an impressive list of annual performance targets covering:

- Technical objectives for water:
- SONEES management objectives:
- Timetable for maintenance by area and type of equipment
- Staff Training timetable
- Timetable for decentralizing management of subscriptions

However, there are no incentives for achieving these objectives. We therefore call these wishful-thinking targets. Most of the action, and there is a lot, comes from the primary incentives with some from the secondary. We doubt that the targets described in this subsection affect performance materially and report them here only for completeness.

3.3.4. Access Incentives

Supporters of *affermage* argue that one of its advantages is that it provides no disincentive for providing water to the poor. Under some other arrangements the operator is

disadvantaged if the poor pay a lower rate but the operator compensation is at a flat rate or if the poor are more likely to miss payments. In Senegal, however, the operator is compensated at a single volumetric rate independent of the social rates that might be charged to some consumers and also independent of the payment record. Instead the GoS is responsible for any losses associated with social pricing. It seems to us that this is an important point and reflects a judicious solution to the efficiency/equity tradeoff. However, we do not see this as unique to affermage: the same could be done in any lease contract and, with a bit more creativity, in concessions as well.

4. CONCLUSIONS & LESSONS

Our work is consistent with the conventional wisdom that this privatization was a success. Given the magnitude of the gains we estimate, it might even strengthen the case: there were huge improvements for consumers (quantity, access and price), and substantial gains for government, with labor losing only a bit (and that showing signs of possible reversal in 2005). The Government of Senegal did things pretty much by the book, and in the process helped write a new edition. Structural features of the reform included: *affermage*, a state-owned asset holding company, and no independent regulator. Some have argued that these three features are keys to the success. We are inclined to the view that other fundamentals were considerably more important: taking the time to "do it right", doing their homework, spending a lot of effort on bringing all the stakeholders on board, getting the regulatory principles right, operating flexibly and pragmatically and introducing the two-part operator tariff. Had these features been embodied in a different institutional model (say, lease contract with a regulator) might not similar results have been likely?

In sum, if you want a success story of infrastructure privatization in Africa (or elsewhere for that matter), Senegal water is a prime candidate. It is certainly head and shoulders above the other seven cases we cover in our larger study.

APPENDIX A: TABLES REFERRED TO IN TEXT

This appendix provides detailed figures referred to, but not included, in the body of the report.

Table 19: Volume Indicators (in million m3)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Production	92	93	94	94	95	97	99	96	96	98	107	108	112	114	119
Sales	67	65	65	66	66	69	65	70	72	73	79	84	88	91	95
Paid-for							63	68	70	70	76	82	86	89	93

Sources: SDE, SONES and SONEES.

Table 20: Indicators of Access (in thousands)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of connections	155.9	173.7	191.2	211.5	220.0	234.8	241.6	254.8	268.2	286.8	298.7	327.5	338.9	363.2	377.0
Number of "social" connections[1)]				10.0	10.6	7.6	3.3	8.2	4.3	9.6	6.8	20.1	14.6	15.3	
Number of public standpipes							2.6	2.9	3.0	3.2	3.3	3.4	4.3	4.2	

1) "Social" connections are those provided to the poor. They are highly subsidized (at a rate estimated at 60% of the average tariff). Since 1996, they have been fully financed by SONES.
Sources: SDE, SONES, SONEES and World Bank (ICR report, 2004).

Table 21: Average Price Paid by Consumers (FCFA per m3)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Nominal	239	239	264	264	353	359	380	400	414	430	449	458	465	485
Constant 1995 prices	345	335	360	360	381	359	370	382	391	403	418	414	411	429

Sources: SONES and authors' calculations.

Table 22: Labor Indicators

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number of employees: SDE					1316	1257	1218	1183	1168	1155	1178
Number of employees: sector	1475	1475	1480	1420	1396	1338	1298	1264	1246	1235	1248
Average unit labor cost: nominal (000 FCFA)											
SDE					4305	5076	4802	5184	5269	5673	6003
SONES					5913	7111	6863	7568	8679	9100	10457
Sector	2579	3076	3348	4518	4397	5200	4929	5337	5482	5895	6253
Average unit labor cost: constant 1995 prices											
SDE					4113	4796	4500	4823	4760	5008	5302
SONES					5650	6718	6430	7040	7841	8033	9236
Sector	2864	3161	3348	4395	4201	4912	4619	4965	4953	5204	5523

Note: "sector" numbers refer to only water operation. That is, ONAS was not included in the 1996-2003 numbers, and an estimate for sewerage operation before 1996 was deducted from SONEES figures.
Sources: SDE, SONES, SONEES and authors' calculations.

Table 23: Sector Performance Using Economically Relevant Accounts (billion FCFA)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Output	17.3	21.6	22.5	24.1	28.0	32.7	33.9	39.2	39.7	39.6	45.0
- Intermediate Inputs	9.1	10.0	10.5	10.4	9.5	12.1	11.6	13.2	13.0	12.4	15.0
= Value added	8.3	11.6	12.0	13.7	18.5	20.6	22.3	26.0	26.7	27.3	30.0
- Return to Labor	3.8	4.5	5.0	6.4	6.1	7.0	6.4	6.7	6.8	7.3	7.8
= Total Return to Capital	4.4	7.1	7.1	7.2	12.3	13.6	15.9	19.2	19.9	20.0	22.2

Sources: authors' calculations.

Table 24: Sector Performance Using Flows at Constant 1995 Prices (billion FCFA)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Output	23.5	21.9	22.5	23.1	25.6	28.9	28.9	31.7	31.3	30.2	32.5
- Intermediate Inputs	10.8	10.6	10.5	10.2	10.2	12.9	12.3	13.6	13.3	12.4	14.8
= Value added	12.6	11.4	12.0	12.9	15.4	16.0	16.6	18.1	18.0	17.8	17.6
- Return to Labor	4.9	4.9	5.0	4.8	4.7	4.4	4.3	4.2	4.2	4.1	4.1
= Total Return to Capital	7.7	6.4	7.1	8.2	10.7	11.5	12.3	13.8	13.8	13.6	13.5

Sources: authors' calculations.

Table 25: Distribution of Sector Surplus (billion FCFA)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
SDE				2.0	2.2	5.1	5.1	5.6	5.5	5.0	5.8
Government	3.6	5.5	5.7	4.8	8.5	6.0	6.6	9.0	9.6	10.5	11.7

Sources: authors' calculations

Table 26: Decomposition of Sector Return to Capital Into Price & Quantity Effects (billion FCFA)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Change in Output										
P	5.50	0.30	0.91	1.27	1.06	1.13	1.91	1.07	1.29	2.29
Q	-1.21	0.56	0.66	2.66	3.67	0.09	3.32	-0.50	-1.37	3.06
V	4.29	0.86	1.58	3.93	4.73	1.22	5.22	0.57	-0.08	5.35
Intermediate Inputs										
P	1.17	0.55	0.19	-0.88	0.07	0.04	0.32	0.16	0.20	0.17
Q	-0.25	-0.09	-0.26	0.02	2.51	-0.55	1.26	-0.33	-0.84	2.42
V	0.92	0.47	-0.07	-0.86	2.58	-0.51	1.58	-0.17	-0.64	2.60
Value Added										
P	4.33	-0.25	0.72	2.15	0.99	1.09	1.59	0.91	1.09	2.11
Q	-0.96	0.65	0.93	2.64	1.16	0.63	2.06	-0.17	-0.53	0.64
V	3.37	0.40	1.65	4.79	2.15	1.73	3.64	0.74	0.56	2.75
Employee Benefits										
P	0.73	0.40	1.67	-0.17	1.13	-0.40	0.52	0.18	0.51	0.53
Q	0.00	0.02	-0.21	-0.11	-0.31	-0.15	-0.17	-0.10	-0.06	-0.01
V	0.73	0.42	1.46	-0.28	0.82	-0.56	0.35	0.09	0.45	0.52
Return to Capital										
P	3.60	-0.66	-0.95	2.32	-0.14	1.50	1.07	0.73	0.58	1.58
Q	-0.96	0.63	1.13	2.74	1.47	0.79	2.23	-0.07	-0.47	0.65
V	2.64	-0.02	0.19	5.06	1.34	2.29	3.30	0.66	0.11	2.23

Sources: authors' calculations.

APPENDIX B: TARIFF STRUCTURE

The structure of water tariffs has undergone significant changes since1980. This appendix provides historical series between 1980 and 2003 by different categories of consumers.

Table 27: Water Tariffs in Cities with Sewerage Services 1980-1997 (FCFA per m^3)

	July 1980	July 1981	July 1982	Sept 1983	July 1984	Jan 1986	Jan 1989	Nov 1989	March 1992	Jan 1994	July 1995	Jan 1996	Jan 1997
Social tranche	79.63	81.15	93.32	87.34	87.34	112.41	112.41	112.41	113.91	152.19	156.7	160.72	165.17
Full tranche: Dakar	152.89	154.57	191.57	219.17	250.05	283.92	283.92	344.58	389.15	519.94	534.48	548.24	563.44
Full tranche: other areas	127.89	129.57	163.00										
Dissuasive tranche				252.05	286.28	327.08	327.08	395.9	446.92	597.15	614.01	629.84	647.31
Public standpipes: Dakar	83.39	90.07	111.83	116.82	137.51	150.36	150.36	162.2	166.2	221.97	227.49	233.26	239.64
Public standpipes: other areas	61.54	62.71	77.74										
Small gardeners: 0-3000 m^3	30.21	30.82	38.19	37.74	77.2	49.21	49.21	48.57	50.07	66.86	105.81	105.81	105.81
Small gardeners: 3000-10000 m^3	36.25	36.98	45.83										
Small gardeners: 3000-20000 m^3				53.55	109.53	68.93	68.93	68.93	70.42	94.07	149.35	149.35	149.35
Small gardeners: 10001-20000 m^3	46.25	46.98	61.83										
Small gardeners: >20000 m^3 Dakar	152.89	154.57	191.57	219.17	250.05	283.92	283.92	344.9		519.94	534.48	534.48	563.44
Small gardeners: >20000 m^3 Other	127.69	129.57	163.00										

Note: tariffs in the table include applicable taxes and surcharges.
Source: SONES.

Table 28: Water Tariffs in Cities with No Sewerage Services 1980-1997 (FCFA per m^3)

	July 1980	July 1981	July 1982	Sept 1983	July 1984	Jan 1986	Jan 1989	Nov 1989	March 1992	Jan 1994	July 1995	Jan 1996	Jan 1997
Social tranche	76.6	78.07	89.78	87.34	87.34	112.41	112.41	112.41	113.91	152.19	156.7	160.72	165.17
Full tranche	124.54	126.16	158.98	203.54	231.65	263.8	263.8	319.83	366.92	490.23	504.77	517.76	532.1
Dissuasive tranche				234.07	265.29	303.89	303.89	367.43	421.35	562.97	579.7	594.62	611.14
Public standpipes	58.18	59.29	73.5	101.19	119.11	130.24	130.24	137.47	141.45	188.9	194.41	199.33	204.76
Small gardeners: 0-3000 m^3	30.21	30.82	38.19	37.74	77.2	49.21	49.21	48.57	50.07	66.86	105.81	105.81	105.81
Small gardeners: 3000-10000 m^3	36.25	36.98	45.83										
Small gardeners: 3000-20000 m^3				53.55	109.53	68.93	68.93	68.93	70.42	94.07	149.35	149.35	149.35
Small gardeners: 10001-20000 m^3	46.25	46.98	61.83										
Small gardeners: >20000 m^3	124.54	126.16	158.98	203.54	231.65	263.8	263.8	319.83		490.23	504.77	517.76	532.1

Note: tariffs in the table include applicable taxes and surcharges.
Source: SONES.

Table 29: Water Tariffs in Cities with Sewerage Services 1995-2003 (FCFA per m^3)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Individuals: diameter > 15mm									
Social tranche: 0-20 m^3 in 60 days	156.70	160.72	165.17	170.26	175.21	181.99	189.33	176.32	191.32
Full tranche: 21-40 m^3 in 60 days	534.48	548.24	563.44	587.56	604.70	631.47	658.84	613.73	629.88
Full tranche: 41-100 m^3 in 60 days	534.48	548.24	563.44	587.56	604.70	631.47	658.84	723.26	788.67
Dissuasive tranche: 21-40 m^3 in 60 days	614.01	629.84	647.31	674.06	693.73	723.99	755.13	829.01	788.67
Individuals: diameter > 15, establishments, administrations									
Full tranche: 0-100 m^3 in 60 days	534.48	548.24	563.44	587.56	604.70	631.47	658.84	723.26	788.67
Dissuasive tranche: > 100 m^3 in 60 days	614.01	629.84	647.31	674.06	693.73	723.99	755.13	829.01	788.67
Public standpipes	227.49	233.26	239.64	253.67	260.99	274.33	287.12	315.09	322.31
Gardeners (small, industrial, parks)									
Initial tranche: 0-3000 m^3 in 60 days	105.81	105.81	105.81	105.81	105.81	105.81	105.81	113.37	113.37
Intermediate tranche: 3000-20000 m^3 in 60 days	149.35	149.35	149.35	149.35	149.35	149.35	149.35	160.07	507.84
Full tranche: > 20000 m^3 in 60 days	534.48	548.24	563.44	587.56	604.70	631.47	658.84	723.26	788.67

Note: tariffs in the table include applicable taxes and surcharges. Historical series with the new classification was provided by SONES starting in 1995. Note that the 1995-1997 numbers are consistent with those in Table 27 despite the different classification.
Source: SONES.

Table 30: Water Tariffs in Cities with No Sewerage Services 1995-2003 (FCFA per m^3)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Individuals: diameter > 15mm									
Social tranche: 0-20 m^3 in 60 days	156.70	160.72	165.17	170.26	175.21	181.99	189.33	176.32	181.32
Full tranche: 21-40 m^3 in 60 days	504.77	517.76	532.10	548.53	564.51	586.37	610.09	568.08	584.23
Full tranche: 41-100 m^3 in 60 days	504.77	517.76	532.10	548.53	564.51	586.37	610.09	669.40	714.98
Dissuasive tranche: 21-40 m^3 in 60 days	579.69	594.62	611.14	630.06	648.43	673.58	700.84	769.04	714.98
Individuals: diameter > 15, establishments, administrations									
Full tranche: 0-100 m^3 in 60 days	504.77	517.76	532.10	548.53	564.51	586.37	610.09	669.40	714.98
Dissuasive tranche: > 100 m^3 in 60 days	579.69	594.62	611.14	630.06	648.43	673.58	700.84	769.04	714.98
Public standpipes	194.41	199.33	204.76	210.99	217.04	225.32	234.30	256.76	263.98
Gardeners (small, industrial, parks)									
Initial tranche: 0-3000 m^3 in 60 days	105.81	105.81	105.81	105.81	105.81	105.81	105.81	113.37	113.37
Intermediate tranche: 3000-20000 m^3 in 60 days	149.35	149.35	149.35	149.35	149.35	149.35	149.35	160.07	507.84
Full tranche: > 20000 m^3 in 60 days	504.77	517.76	532.10	548.53	564.51	586.37	610.09	669.40	714.98

Note: tariffs in the table include applicable taxes and surcharges. Historical series with the new classification was provided by SONES starting in 1995. Note that the 1995-1997 numbers are consistent with those in Table 28 despite the different classification.
Source: SONES.

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